doubtnut
India's Number 1 Education App

CHEMISTRY

JEE (MAIN AND ADVANCED) CHEMISTRY

ATOMIC STRUCTURE

Example

1. How many protons and neutrons are there in an atom of ${}_{6}^{13}C$?

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2. Calculate the number electrons which weigh one gram.

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3. An ion with mass number 37 possesses one unit of negative charge. If the ion contains 11.1% more neutrons than the electrons, write its symbol.

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4. A certain particle carries $-2.5 \times 10^{-16} C$ of static charge. Calculate the number of electrons present in it.

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5. What is the wave length in meters of an FM radio wave with frequency 102.5 MHz ?

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6. The wavelength of a blue light is 4800 Å. Calculate the frequency and wave number of this light.

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7. The vividh bharati station of All India Radio, Delhi broadcasts on a frequency of 1.368 kHz. Calculate the wave length of the electromagnetic radiation emitted by the transmitter. Which part of the electromagnetic spectrum does it belong ?

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8. The wavelength of a radiation emitted by a sodium lamp is 600 nm. Find the frequency ?

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9. Neon gas is generally used in the sign boards. If it emits with wavelength of 616 nm, calculate

(i) the frequency of emission

(ii) energy of quantum and

(iii) distance travelled by this radiation in 30 s.

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10. Calculate the energy of one mole of photons of radiations whose frequency is $3 \times 10^{12} Hz$

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11. How many photons of light with a wave length of 400 pm are necessary to provide on joule of energy ?

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12. The threshold frequency of a metal is $1.11 \times 10^{16} Hz$. What is the maximum kinetic energy of the photo electron produced by applying a light of 15 Å on the metal ?

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13. What is the ratio between the energies of two types of radiation whose wavelengths are 6000 Å and 2000 Å respectively.

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14. The work function of a metal is 4.2 eV. IF the radiation of 2000 Å falls on the metal, find the kinetic energy of the metal.

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15. Electrons are emitted with zero velocity from a metal surface when it is exposed to radiation of wavelength 6800 Å. Calculate threshold frequency $\left(V_0\right)$ and work function $\left(W_0\right)$ of metal.

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16. The threshold frequency for a metal is $7.0 \times 10^{14} s^{-1}$. Calculate the kinetic energy of an electron emitted when radiation of frequency $10^{15} s^{-1}$ hits the metal.

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17. Calculate the wave number and wave length of H_α line in the Balmer series of hydroge emission spectrum.

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18. Why many lines are observed in the hydrogen emission spectrum ?

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19. Hydrogen atoms are de-excited from N shell. Illustrate the spectral lines obtained in the emission.

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20. Calculate the wave number of the first spectral line in the Lyman series of He^+ spectrum

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21. What is the wavelength of light emitted when the electron in a hydrogen atom undergoes transition from an energy level with n = 4 to an energy level with n = 2

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22. Why the total energy of atomic electron is negative ?

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23. The radius of the fourth orbit in hydrogen atom is 0.85 nm. Calculate the velocity of the electron in this orbit.

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24. Why is the transition from n=3 to n=1 gives a spectral triplet

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25. What is the ratio of the radii of the 3rd orbits of He^+ and Li^{2+} ?

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26. The ionisation energy of He^+ is 19.6×10^{-18}J atom^{-1}. Calculate the energy of first stationary state of Li^{2+}.

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27. How many times the normal electrons of hydrogen atom revolve round the nucleus in on sec ?

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28. What is the circumference of the second orbit of hydrogen atom ?

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29. Calculate the wave length of an electron of mass $9.1 \times 10^{-31} kg$, moving with a velocity of $2.05 \times 10^{7} ms^{-1}$.

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30. Find the momentum of a particle whose de Broglie wavelength is $1A^{0}$.

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31. If the kinetic energy of an electron is $4.55 \times 10^{-25} J$, find its wavelength (Planck's cosntant, $h = 6.625 \times 10^{-34} kgm^2 s^{-1}$, $m = 9.1 \times 10^{-31} kg$).

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32. Calculate the circumference of Bohr's L shell.

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33. Find the number of waves made by a Bohr electron in one complete revolution in the 3rd orbit.

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34. When would the wavelength associated with an electron become equal to that with proton ? (Mass of electron $= 9.10 \times 10^{-31} kg$, Mass of proton $= 1.6725 \times 10^{-27} kg$)

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35. Calculate the uncertainty in the velocity of an electron, if the uncertainity in position is 100 pm.

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36. The uncertainty in the position and velocity of a particle are $10^{-10}m$ and $5.25 \times 10^{-24}ms^{-1}$. What is the mass of the particle ? $\left(h = 6.625 \times 10^{-34}Js\right)$

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37. What is the product of uncertainties in position and velocity of an electron ?

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38. A golf ball has a mass 40g and a speed of $45ms^{-1}$. If the speed can be measured with inaccuracy of 2%, calculate the uncertainty in position.

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39. s-orbitals have no direction. Comment.

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40. How many peaks and radial nodes are present in the radial probability curve of 3s-orbital ?

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41. Calculate the radial distance between two peaks in the radial probability of 2s orbital.

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42. How many nodal planes and nodal regions are present for 3p orbital ?

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43. How many electrons in an atom may have the following quantum numbers ?

(a) $n = 3, m_s = -1/2$

(b) n = 4, l = 0

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44. The quantum numbers of six electrons are given below. Arrange them in order of increasing energies. Do any of these combination have same

energy.

1. $n = 4 \quad l = 2 \quad m_l = -2 \quad m_s = -1/2$
2. $n = 3 \quad l = 2 \quad m_l = 1 \quad m_s = +1/2$
3. $n = 4 \quad l = 1 \quad m_l = 0 \quad m_s = +1/2$
4. $n = 3 \quad l = 2 \quad m_l = -2 \quad m_s = -1/2$
5. $n = 3 \quad l = 1 \quad m_l = -1 \quad m_s = +1/2$
6. $n = 4 \quad l = 1 \quad m_l = 0 \quad m_s = +1/2$

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45. How many sub-shells are associated with n=4 ? How many electrons will be present in the sub-shell having ms value of -1/2 for n=4 ?

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46. Among the following pairs of orbitals which orbital will experience the larger effective nuclear charge ?

(i) 2s and 3s (ii) 4d and 4f (iii) 3d and 3p

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47. The bromine atom possesses 35 electrons. It contains 6 electrons in 2p orbital, 6 electrons in 3p orbital and 5 electrons in 4p orbital. Which of these electrons experience the lowest effective nuclear charge ?

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Subjective Exercise - I (Long answer questions)

1. Explain Rutherford 's nuclear of an atom . What are its drawbacks ?

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2. Write Planck's equation .

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3. What are the facts in support of the belief that electrons are an essential constituent particles of atoms ?

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Subjective Exercise - I (Short answer questions)

1. Find energy of photons which corresponds to light of frequency $3 \times 10^{12} Hz$

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2. Calculate the wave numbers corresponding to the following wavelengths (a) 2000Å (b) 800 nm

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3. Explain photoelectric effect on the basis of Einstein theory.

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4. When a light of wavelength 300 nm falls on the surface of potassium metal, electrons with kinetic energy of $1.5 \times 10^5 Jmol^{-1}$ are emitted, then calculate the minimum energy needed to remove an electron from the metal.

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5. The threshold frequency $\left(v_0\right)$ for a metal is $5 \times 10^{14} S^{-1}$. Calculate the kinetic energy of emitted electron when a radiation with frequency of $2 \times 10^{15} \text{sec}^{-1}$ hits the metal surface.

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6. Calculate the frequency (v) and wave number $\left(\bar{\nu}\right)$ of the yellow light with a wavelength of 580 nm emitted from sodium lamp.

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7. What is the charge , mass and charge to mass ratio of an electron ?

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8. What is a black body ?

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9. What are the units of wavelength, wavenumber and frequency.

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10. What is the wave number of a radiation of wavelength 400 nm ?

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11. What is the value of Planck's constant

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Subjective Exercise - 2 (Long answer questions)

1. What are characteristics of electromagnetic waves ?

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2. Explain the difference between emission and absorpation spectra.

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3. Give the main postulates of Bohr's model of an atom.

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4. (A) : Bohr's atomic model cannot be used to explain multiple electron species.

(R) : Bohr's atomic model does not take inter-electronic interactions in account

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5. The de Broglie wavelength associated with a moving particle of fixed mass is inversely proportional to

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6. State Heisenberg's uncertainly principle.

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7. Explain the particle nature of electromagnetic radiations .

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8. What is electromagnetic specturm ?

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9. (A) : Bohr's atomic model cannot be used to explain multiple electron species.

(R) : Bohr's atomic model does not take inter-electronic interactions in account

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10. Explain Heisenberg's uncertainty principle .

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Subjective Exercise - 2 (Short answer questions)

1. Explain the difference between emission and absorpation spectra.

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2. Give the main postulates of Bohr's model of an atom.

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3. What are broad spectrum and narrow spectrum antibiotics?Give one example for each .

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4. Explain photoelectric effect on the basis of Einstein theory.

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5. Explain Heisenberg's uncertainty principle .

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6. A line in Lyman series of hydrogen atom has a wavelength of $1.03 \times 10^{-7} m$. What is the initial energy level of the electron ?

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7. The Lyman series occurs between 91.2 nm and 121.6 nm , the Balmer series occurs between 364.7 nm and 656.5 nm and the Paschen series occurs between 820.6 nm and 1876 nm, Identify the spectral regions to which these wavelengths correspond .

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8. Explain the significance of Heisenberg's uncertainty principle .

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9. if a is the radius of first Bohr orbit in hydrogen atom, the radius of $3^r d$ orbit is

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10. Explain the difference between emission and absorpation spectra.

Watch Video Solution

11. Explain the influence of Planck's quantum theory on Bohr's model of structure of atom.

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12. What is emission spectrum?

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13. Explain photoelectric effect on the basis of Einstein theory.

Watch Video Solution

14. Explain Heisenberg's uncertainty principle .

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15. A line in Lyman series of hydrogen atom has a wavelength of $1.03 \times 10^{-7} m$. What is the initial energy level of the electron ?

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16. The Lyman series occurs between 91.2 nm and 121.6 nm , the Balmer series occurs between 364.7 nm and 656.5 nm and the Paschen series occurs between 820.6 nm and 1876 nm, Identify the spectral regions to which these wavelengths correspond .

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Subjective Exercise - 2 (Very short answer questions)

1. Which part of electromagnetic spectrum does Balmer series belong ?

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2. Which part of electromagnetic spectrum does Balmer series belong ?

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3. What is Zeeman effect ?

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4. What is Stark effect ?

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5. Explain Heisenberg's uncertainty principle .

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6. What is the wavelength of light emitted when the electron in a hydrogen atom undergoes transition from an energy level with n = 4 to an energy level with n = 2

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7. Calculate the wave length of an electron moving with a velocity of $2.05 \times 10^{7} ms^{-1}$.

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8. What is electromagnetic specturm ?

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9. What is Balmer series? To which part of the electromagnetic spectrum does it belong to ?

Watch Video Solution

10. What is Zeeman effect ?

Watch Video Solution

11. What is Stark effect ?

Watch Video Solution

12. What is uncertainty principle ?

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13. What is the wavelength of light emitted when the electron in a hydrogen atom undergoes transition from an energy level with n = 4 to an energy level with n = 2

Watch Video Solution

14. Calculate the wave length of an electron moving with a velocity of $2.05 \times 10^{7} ms^{-1}$.

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Subjective Exercise - 3 (Long answer questions)

1. What are the main features of quantum mechanical model of an atom?

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2. What are quantum numbers ?

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3. Define atomic orbital . Explain the shapes of s, p and d orbitals with the help of diagrams.

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4. What are the main features of quantum mechanical model of an atom?

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5. What are quantum numbers? Explain the significance of various types of quantum numbers.

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6. Define atomic orbital . Explain the shapes of s, p and d orbitals with the help of diagrams.

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Subjective Exercise - 3 (Short answer questions)

1. What does each quantum number signify ?

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2. What does each quantum number signify ?

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3. Write the Schrodinger wave equation and explain each term in it.

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4. According to aufbau principle, the correct order of energy of 3d, 4s and 4p-orbitals is

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5. Which of the following is violation of Pauli's exclusion principle ?

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6. Explain Hund's rule with an example .

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7. What is a nodal plane ? How many nodal plance are possible for 2p and 3d - orbitals ?

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8. Explain the significance of three quantum numbers in predicting the positions of an electron in an orbit .

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9. Which of the following sets of quantum numbers is correct for an electron in 3d orbital.

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10. Which one of the following is a correct electronic configuration of sodium?

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11. Why there are exemptions in writing the electronic configurations of Chromium and Copper ?

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12. What is an atomic orbital ?

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13. How many P - electrons are present in sulphur atom ?

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14. How many electrons are present in sulphur ?

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15. What are the values of principal quantum number (n) and azimuthal quantum number (l) for a 3d electron ?

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16. The electronic configuration of Magnesium (Mg) is

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17. To which element do the following electronic configuration correspond to

(i) $1s^2 2s^2 2p^6 3s^1$ (ii) $1s^2 2s^2 2p^6 3s^2 3p^1$

(iii) $1s^2 2s^2 2p^6 3s^2 3p^6$

(iv) $1s^2 2s^2 2p^5$ (v) $1s^2 2s^1$

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18. Explain the significance of sodium , potassium, magnesium and calcium in biological fluids.

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19. What is Hund's rule ?

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20. Explain Pauli's Exclusion principle with an example.

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21. What is the principle involved in dialysis?

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22. Which of the following orbitals are possible ? (2s,1p,3f,2p)

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23. How many sub-shells are associated with n=4 ? How many electrons will be present in the sub-shell having ms value of -1/2 for n=4 ?

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24. The bromine atom possesses 35 electrons. It contains 6 electrons in 2p orbital, 6 electrons in 3p orbital and 5 electrons in 4p orbital. Which of these electrons experience the lowest effective nuclear charge ?

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25. What is principal quantum number and explain its significance?

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26. What its azimuthal quantum number and explain its significance?

Watch Video Solution

27. Write the Schrodinger wave equation and explain each term in it.

Watch Video Solution

28. What is Aufbau's principle? Give the sequence in which various orbitals are filled with electrons.

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29. State and explain Pauli's exclusion principle.

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30. State and explain Hunds's rule of maximum multiplicity.

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31. What is the significance of spin quantum number in electronic structure of an atom.

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32. Write the four quantum numbers for $3d^1$ electron.

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33. What is electronic configuration? Write the electronic configuration of sodium.

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34. Why does the electronic configuration of chromium and copper have special features?

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Objective exercise - 1

1. Which of the following is not a fundamental particle ?

A. Proton

B. Neutron

C. Alpha particle

D. Electron

Answer: C

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2. The siotopes of neutral atom of an element differ in

A. electron and proton

B. neutron and electron

C. neutron, electron and proton

D. neutron and proton

Answer: C

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3. The study of discharge of electricity through gases led to the discovery of

A. Structure of the atom

B. Nucleus

C. Spectral lines

D. Electron

Answer: D

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4. Electron is a particle having a

A. negative charge of one unit and zero mass

B. positive charge of one unit and zero mass

C. negative charge of one unit and a mass of about $9.1 \times 10^{-31} kg$

D. negative charge of one unit and a mass of about $1.67 \times 10^{-27} kg$.

Answer: C

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5. The value of e/m for an electron is

A. $1.78 \times 10^{8} c/g$

B. $1.6724 \times 10^{-24} c/g$

C. 0.005486 c/g

D. 1.00866 c/g

Answer: A

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6. IF the charge of electron c , mass of electron m, speed of light in vaccum c and Planck's constant h are taken as fundamental quantities. Then the permeability of vaccum μ_0 can be expressed as

A. 1.602×10^{-10} Coulomb

B. 4.8×10^{-10} coulomb

C. 1.602×10^{-19} e.s.u

D. 4.8×10^{-10} e.s.u

Answer: D

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7. A gun of mass M fires a bullet of mass m, with a Kinetic energy E. The total kinetic energy in the firing process is

A. 1.78×10^{8} c/g

B. 9.57×10^{4} c/g

C. 19.14×10^{4} c/g

D. 0.478×10^{4} c/g

Answer: B

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8. Atomic number is equal to the

A. number of neutrons in the nucleus

B. number of protons in the nucleus

C. sum of proton and neutrons

D. atomic mass of the element.

Answer: B

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9. Can a body in free fall be in equilibrium ?Explain?

A. negative

B. fractional

C. zero

D. Whole number

Answer: D

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10. Calculate the number of protons , neutrons and electrons in $._{35}^{80}Br$

A. 35,35,80

B. 35,35,45

C. 80,80,35

D. 45,45,35

Answer: B

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11. Which of the following is an acid?

A. ${}_6C^{13}$

B. ${}_6C^{12}$

C. ${}_7N^{14}$

D. ${}_7N^{15}$

Answer: C

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12. Number of protons in the nucleus of carbon atom is

A. 7

B. 8

C. 4

D. 6

Answer: D

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13. The number of nucleons present in chlorine -37 is

A. 17

B. 20

C. 54

D. 37

Answer: D

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14. The nucleus of an atom contains

A. electron and proton

B. Proton and neutrons

C. Electrons and beta particles

D. Protons and alpha particles

Answer: B

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15. The siotopes of neutral atom of an element differ in

A. Atomic number

B. Mass number

C. Number of electrons

D. Chemical properties

Answer: B

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16. The nucleus of tritium consists of

A. 1 proton +1 neutron

B. 1 proton +1 neutrons

C. 1 proton + zero neutrons

D. 1 proton + 2 neutrons

Answer: D

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17. Sodium ion is isoelectronic with.....atom

A. Mg^{2+}

B. Al^{3+}

C. Ne

D. N^{3-}

Answer: C

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18. An atom differs from its ion in

A. Nuclear charge

B. Mass number

C. Number of electrons

D. Number of neutrons

Answer: C

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19. In C^{14} isotope the number of nuetrons would be

A. 6

B. 14

C. 8

D. 10

Answer: C

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20. The number of neutrons in the dipositive zinc ion (Mass no. of Zn = 65)

A. 35

B. 33

C. 65

D. 67

Answer: A

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21. Rutherford's alpha ray scattering experiment showed for the first time that that atom has

A. Nucleus

B. Proton

C. Electron

D. Neutron

Answer: A

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22. The radius of the atom (in cm) is of the order of

A. 10^{-10}

B. 10^{-13}

C. 10^{-15}

D. 10^{-8}

Answer: D

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23. When alpha particles are sent through a thin metal foil most of them go straight through the foil because

A. Alpha particles are much heavier than electrons

B. Alpha particles are positively charged

C. Most part of the atom is empty

D. Alpha particles move with high velocity

Answer: C

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24. Identify the incorrectly matched set ffrom the following

A. Set - A : Wavelength (λ) , SET - B : Nanometre

B. Set A : Frequency (υ) , Set B : Hertz

C. Set A : Wave number , Set B : metre^{-1}

D. Set A : Velocity (C), Set B : ergs

Answer: D

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25. Einstein was awarded Noble Prize for

A. General theory of relatively

B. The equation, $E = mc^2$

C. Enunciation of quantum theory

D. Explanation of photoelectric effect

Answer: D

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26. In electromagnetic radiation, which of the following,..... rays has greater wavelength than visible light ?

A. U.V.

B. I.R

C. Gamma

D. X-rays

Answer: B

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27. Which of the following is not an electromagnetic radiation ?

A. Gamma rays

B. Alpha rays

C. Radio waves

D. x-rays

Answer: B

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28. A particle revolves round a circular path. The acceleration of the particle is inversely proportional to

A. Wavelength

B. Frequency

C. Wave number

D. Velocity

Answer: A

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29. What is the value of Planck's constant

A. $6.626 \times 10^{-27} Js$

B. $6.626 \times 10^{-34} Js$

C. $6.023 \times 10^{23} Js$

D. $1.602 \times 10^{-19} Js$

Answer: B

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30. Of the following properties of a wave, the one that is independent of the others is it

A. Wave number

B. Wave length

C. Frequency

D. Amplitude

Answer: D

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31. The radiation with highest wave number

A. Microwaves

B. X-rays

C. I.R - rays

D. Radiowaves

Answer: B

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32. Which of the following relates to photon both as wave motion and as a stream of particles ?

A. $E = mc^2$

B. Photoelectric effect

C. Diffraction

D. E = h v

Answer: D

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33. Alkali metals used in photoelectric cells

A. Na

B. Mg

C. Al

D. Cs

Answer: D

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34. The energy required to excite the electron from ground state of hydrogen atom to first excited state is

A. Activation energy

B. Threshold energy

C. Critical energy

D. Kinetic energy

Answer: B

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35. Kinetic energy of photoelectrons is independent on------- of incident radiation.

A. Wavelength

B. Wave number

C. Frequency

D. Intensity

Answer: D

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36. Assertain (A): K, Rb and Cs form superoxides.

Reason (R) : The stability of the superoxides increases from 'K' to 'Cs' due to decrease in lattice energy.

The correct answer is

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

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37. If the wavelength of an electromagnetic radiation is 2000 A. what is its energy in ergs?

A. 9.94×10^{-12}

B. 9.94×10^{-10}

C. 4.97×10^{-12}

D. 4.97×10^{-19}

Answer: A

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38. The energy of a photon is $3 \times 10^{-12} erg$.What is its wavelength in nm?

$\left(h = 6.62 \times 10^{-27} erg - s, 3 \times 10^{10} cms^{-1}\right)$

A. 662

B. 1324

C. 66.2

D. 6.62

Answer: A

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39. The frequency associated with photon of radiation having a wavelength of 6000 Å is

A. 5×10^{14} Hz

B. 5×10^{10} Hz

C. 2×10^{14} Hz

D. 5×10^{15} Hz

Answer: A

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40. The wave number of the radiation whose quantum is 1 erg is

A. $5 \times 10^{15} cm^{-1}$

B. $15 \times 10^{5} cm^{-1}$

C. $1.5 \times 10^{15} cm^{-1}$

D. $5 \times 10^{5} cm^{-1}$

Answer: A

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41. A sound wave is sent into a gas pipe . Does its internal energy change ?

A. 4.36×10^{-12} ergs

B. 4.36×10^{-20} ergs

C. 4.36×10^{-11} ergs

D. 4.36×10^{14} ergs

Answer: A

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42. A wave has a frequency of $3 \times 10^{15} \text{sec}^{-1}$. The energy of that photon is

A. 1.6×10^{-12} erg

B. 3.2×10^{-11} erg

C. 2.0×10^{-11} erg

D. 3×10^{15} erg

Answer: C

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43. Calculate

wave number

A. $2.5\mu m$

B. $250\mu m$

C. $25\mu m$

D. 25 nm

Answer: A

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44. The energy of an electromagnetic radiation is 19.875×10^{-13} ergs. What is the wave number in cm^{-1} ? ($h = 6.625 \times 10^{-27}$ erg.sec, $c = 3 \times 10^{10} cm.\sec^{-1}$)

A. 1000

B. 10^6

C. 100

D. 10000

Answer: D

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45. According to the Moseley's law, the frequency of a spectral line in X-ray spectrum varies as.

A. Atoms

B. Molecules

C. Any substance in solid state

D. Any substance in liquid state

Answer: A

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46. Antibiotic obtained from lichens is

A. Continuous

B. Line

C. Band

D. Absorption

Answer: A

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47. The Lyman series of hydrogen spectrum lies in the ultraviolet region. Why?

A. Lyman

B. Balmer

C. Paschen

D. None of the above

Answer: A

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48. (A) Hydrogen atom consists of only one electron but its emission spectrum has many lines.

(R) Only Lyman series is found in the absorption spectrum of hydrogen atom whereas in the emission spectrum, all the series are found.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

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49. Whwn the electron in an excited hydrogen atom jumps from an energy level for which $n = 5$ to level for which $n = 2$,the spectral line is obeserved in which series of the hydrogen spectrum?

A. Balmer

B. Lyman

C. Paschen

D. Pfund

Answer: B

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50. When the electron in hydrogen atom jumps from the second orbit to the first orbit, the wavelength of the radiation emitted is λ. When the electron jumps from the third to the first orbit . The wavelenth of the radiation emitted is

A. Visible

B. Ultraviolet

C. Near IR

D. Far IR

Answer: A

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51. Which one of the following series of line is found in the UV region of atomic spectrum of hydrogen

A. Balmer

B. Paschen

C. Bracket

D. Lyman

Answer: D

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52. What is the energy which is used to remove an electron from its outer most orbit ?

A. Third orbit

B. Second orbit

C. Fourth orbit

D. Fifth orbit

Answer: C

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53. The number of spectral lines in hydrogen atom are

A. $R\left[\frac{1}{4^2} - \frac{1}{5^2}\right]$

B. $R\left[\frac{1}{3^2}-\frac{1}{4^2}\right]$

C. $R\left[\frac{1}{2^2}-\frac{1}{3^2}\right]$

D. $R\left[\frac{1}{5^2}-\frac{1}{6^2}\right]$

Answer: D

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54. n_1 value in Balmer series is

A. 2

B. 1

C. 3

D. 0

Answer: A

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55. The value of Planck's constant in SI unit is

A. $109677 cm^{-1}$

B. $109700 cm^{-1} s^{-1}$

C. $10968 cm^{-1}$

D. 10970 m

Answer: A

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56. Whwn the electron in an excited hydrogen atom jumps from an energy level for which $n = 5$ to level for which $n = 2$,the spectral line is obeserved in which series of the hydrogen spectrum?

A. Lyman

B. Balmer

C. Parchen

D. Pfund

Answer: B

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57. Among the first lines of Lyman,Balmer, paschen and Brackett series in hydrogen atomic spectra,which has the highest energy?

A. Lyman

B. Balmer

C. Paschen

D. Bracket

Answer: A

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58. What are the values of n_1 and n_2 for the 2_nd line in the Lyman series of hydrogen atomic spectrum?

A. 3 and 5

B. 2 and 3

C. 1 and 3

D. 2 and 4

Answer: C

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59. The series corresponding to minimum wave- length transition in H-atom

A. 3 and 1

B. 5 and 1

C. 5 and 2

D. 6 and 2

Answer: D

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60. Electrons from n = 2 to n= 1 in hydrogen atom is made to fall on a metal surface with work function 1.2ev. The maximum velocity of photo electrons emitted is nearly equal to

A. 4400 Å

B. 1250 Å

C. 1650 Å

D. 1850 Å

Answer: B

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61. The wave number of limiting line in Balmer series of hydrogen atoms is

A. 4400 Å

B. 5500 Å

C. 6600 Å

D. 7700 Å

Answer: C

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62. The wave number of limiting line in Balmer series of hydrogen atoms is

A. 4090 Å

B. 5400 Å

C. 6800 Å

D. 7200 Å

Answer: A

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63. The first emision line of hydrogen atomic spectrum in the Balmer series appear at(R=Rydberg constant)

A. $\frac{5R}{36}cm^{-1}$

B. $\frac{3R}{4}cm^{-1}$

C. $\frac{7R}{144}cm^{-1}$

D. $\frac{9R}{400}cm^{-1}$

Answer: A

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64. What is the wave length of H_b line Balmer series of hydrogen spectrum ? (R = Rydberg constant)

A. 36/5R

B. 5R/36

C. 3R/16

D. 16/3R

Answer: D

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65. If in Hydrogen atom, an electron jumps from $n_2 = 2$ to $n_1 = 1$ in Bohr's orbit, then the value o wave number of the mitted photon will be $\left(R = 109700 cm^{-1}\right)$

A. $54850 cm^{-1}$

B. $82275 cm^{-1}$

C. $62875 cm^{-1}$

D. $10970 cm^{-1}$

Answer: B

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66. The wavelength of the radiation emitted, when in hydrogen atom electrons falls from infinity to stationary state 1, would be (Rydberg constant $1.097 \times 10^{7} m^{-1}$)

A. 91 nm

B. $9.1 \times 10^{-8} nm$

C. 406 nm

D. 192 nm

Answer: A

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67. The first use of quantum theory to explain the structure of atom was made by

A. Planck

B. Einstein

C. Bohr

D. Heisenberg

Answer: C

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68. Bohr's theory is applicable to

A. Li^{+2}

B. Li^{+}

C. He^{+}

D. Both 1 and 3

Answer: D

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69. Bohr's theory is not applicable to

A. H

B. He^+

C. Li^{2+}

D. H^+

Answer: D

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70. (A) Bohr's third postulate states that the stationary orbits are these for which the angular momentum is same integral multiple of $h/2\pi$

(R) Linear momentum of the electron in the atom is quantized

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: C

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71. If the electron of a hydrogen atom is present in the first orbit. The total energy of the electrons is

A. $\frac{-e^2}{r}$

B. $\frac{-e^2}{r^2}$

C. $\frac{-e^2}{2r}$

D. $\frac{-e^2}{2r^2}$

Answer: C

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72. The angular momentum of an electron present in the excited state of hydrogen is $1.5h/\pi$. The electron is present in

A. Third orbit

B. Second orbit

C. Fourth orbit

D. Fifth orbit

Answer: A

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73. According to Bohr's theory, the angular momentum of electron in 5th orbit is

A. $2.5h/\pi$

B. $25h/\pi$

C. $1.0h/\pi$

D. $10h/\pi$

Answer: A

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74. The angular momentum of electron in 'd' orbital is equal to

A. $\frac{nh}{2\pi}$

B. $\frac{h}{2\pi}$

C. $\left(\frac{nh}{2\pi}\right)^2$

D. $\frac{n\pi}{2h}$

Answer: A

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75. The ratio of kinetic energy to the total energy of an electron in a Bohr orbit of the hydrogen atom is

A. $-\frac{n^2h^2}{4\pi^2mZe^2}$

B. $-\frac{2n^2Z^2me^4}{n^2h^2}$

C. $-\frac{2\pi Ze^2}{nh}$

D. $-\frac{n^2h^2}{2\pi^2Z^2me^4}$

Answer: B

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76. As an electron is brought from an infinite distance close to nucleus of atom, the energy of electron

A. Infinity

B. Zero

C. Minimum

D. Can not be predicted

Answer: B

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77. When electron falls from a higher energy to a lower energy level the difference in the energies appears in the form of

A. $\lambda = \frac{h}{mv}$

B. $mvr = \frac{nh}{2\pi}$

C. $\upsilon = \frac{\Delta E}{h}$

D. $\upsilon = \frac{h}{\Delta E}$

Answer: C

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78. In an atom when an electron jumps from K-shel to M-shell

A. Energy is absorbed

B. Energy is emitted

C. Energy is neither absorbed nor emitted

D. Sometines energy is absorbed and some times emitted

Answer: A

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79. Radius of 3rd Bohr orbit is

A. $\frac{nh}{2\pi mr}$

B. $\frac{n^2h^2}{4\pi^2me^2}$

C. $-\frac{2\pi^2me^4}{n^2h^2}$

D. $\frac{n^2}{4\pi^2mhe^2}$

Answer: B

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80. The total energy of electron in an atom is a combination of potential energy and kinetic energy. If total energy is $-E$ for an electron in an atom, then its K.E. and P.E. respectively are

A. Decreases, increases

B. Increases, increases

C. Decreases, decreases

D. Increases, decreases

Answer: D

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81. Match the following :

List - 1	List - 2
(*a*)second	(*e*)carbon - 12
(*b*)mole	(*f*)Platinum iridium
(*c*)Metre	(*g*)*Cs* - 133
(*d*) Kilogram	(*h*)*Kr* - 86

A. I-e, II - a, III - c, IV - d

B. I-b, II-a, III-c, IV-d

C. I-e, II-b, III-c ,IV-d

D. I-b, II-a, III-d, IV-c

Answer: B

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82. What are the postulates of Bohr's model of hydrogen atom ? Discuss the importance of this model to explain various series of line spectra in hydrogen atom.

A. The spectrum of hydrogen atom only

B. Spectrum of an atom or ion containing one electron only

C. The spectrum of hydrogen molecule

D. The solar specturm

Answer: B

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83. Splitting of spectral lines under the influence of strong magnetic field is called

A. Stark effect

B. Zeeman effect

C. Photoelectric effect

D. None of these

Answer: B

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84. Radius of tenth Bohr orbit of the Hydrogen atoms is

A. 0.53 Å

B. 5.3 Å

C. 53 Å

D. $5.3 \times 5Å$

Answer: C

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85. Radius of 3rd Bohr orbit is

A. 6.529 Å

B. 2.116 Å

C. 4.761 Å

D. 8.464 Å

Answer: C

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86. Velocity of the electron in the 1st Bohr orbit

A. $2.18 \times 10^8 cm/\sec$

B. $2.18 \times 10^8 m/\sec$

C. $2.18 \times 10^{16} cm/\sec$

D. 36559×10^8 cm/sec

Answer: A

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87. The energy that is needed to remove an electron from the 1st Bohr orbit or Hydrogen atom is

A. 2.72 ev

B. 40.8 ev

C. 13.6 ev

D. 54.4 ev

Answer: C

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88. The speed of an electron in the inner most orbit of the hydrogen (Bohr radius = 52.9 pm, me $= 9.11 \times 10^{-31} kg$) is

A. $2.19 \times 10^4 m.s^{-1}$

B. $2.19 \times 10^6 m.s^{-1}$

C. $2.19 \times 10^7 m.s^{-1}$

D. $2.19 \times 10^8 m.s^{-1}$

Answer: B

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89. The energy of an electron present in Bohr's second orbit of hydrogen atom is

A. $-1312 J \text{ atom}^{-1}$

B. $328 J \text{ mol}^{-1}$

C. $-328 J mol^{-1}$

D. $-164 kJ mol^{-1}$

Answer: B

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90. The de-Broglie equation treats an electron to be

A. a particle

B. a wave

C. ray

D. both (1) and (2)

Answer: D

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91. Wavelength of the wave associated with a moving electron

A. Decreases with increase in speed of electron

B. Increases with increase in speed of electron

C. Remains same irrespective of speed of electron

D. is zero

Answer: A

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92. The uncertainity principle and the concept of wave nature of matter were proposed by----- and ---- respectively

A. Pauli, Hund

B. Heisenberg, Aufbau

C. Heisenberg, de Broglie

D. Heisenberg, Planck

Answer: C

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93. Bohr's postulate that $mvr = \frac{nh}{2\pi}$ is proved mathematically by

A. Pauli's exclusion principle

B. de Broglie wave nature of the electron

C. Heisenberg uncertainity principle

D. Sommerfield theory

Answer: B

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94. The momentum of a particle of wave length 1 Å is

A. $6.625 \times 10^{-27} g.cm.s^{-1}$

B. $6.625 \times 10^{-19} g.cm.s^{-1}$

C. $6.625 \times 10^{-16} g.cm.s^{-1}$

D. $6.625 \times 10^{-23} g.cm.s^{-1}$

Answer: B

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95. The de Broglie wavelength of a particle with mass 1 g and velocity 100 m/s is

A. $6.63 \times 10^{-33} m$

B. $6.63 \times 10^{-34} m$

C. $6.63 \times 10^{-35} m$

D. $6.63 \times 10^{-36} m$

Answer: A

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96. The de Broglie wave length of a riffle bullet of mass 2 grams moving with a velocity of 2m/sec of

A. $\frac{6.6 \times 10^{-34}}{2 \times 2} m$

B. $\frac{6.6 \times 10^{-27}}{2 \times 10^{-3} \times 2} cm$

C. $\frac{6.6 \times 10^{-34}}{2 \times 10^{-3} \times 2} m$

D. $\frac{6.6 \times 10^{-27}}{2 \times 2} m$

Answer: C

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97. A cricket ball of mass 0.5 kg is moving with a velocity of $100 ms^{-1}$, the wavelength associated with its motion is

A. $13.25 \times 10^{-26} m$

B. $13.25 \times 10^{-34} m$

C. $13.25 \times 10^{-36} m$

D. $6.6 \times 10^{-34} m$

Answer: C

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98. If the Planck's constant $h = 6.6 \times 10^{-34} Js$, the de-Broglie wave length of a particle having momentum of $3.3 \times 10^{-24} kg.\, ms^{-1}$ will be

A. $2 \times 10^{-10} m$

B. $1 \times 10^{-15} m$

C. $10^{-5} m$

D. $4 \times 10^{-10} m$

Answer: A

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99. The de Broglie wave length associated with a particle of mass 1 mg moving with a velocity of 1m/sec is

A. $6.63 \times 10^{-29} m$

B. $6.63 \times 10^{-31} m$

C. $6.63 \times 10^{-28} m$

D. $6.63 \times 10^{-22} m$

Answer: C

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100. The de Broglie wavelength of a tennis ball of mass 60 g moving with a velocity of 10 metres per second is approximately

A. 10^{-33} metres

B. 10^{-31} metres

C. 10^{-16} metres

D. 10^{-25} metres

Answer: A

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101. The de Broglie wavelength associated with a ball of mass, 200g and moving at a speed of 5 metres/hour, is in the order of

$\left(h = 6.625 \times 10^{-34} Js\right)$

A. $10^{-15} m$

B. $10^{-20} m$

C. $10^{-25} m$

D. $10^{-30} m$

Answer: D

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102. If uncertainity in position is zero, the uncertainity in momentum of an electron will be

A. Zero

B. Infinity

C. Unity

D. Zero or infinity

Answer: B

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103. Uncertainity inposition of a minute particle of mass 25 g in space is $10^{-5}m$. What is the uncertainity in its velocity (in ms^{-1}) ? $\left(h = 6.6 \times 10^{-34}Js\right)$

A. 2.1×10^{-34}

B. 0.5×19^{-34}

C. 2.1×10^{-28}

D. 0.5×10^{-23}

Answer: C

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104. The uncertainity in momentum of an electron is $1 \times 10^{-5} kg.\, m/s$. The uncertainity in its position will be $\left(h = 6.62 \times 10^{-34} kg.\, m/s\right)$

A. $1.05 \times 10^{-28} m$

B. $1.05 \times 10^{-26} m$

C. $5.27 \times 10^{-30} m$

D. $5.27 \times 10^{-28} m$

Answer: C

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105. Identify the correct set from the following for fundamental particles

	List-A		List-B
(*I*)	Decreasing order of masses	(*a*)	$e^- > p > n$
(*II*)	Decreasing order of e/m values	(*b*)	$p > e^- > n$
(*III*)	Decreasing order of de-Broglie wavelength with same velocities	(*c*)	$n > p > e^-$
(*IV*)	Decreasing order of uncertainity in velocity when Δx is same	(*d*)	$n > e^- > p$

The correct match is

A. I-C, II-a, III-d, IV-a

B. I-C, II-a, III-a, IV-a

C. I-c, II-d, III-b, IV-a

D. I-c, II-b, III-d, IV-a

Answer: B

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106. The uncertainty in the momentum of a particle is $3.31 \times 10^{-2} kgms^{-1}$.

The uncertainity in its position is (in metres)

A. 1.59×10^{-33}

B. 0.33×10^{-30}

C. 0.4×10^{-20}

D. 3.3×10^{-24}

Answer: A

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107. According to Schrodinger model, nature of electron in an atom is as

A. Particles only

B. Wave only

C. Both simultaneously

D. Sometimes waves and sometimes particles

Answer: C

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108. Which one of the following expressions represent the electron probability function (D)

A. $4\pi r dr\psi^2$

B. $4\pi r^2 dr\psi$

C. $4\pi r^2 dr\psi^2$

D. $4\pi r dr\psi$

Answer: C

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109. Radial part of the wave function depends on quantum numbers

A. n and s

B. 1 and m

C. 1 and s

D. n and 1

Answer: D

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110. p-orbitals are ---- degenerate

A. Two fold

B. Three fold

C. four fold

D. Five fold

Answer: B

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111. Number of nodal planes that a p-orbital has

A. 0

B. 1

C. 2

D. 3

Answer: B

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112. Which of the following is correct with respect to 'p' orbitals ?

A. Spherical

B. Strong directional character

C. Five fold degenerate

D. No directional character

Answer: B

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113. The maximum number of electrons accomodated in 5f orbitals

A. 5

B. 0

C. 14

D. 18

Answer: C

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114. The maximum probability of finding an electron of a particular energy in an orbital is about

A. 80 %

B. 0.85

C. 0.95

D. 0.99

Answer: C

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115. Which one of the following conditions incorrect for a well behaved wave function (φ) ?

A. φ must be finite

B. φ must be single valued

C. φ must be infinite

D. φ must be continuous

Answer: C

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116. (A) : The p-orbital has dumb ball shape

(R) : Electron present in p-orbital can have any one of the three values of magnetic quantum numbers (0, +1, -1)

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: B

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117. The number of nodal planes for P_x orbital is

A. 1

B. 2

C. 3

D. 0

Answer: A

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118. Number of nodes in 3p orbital is

A. 0

B. 1

C. 2

D. 3

Answer: B

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119. The orbital without nodal plane is

A. 1s

B. 2p

C. 3d

D. 3p

Answer: A

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120. The no. of spherical nodes in a 4s orbital is

A. Zero

B. 1

C. 2

D. 3

Answer: D

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121. Which d-orbitals has its lobes along the axes

A. d_{xy}

B. $d_{x^2-y^2}$

C. d_{z^2}

D. d_{xz}

Answer: B

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122. The density of electron cloud of the orbital d_{xy} in yz plane is

A. Zero

B. Maximum

C. Not determined

D. None

Answer: A

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123. The probability of finding an electron in p_y orbital along the x-axis is

A. Maximum

B. Zero

C. Not determined

D. Infinite

Answer: B

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124. The number of nodes and nodal planes in 4p orbitals are respectively

A. 2,1

B. 1,2

C. 2,3

D. 3,2

Answer: A

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125. The number of nodes possible in radial probability distribution curve of 3d orbital is

A. 1

B. 2

C. 3

D. 0

Answer: D

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126. The number of nodal planes 'd' orbital has

A. Zero

B. one

C. two

D. three

Answer: C

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127. In the radial probability distribution curve for the 2s orbital of the hydrogen atom, the minor maximum, the node and the major maximum occur at the following distances from the nucleus respectively

A. 1.1Å, 0.53 Å, 2.6Å

B. 0.53Å, 1.1 Å, 2.6 Å

C. 2.6Å, 1.1 Å, 0.53 Å

D. 0.53Å, 2.116Å, 2.6 Å

Answer: B

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128. (A) There are two noda regions in 3s-orbital

(R) : There is no nodal plane in 3x orbital

The correct answer is

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: B

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129. Match the following columns

List – I	List – II
A) Starch	p) Natural polymers
B) Rubber	q) synthetic polymer
C) Neoprene	r) addition polymer
D) Nylon - 6	s) condensation polymer
	t) homo polymer

A. A-2, B-3, C-4, D-1

B. A-4, B-3, C-2, D-1

C. A-4, B-3, C-1, D-2

D. A-3, B-4, C-2, D-1

Answer: C

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130. For complete description of an electron in an atom, the number of quantum numbers required is

A. one

B. two

C. three

D. four

Answer: D

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131. The azimuthal quantum number indicates .....of the orbital

A. Size

B. Shape

C. Orientation

D. Spin

Answer: B

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132. Which of the following is indicated by the magnetic quantum number ?

A. Size

B. Shape

C. Spatial orientation

D. Spin

Answer: C

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133. Principal quantum number is related to

A. Size of the orbit

B. Spin angular momentum

C. Orbital angular momentum

D. Orientation of orbital in space

Answer: A

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134. The spin quantum number has a value of

A. $1/2$

B. $+1/2$

C. $-1/2$

D. either +1/2 or -1/2

Answer: D

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135. When there are two electrons in the same orbital they have ..... Spins

A. $+\frac{1}{2}, +\frac{1}{2}$

B. $-\frac{1}{2}, -\frac{1}{2}$

C. $+\frac{1}{2}, -\frac{1}{2}$

D. 0,0

Answer: C

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136. The values of quantum numbers n, 1 and m for the fifth electron of boron is

A. n=2, 1 = 1, m=-1

B. n=2, 1 = 0, m = -1

C. n = 2, 1 = 2, m = -1

D. n = 1, 1 = 2, m = -1

Answer: A

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137. When n = 3, 1=1, the designation given to he orbital is

A. 4s

B. 4p

C. 3s

D. 3p

Answer: D

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138. Which of the following designation is impossible ?

A. 4f

B. 5g

C. 2d

D. 6p

Answer: C

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139. I = 3, then the values of magnetic quantum numbers are

A. $\pm 1,\ \pm 2,\ \pm 3$

B. $0,\ \pm 1,\ \pm 2,\ \pm 3$

C. $-1,\ -2,\ -3$

D. $0 + 1,\ +2,\ +3$

Answer: B

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140. For a f-orbital, the values of m are

A. $-1, 0, +1$

B. $0, +1+2, +3$

C. $-2, -1, 0, +1, +2$

D. $-3, -2, -1, 0, +1, +2, +3$

Answer: D

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141. The impossible set of quantum numbers is

A. n = 2, 1 = 0, m = 0, s = +1/2

B. n = 2, 1 = 1, m = 0, s = +1/2

C. n = 2, 1 = 0, m = 1, s = -1/2

D. n = 3, 1 = 1, m = -1, s = -1/2

Answer: C

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142. Which of the following quantum numbers are not possible ?

A. n = 2,l = 1, = -1, s = -1/2

B. n = 3,l = 2, = -3, s = +1/2

C. n = 2,l = 0, = 0, s = +1/2

D. n = 3,l = 2, = -2, s = +1/2

Answer: B

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143. The correct set of quantum number for the unpaired electron of chlorine atom is

A. n=2, l = 1, m = 0

B. n=2, l=1, m=1

C. n=3, l=1, m=0

D. n=3, l=0, m=0

Answer: C

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144. The two electrons occupying an orbital are distinguished by

A. principal quantum number

B. Azimuthal quantum number

C. Magnetic quantum number

D. Spin quantum number

Answer: D

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145. Which of the following sets of quantum number is correct for an electron in 4f orbitals ?

A. n=4, l=3, m +4, s = +1/2

B. n=4, l=2, m = -2, s = +1/2

C. n=4, l=3, m = +1, s = +1/2

D. n=4, l=4, m = -4, s = -1/2

Answer: C

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146. The set of quantum numbers not applicable to an electron is

A. 1,1,1,+1/2

B. 1,0,0,+1/2

C. 1,0,0,-1/2

D. 2,0,0,+1/2

Answer: A

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147. For the p_z orbital, conventionally m is

A. -2

B. +2

C. 0

D. Any of these

Answer: C

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148. For the d_{z^2} orbital, the value of m may be

A. -3

B. -2

C. 0

D. None

Answer: C

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149. The quantum number not obtained from the Schrodinger's wave equation is

A. n

B. 1

C. m

D. s

Answer: D

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150. A given orbital is labelled by the magnetic quantum number, m = -1. This can not be

A. s- orbital

B. p-orbital

C. d-orbital

D. f-orbital

Answer: A

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151. The shape of orbital for which l = 1 is

A. Spherical

B. Dumb-bell

C. Double dumb-bell

D. Circular

Answer: B

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152. The maximum number of electrons in a sub-shell is given by the expression.

A. (l+2)

B. (2l+2)

C. (4l+2)

D. (l+1)

Answer: C

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153. The magnetic quantum number m for the outermost electron in the Na atom,is

A. 1

B. 0

C. 2

D. -1

Answer: B

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154. For the configuration $1s^2 2s^1$, the quantum numbers for the outermost electron are

A. 2,1,0,-1/2

B. 2,0,0,+1/2

C. 2,1,0,+1/2

D. 2,0,1,+1/2

Answer: B

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155. The maximum number of electrons that a p-orbital can accommodate is

A. 6

B. 2

C. 10

D. 14

Answer: B

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156. The number of orbitals in the quantum level n = 4 is

A. 4

B. 9

C. 16

D. 18

Answer: C

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157. The quantum number which is equal for all the d-electrons in an atom is

A. l

B. m

C. s

D. n

Answer: A

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158. Correct set of four quantum numbers for the valence electron of Rubidium (Z=37) is

A. 5,0,0,+1/2

B. 5,1,0,+1/2

C. 5,1,1,+1/2

D. 6,0,0,+1/2

Answer: A

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159. n, l and m values of the $2p_z$ orbital are

A. 3,2,1

B. 2,1,0

C. 1,2,0

D. 2,0,1

Answer: B

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160. The horizontal quantum number for the last electron in sodium atom is

A. 1

B. 2

C. 0

D. 3

Answer: C

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161. Which of the following is not a possible value of azimuthal quantum number (l) for an electron with n = 3?

A. zero

B. 1

C. 2

D. 3

Answer: D

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162. Maximum number of electrons that can be present in M and N - shells respectively are

A. 18, 32

B. 8, 18

C. 32, 50

D. 32, 48

Answer: A

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163. What is the maximum number of electrons that can be theoretically present in the seventh orbit ?

A. 49

B. 32

C. 72

D. 98

Answer: D

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164. The correct set of quantum numbers for a 4d electrons is

A. 4,3,2,+1/2

B. 4,2,1,0

C. 4,3,-2,+1/2

D. 4,2,1,-1/2

Answer: D

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165. Which of the following sets of quantum numbers is correct for an electron is 4f - orbital ?

A. n = 4, l = 3, m = 4, s = +1/2

B. n = 4, l = 3, m = +1, s = +1/2

C. n = 4, l = 3, m = +1, s = +1/2

D. n = 3, l = 2, m = -2, s = +1/2

Answer: C

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166. No two electrons in an orbital can have parallel spin. This statement emerges from

A. Hund's rule

B. Aufbau principle

C. Pauli's exclusion principle

D. (n+1) rule

Answer: C

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167. Electrons never pair, if there are empty orbitals in a given sub-shell. This is

A. Aufbau principle

B. Pauli's exclusion principle

C. Hund's rule of maximum multiplicity

D. Heisenberg's uncertainity principle

Answer: C

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168. Which of the following explains the sequence of filling electrons in different subshells ?

A. Hund's rule

B. Aufbau principle

C. Pauli's principle

D. All of these

Answer: B

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169. Nitrogen atom has 3 unpaired electrons in its ground state. It can be explained by

A. Auf - bau principle

B. Paulis principle

C. Hund's rule

D. None of these

Answer: C

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170. The electronic cnfiguration of sodium is

A. $[Ne]3s^2$

B. $[Ne]3s^1$

C. $[Ar]4s^1$

D. $[Ar]4s^2$

Answer: B

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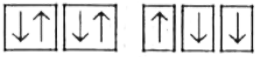
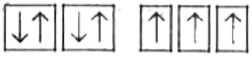
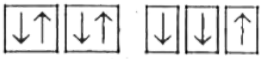
171. Which of the following represent an acetal/ ketal

A. 

B. 

C. 

D.

Answer: B

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172. Electronic configuration of the element with atomic number 56 and mass number 138 is

A. $[Xe]6s^2$

B. $[Kr]5s^2$

C. $[Xe]6s^26p^2$

D. $[Xe]3d^25d^2$

Answer: A

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173. The electronic configuration of Sodium is $1s^2 2s^2 2p^6 3s^1$.

What information that it gives ?

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

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174. The correct valence electronic configuration for Cu(z = 29) is

A. $3d^9 4s^2$

B. $3d^{10} 4s^1$

C. $3d^{10} 4s^2$

D. $3d^8 4s^2$

Answer: B

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175. Which one of the following pairs of ions have the same electronic configuration

A. Cr^{3+}, Fe^{3+}

B. Fe^{3+}, Mn^{2+}

C. Fe^{3+}, Co^{3+}

D. Sc^{3+}, Cr^{3+}

Answer: B

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176. The (n+l) value for 4f sub-shell is

A. 4

B. 5

C. 6

D. 7

Answer: D

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177. The energy of the electron in the hydrogen atom is given by the expression

A. The principal quantum number only

B. All the quantum numbers

C. The Azimuthal quantum number

D. The principal and azimuthal quantum numbers

Answer: A

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178. After 3d-su level is completely filled the differentiating electron enters into ..... sub level.

A. 4s

B. 4p

C. 4f

D. 5s

Answer: B

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179. The electronic configuration of chromium (Z=24) is

A. $[Ar]3d^5 4s^1$

B. $[Ar]3d^4 4s^2$

C. $[Ar]3d^6$

D. $[Ar]3d^5 4s^2$

Answer: A

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180. The configuration $1s^2 2s^2 2p^6 3s^2 3p^3$ corresponds to

A. S

B. P

C. Na

D. Ar

Answer: B

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181. To which element does the following electronic configuration correspond ?

$1s^2 2s^2 2p^6 3s^2 3p^1$

A. Nitrogen atom (ground state)

B. Carbon atom (ground state)

C. An excited carbon atom

D. An excited nitrogen atom

Answer: C

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182. The total number of 'p' electrons present in phosphorous atom is

A. 9

B. 2

C. 8

D. 3

Answer: A

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183. Element with atomic number 38, belongs to

A. $3d^5$

B. $3d^5 4s^2$

C. $3d^2 4s^1 4p^1$

D. $3d^2 4s^2 4p^1$

Answer: B

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184. Among $N^{-3}, O^{-2}, F^{-}, Na^{+}, Mg^{+2}$ and Al^{+3}

(a) What is common in them?

A. Protons

B. Neutrons

C. Electronic configuration

D. neutrons + protons

Answer: C

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185. The number of unpaired electrons in the valance shell of silicon is

A. 2

B. 3

C. 1

D. 0

Answer: A

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186. a) An orbital can hold only two electrons

b) An orbital must have electrons with opposite spins. Which is correct ?

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: B

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187. Which of the following electronic configuration corresponds to an inert gas?

A. $1s^2 2s^2 2p^5$

B. $1s^2 2s^2 2p^6$

C. $1s^2 2s^2 2p^6 3s^1$

D. None

Answer: B

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188. The rule that explain the reason for chromium to have $[Ar]3d^5 4s^1$ configuration instead of $[Ar]3d^4, 4s^2$ is

A. Pauli's exclusion principle

B. Aufbau principle

C. more exchange energy

D. Heisenberg's principle

Answer: C

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189. Which of the following configuration is not possible ?

A. $2p^2$

B. $3f^2$

C. $3d^5$

D. $4p^6$

Answer: B

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190. Which of the following ions is not isoelectronic with O^{2-}

A. N^{3-}

B. F^{-}

C. Ti^{+}

D. Na^{+}

Answer: C

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191. Number of valence electrons in carbon is

A. 3

B. 1

C. 4

D. 0

Answer: C

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192. The number of unpaired electrons in Fe^{3+} ion are

A. 1

B. 0

C. 4

D. 5

Answer: D

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193. The number of unpaired electrons in $1s^2 2s^2 2p^3$ is

A. 1

B. 2

C. 3

D. 5

Answer: C

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194. Bohr's basic idea of discrete energy levels in atorns and the of Photons from the higher levels to lower levels was experimentally confirmed by experiments performed by

A. $4s > 3d$

B. $4d < 3d$

C. $4s < 3p$

D. $4s = 3d$

Answer: B

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195. The number of d-electrons retained in Fe^{3+} (At. No. of Fe = 26) ion is

A. 3

B. 4

C. 5

D. 6

Answer: C

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196. Which of the following is the correct electronic configuration of Fe^{3+} ion ? (Z for Fe = 26)

A. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^4, 4s^1$

B. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^3, 4s^2$

C. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^2$

D. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^5, 4s^2, 4p^3$

Answer: C

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197. The configuration of chromium atom in ground state is

A. $[Ar]3d^4 4s^2$

B. $[Ar]3d^5 4s^1$

C. $[Ar]3d^6 4s^2$

D. $[Ar]3d^7 4s^2$

Answer: B

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198. The number of unpaired electrons in $1s^2 2s^2 2p^3$ is

A. 1

B. 2

C. 3

D. 5

Answer: C

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199. Number of unpaired electrons in the electronic configuration $1s^2 2^2 2p^4$ is

A. 2

B. 3

C. 4

D. 6

Answer: A

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200. Which of the following is not a fundamental particle ?

A. Proton

B. Neutron

C. Alpha particle

D. Electron

Answer: C

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201. A neutral atom (At.no. > 1) has

A. electron and proton

B. neutron and electron

C. neutron, electron and proton

D. neutron and proton

Answer: C

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202. The study of discharge of electricity through gases led to the discovery of

A. Structure of the atom

B. Nucleus

C. Spectral lines

D. Electron

Answer: D

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203. Electron is a particle having a

A. negative charge of one unit and zero mass

B. positive charge of one unit and zero mass

C. negative charge of one unit and a mass of about $9.1 \times 10^{-31} kg$

D. negative charge of one unit and a mass of about $1.67 \times 10^{-27} kg$.

Answer: C

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204. The value of e/m for an electron is

A. $1.78 \times 10^{8} c/g$

B. $1.6724 \times 10^{-24} c/g$

C. $0.005486 c/g$

D. $1.00866 c/g$

Answer: A

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205. Charge of electron is

A. $1,602 \times 10^{-10}$ Coulomb

B. 4.8×10^{-10} Coulomb

C. 1.602×10^{-19} e.s.u

D. 4.8×10^{-10} e.s.u

Answer: D

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206. The e/m of proton is

A. $1.78 \times 10^{8} c/g$

B. $9.57 \times 10^{4} c/g$

C. $19.14 \times 10^{4} c/g$

D. $0.478 \times 10^4 c/g$

Answer: B

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207. Cathode rays are deflected towards_____.

A. electromagnetic waves

B. radiation

C. strea of alpha particles

D. stream of electron

Answer: D

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208. The ratio of charge and mass would be greater for

A. Proton

B. Electron

C. Neutron

D. Alpha particle

Answer: B

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209. ${}_{11}^{22}Na$ contains

A. 22 protons

B. 11 neutrons

C. 22 neutrons

D. 11 nucteons

Answer: B

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210. Which one of the following is an isobar of ${}_6C^{14}$?

A. ${}_6C^{13}$

B. ${}_6C^{12}$

C. ${}_7N^{14}$

D. ${}_7N^{15}$

Answer: C

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211. Number of protons in the nucleus of carbon atom is

A. 7

B. 8

C. 4

D. 6

Answer: D

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212. The number of nucleons in chlorine - 37 is

A. 17

B. 20

C. 54

D. 37

Answer: D

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213. The nucleus of an atom contains

A. Electrons and protons

B. Protons and neutrons

C. Electrons and beta particles

D. Protons and alpha particles

Answer: B

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214. The siotopes of neutral atom of an element differ in

A. Atomic number

B. Mass number

C. Number of electrons

D. Chemical properties

Answer: B

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215. The nucleus of tritium consists of

A. 1 proton + 1 neutron

B. 1 proton + 3 neutrons

C. 1 proton + zero neutrons

D. 1 proton + 2 neutrons

Answer: D

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216. Sodium ion is isoelectronic with.....atom

A. Mg^{2+}

B. Al^{3+}

C. Ne

D. N^{3-}

Answer: C

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217. An atom differs from its ion in

A. Nuclear charge

B. Mass number

C. Number of electrons

D. Number of neutrons

Answer: C

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218. In C^{14} isotope the number of nuetrons would be

A. 6

B. 14

C. 8

D. 10

Answer: C

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219. The number of neutrons in the dipositive zinc ion (Mass no. of Zn = 65)

A. 35

B. 33

C. 65

D. 67

Answer: A

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220. Which of the following statements concer ning light is false ?

A. It is a form of energy

B. It cannot be deflectedby a magnet

C. It consists of photons of same enrgy

D. It is a part of electromagnetic spectrum

Answer: C

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221. Atomic and mass numbers can be

A. Negative

B. Fractional

C. Zero

D. Whole number

Answer: D

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222. The number of protons, electrons and neutrons in $_{35}Br^{80}$ are respectively

A. 35, 35, 80

B. 35, 35, 45

C. 80, 80, 35

D. 45, 45, 35

Answer: B

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223. Nitride ion is composed of

A. 7 electrons and 7 protons

B. 7 protons and 10 protons

C. 10 electrons and 7 protons

D. 10 electrons and 10 protons

Answer: C

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224. Three isotopes of an element have mass numbers $m, (m+1)$ and $(m+2)$. If the mean mass number is $(m+0.5)$ then which of the following ratios may be accepted for $m, (m+1)(m+2)$ in that order?

A. $1:1:1$

B. $4:1:1$

C. $3:2:1$

D. $2:1:1$

Answer: B

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225. Rutherford's alpha ray scattering experiment showed for the first time that that atom has

A. Nucleus

B. Proton

C. Electron

D. Neutron

Answer: A

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226. The radius of the atom is of the order of

A. $10^{-10}cm$

B. $10^{-13}cm$

C. $10^{-15}cm$

D. $10^{-8}cm$

Answer: D

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227. When alpha particles are sent through a thin metal foil most of them go straight through the foil because

A. Alpha particles are much heavier than electrons

B. Alpha particles are positively charged

C. Most part of the atom is empty

D. Alpha particles move with high velocity Nature of light

Answer: C

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228. Electromagnetic radiation with minimum wavelength is

A. Ultra violet

B. Radio wave

C. X-ray

D. Infra red

Answer: C

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229. Einstein was awarded Noble Prize for

A. General theory of relativity

B. The equation, $E = mc^2$

C. Enunciation of quantum theory

D. Explanation of photoelectric effect

Answer: D

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230. In electromagnetic radiation, which of the following,..... rays has greater wavelength than visible light ?

A. U.V-rays

B. I.R-rays

C. Gamma rays

D. X-rays

Answer: B

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231. Which of the following is not an electromagnetic radiation ?

A. Gamma rays

B. Alpha rays

C. Radio waves

D. X-rays

Answer: B

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232. The energy of a photon is inversely propor tional to its

A. Wavelength

B. Frequency

C. Wave number

D. Velocity

Answer: A

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233. What is the value of Planck's constant

A. $6.626 \times 10^{-27} Js$

B. $6.626 \times 10^{-34} Js$

C. $6.023 \times 10^{23} Js$

D. $1.602 \times 10^{-19} Js$

Answer: B

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234. Of the following properties of a wave, the one that is independent of the others is it

A. Wave number

B. Wave length

C. Frequency

D. Amplitude

Answer: D

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235. The radiation with highest wave number

A. Microwaves

B. X- rays

C. I.R. - rays

D. Radiowaves

Answer: B

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236. Which of the following relates to photon both as wave motion and as a stream of particles ?

A. $E = mc^2$

B. Photoelectrical effect

C. Diffraction

D. $E = hv$

Answer: D

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237. The metal best used in photoelectric cells is

A. Na

B. Mg

C. Al

D. Cs

Answer: D

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238. The energy required to emit an electron from the surface of a metal is called

A. Activation energy

B. Threshold energy

C. Critical energy

D. Kinetic energy

Answer: B

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239. Kinetic energy of photoelectrons is indepen dent on -------- of incident radiation.

A. Wavelength

B. Wave number

C. Frequency

D. Intensity

Answer: D

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240. If the wavelength of an electromagnetic radiation is 2000 A. what is its energy in ergs?

A. 9.94×10^{-12}

B. 9.94×10^{-10}

C. 4.97×10^{-12}

D. 4.97×10^{-19}

Answer: A

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241. The energy of an electromagnetic radiation is 3×10^{-12} ergs. What is its wavelength in nanometers ? ($h = 6.625 \times 10^{-27}$ erg.sec, $C = 3 \times 10^{10} cm.\ \sec^{-1}$

A. 662

B. 1324

C. 66.2

D. 6.62

Answer: A

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242. The frequency associated with photon of radiation having a wavelength of 6000 Å is

A. $5 \times 10^{14} Hz$

B. $4.26 \times 10^{10} Hz$

C. $2 \times 10^{14} Hz$

D. $5 \times 10^{15} Hz$

Answer: A

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243. Energy of a photon with a wave length of 450 nm is

A. $4.36 \times 10^{-12} ergs$

B. $4.36 \times 10^{-13} ergs$

C. $4.36 \times 10^{-20} ergs$

D. $4.36 \times 10^{-11} ergs$

Answer: A

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244. Assertion (A) : The energy of ultraviolet radiation is greater than the energy of infrared radiation

Reason (R) : The velocity of ultraviolet radiation is greater than the velocity of infrared radiation

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true but R is not the correct explanation of A

C. A is true and R is false

D. R is true and A is false

Answer: C

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245. A wave has a frequency of $3 \times 10^{15} \text{sec}^{-1}$. The energy of that photon is

A. $1.6 \times 10^{-12} erg$

B. $3.2 \times 10^{-11} erg$

C. $2.0 \times 10^{-11} erg$

D. $3 \times 10^{15} erg$

Answer: C

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246. The wave length of light having wave number 4000 cm^{-1} is

A. $2.5 \mu m$

B. $250 \mu m$

C. $25 \mu m$

D. $25 nm$

Answer: A

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247. The energy of an electromagnetic radiation is 19.875×10^{-13} ergs. What is the wave number in cm^{-1} ? ($h = 6.625 \times 10^{-27}$ erg.sec, $c = 3 \times 10^{10} cm.\ \sec^{-1}$)

A. 1000

B. 10^6

C. 100

D. 10000

Answer: D

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248. Splitting of spectral lines in the presence of electric field is called _____

A. Photoelectric effect

B. Stark effect

C. Zeeman effect

D. Electromagnetic effect

Answer: B

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249. Identify the incorrectly matched set ffrom the following

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250.

Metal	Li	Na	K	Mg	Cu	Ag
Work function	2.42 eV	2.3 eV	2.25 eV	3.7 eV	4.8 eV	4.3 eV

Elements capable of exhibiting photoelectric effect with 295nm radiation

1)

A. Li, Na, K and Mg

B. K, Mg, Cu and Ag

C. Na, K, Mg and Cu

D. Li, Na, K and Mg

Answer: D

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251. The spectrum obtained from incandescent solids is

A. Continuous

B. Line light

C. Band

D. Absorption

Answer: A

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252. The electron in the Hydrogen atom is excited to the 4th orbit. Number of spectral lines expected in the emission is

A. 4

B. 6

C. 10

D. 12

Answer: B

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253. (A): Emssion spectrum produced due to the transition of an electron from M shell to L shell

(R) : The ratio of energy and frequency of a photon is 6.625×10^{-27}erg-sec

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true but R is not the correct explanation of A

C. A is true and R is false

D. A is false but R is true

Answer: C

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254. The wavelength of a spectral line emitted by hydrogen atom in the Lyman series is 16/15R cm. The value of n_2 if R is Rydberg constant

A. 1

B. 2

C. 3

D. 4

Answer: D

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255. When a greater number of electrons from excited hydrogen atoms reach the ground state, then

A. The intensity of spectral lines in Lyman series increases

B. The number of lines in Lyman series increases

C. Both the intensity and number lines in Lyman series increase.

D. There is no observable change in spectrum

Answer: A

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256. The first spectral line in the Pfund series of Hydrogen spectrum is given by

$\left(R_H = \text{ Rydberg constant}\right)$

A. $\frac{9R_H}{400}$

B. $\frac{56R_H}{36}$

C. $\frac{11R_H}{900}$

D. $\frac{7R_H}{144}$

Answer: D

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257. When electron jumps from 5^{th} energy level to 1^{st} energy level, to which series the spectral line belongs?

A. Balmer

B. Lyman

C. Paschen

D. Pfund

Answer: B

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258. When the electron in the 'H' atom jumps from the fifth orbit to the second orbit, the spectral line emitted is found in ---- region.

A. Visible

B. Ultraviolet

C. Near IR

D. Far IR

Answer: A

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259. The following series of lines is found in the ultraviolet region of hydrogen atomic spectrum

A. Balmer

B. Paschen

C. Brackett

D. Lyman

Answer: D

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260. Brackett series is produced when the electrons from outer orbits jump to

A. Third orbit

B. Second orbit

C. Fourth orbit

D. Fifth orbit

Answer: C

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261. The equation corresponding to the wave number of spectral lines in Pfund series is

A. $R\left[\frac{1}{4^2} - \frac{1}{5^2}\right]$

B. $R\left[\frac{1}{3^2} - \frac{1}{4^2}\right]$

C. $R\left[\frac{1}{2^2} - \frac{1}{3^2}\right]$

D. $R\left[\frac{1}{5^2} - \frac{1}{6^2}\right]$

Answer: D

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262. The value of n_1 in Balmer series is

A. 2

B. 1

C. 3

D. 0

Answer: A

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263. Rydberg constant is given as

A. $109677 cm^{-2}$

B. $109700 cm^{-1} s^{-1}$

C. $10968 cm^{-4}$

D. $10970 m$

Answer: A

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264. A spectral line with $\lambda = 4938 Å$ belongs to the - series of Hydrogen atom

A. Lyman

B. Balmer

C. Parchen

D. Pfund

Answer: B

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265. Among the.first lines of Lyman, Balmer, Paschen and Brackett series in hydrogen atomic spectra, which has higher energy?

A. Lyman

B. Balmer

C. Paschen

D. Bracket

Answer: A

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266. What are the values of n_1 and n_2 respectively for H_β line in the Lyman series of hydrogen atomic spectrum?

A. 3 and 5

B. 2 and 3

C. 1 and 3

D. 2 and 4

Answer: C

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267. The fourth line of the Balmer series corres ponds to the electronic transition between two orbits of the H atom, Identify the orbits.

A. 3 and 1

B. 5 and 1

C. 5 and 2

D. 6 and 2

Answer: D

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268. In a H-atom, the transition takes place from L to K shell. If $R = 1.08 \times 10^7 m^{-1}$, the wave length of the light emitted is nearly

A. 4400Å

B. 1250Å

C. 1650Å

D. 1850Å

Answer: B

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269. The wave length of first member of Balmer series of a hydrogen atom is nearly (The value of Rydberg constant $R = 1.08 \times 10^7 m^{-1}$)

A. 4400Å

B. 5500Å

C. 6600Å

D. 7700Å

Answer: C

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270. The wave length of Hg line of Balmer series of a hydrogen atom is nearly

$\left(R = 1.08 \times 10^{7} m^{-1}\right)$

A. 4090Å

B. 5400Å

C. 6800Å

D. 7200Å

Answer: A

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271. The first emision line of hydrogen atomic spectrum in the Balmer series appear at(R=Rydberg constant)

A. $\frac{5R}{36}cm^{-1}$

B. $\frac{3R}{4}cm^{-1}$

C. $\frac{7R}{144}cm^{-1}$

D. $\frac{9R}{400}cm^{-1}$

Answer: A

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272. What is the wave length of H, line in Balmer series of hydrogen spectrum? (R = Rydberg constant)

A. $36/5R$

B. $5R/36$

C. $3R/16$

D. $16/3R$

Answer: D

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273. If in Hydrogen atom, an electron jumps from $n_2 = 2$ to $n_1 = 1$ in Bohr's orbit, then the value o wave number of the mitted photon will be $\left(R = 109700 cm^{-1}\right)$

A. $54850 cm^{-1}$

B. $82275 cm^{-1}$

C. $62875 cm^{-1}$

D. $10970 cm^{-1}$

Answer: B

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274. What is the lowest energy of the spectral line emitted by the hydrogen atom in the Lyman series? (h = Planck constant, c = Velocity of light, R = Rydberg constant)

A. $\frac{5hcR}{36}$

B. $\frac{4hcR}{3}$

C. $\frac{3hcR}{4}$

D. $\frac{7hcR}{144}$

Answer: C

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275. The wavelength of the radiation emitted, when in hydrogen atom electron falls from infinity to stationary state 1, would be $\left(\text{Rydberg constant } 1.097 \times 10^{7} m^{-1}\right)$

A. 91 nm

B. $9.1 \times 10^{-8} nm$

C. 406 nm

D. 192 nm

Answer: A

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276. The wavelength of spectral line for electron transition is inversely related to

A. Nuclear charge

B. Velocity of electron

C. Number of electrons undergoing transition

D. The energy difference between the energy levels involving transition.

Answer: D

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277. Line spectrum is characteristic of

A. Atoms

B. Molecules

C. Any substance in solid state

D. Any substance in liquid state

Answer: A

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278. Calculate the wave number of the highest energy transition in the Balmer series of Hydrogen atom $\left[\text{Ry} = 109678 cm^{-1}\right]$

A. $27419.5 cm^{-1}$

B. $2741.95 cm^{-1}$

C. $274.195 cm^{-1}$

D. $274195.1cm^{-1}$

Answer: A

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279. If the electron of a hydrogen atom is present in the first orbit. The total energy of the electrons is

A. $\frac{-e^2}{r}$

B. $\frac{-e^2}{r^2}$

C. $\frac{-e^2}{2r}$

D. $\frac{-e^2}{2r^2}$

Answer: C

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280. The angular momentum of an electron present in the excited state of hydrogen is $1.5h/\pi$. The electron is present in

A. Third orbit

B. Second orbit

C. Fourth orbit

D. Fifth orbit

Answer: A

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281. According to Bohr's theory, the angular momentum of electron in 5th orbit is

A. $2.5h/\pi$

B. $25h/\pi$

C. $1.0h/\pi$

D. $10h/\pi$

Answer: A

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282. The angular momentum of a revolving electron in an orbit is equal to

A. $\frac{nh}{2\pi}$

B. $\frac{h}{2\pi}$

C. $\left(\frac{nh}{2\pi}\right)^2$

D. $\frac{n\pi}{2h}$

Answer: A

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283. Energy of an electron in n^{th} Bohr orbit is given as

A. $-\frac{n^2h^2}{4\pi^2mZe^2}$

B. $-\frac{2\pi^2Z^2me^4}{n^2h^2}$

C. $-\frac{2\pi Ze^2}{nh}$

D. $-\frac{n^2h^2}{2\pi^2Z^2me^4}$

Answer: B

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284. According to Bohr's model of an atom, the electrons revolve round the nucleus in

A. orbits

B. sub-orbits

C. orbitals

D. electron cloud

Answer: D

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285. The electronic state in which the hydrogen atom can never emit a photon is

A. 2p orbital

B. 3s orbital

C. 1s orbital

D. 4p orbital

Answer: C

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286. In a hydrogen atom, if energy of an electron in ground state is 13.6eV, then the energy in the nearest excited state is

A. 1.51eV

B. 3.4eV

C. 6.04eV

D. 13.6eV

Answer: B

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287. Choose the correct statement (s)

(i) The energy of an electron in an atom is always negative, because it is negatively charged.

(ii) The charge of an electron in an atom is positive

(iii) When an electron is at an infinite distance from the nucleus so that there is no electrical interaction , then orbitarily the energy of electron is taken to be zero

(iv) As the electron moves closer to the nucleus, energy is released and so its energy becomes less than zero i.e., negative.

A. all are correct

B. ii and iv are correct

C. only ii is correct

D. no statement is correct.

Answer: B

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288. The energy difference between the following two successive levels is minimum

A. 1 and 2

B. 2 and 3

C. 3 and 4

D. 4 and 5

Answer: D

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289. The value of the energy for the first excited state of hydrogen will be

A. $-13.6eV$

B. $-3.40eV$

C. $-1.51eV$

D. $-0.85eV$

Answer: B

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290. In the Bohr's orbit, what is the ratio of total kinetic energy and total energy of the electron

A. -1

B. -2

C. 1

D. +2

Answer: A

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291. In an atom when an electron jumps from K-shell to M-shell

A. Energy is absorbed

B. Energy is emitted

C. Energy is neither absorbed nor emitted

D. Sometimes energy is absorbed and some times emitted

Answer: A

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292. The expression for radius of a Bohr orbit in hydrogen atom is

A. $\frac{nh}{2\pi mr}$

B. $\frac{n^2h^2}{4\pi^2me^2}$

C. $-\frac{2\pi^2me^4}{n^2h^2}$

D. $\frac{n^2}{4\pi^2mhe^2}$

Answer: B

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293. As the electron moves away from the nucleus its potential energy --- and kinetic energy ---

A. Decreases, increases

B. Increases, increases

C. Decreases, decreases

D. Increases, decreases

Answer: D

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294. Bohr's model can explain

A. The spectrum of hydrogen atom only

B. Spectrum of an atom or ion containing one electron only

C. The spectrum of hydrogen molecule

D. The solar spectrum

Answer: B

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295. Splitting of spectral lines under the influence of strong magnetic field is called

A. Stark effect

B. Zeeman effect

C. Photoelectric effect

D. None of these

Answer: B

296. Radius of tenth Bohr orbit of the hydrogen atom is.

A. 0.53Å

B. 5.3Å

C. 53Å

D. $5.3 \times 5\text{Å}$

Answer: C

297. Radius of 3rd Bohr orbit is

A. 6.529Å

B. 2.116Å

C. 4.761Å

D. 8.464Å

Answer: C

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298. Velocity of the electron in the 1st Bohr orbit

A. $2.18 \times 10^8 cm/\sec$

B. $2.18 \times 10^8 m/\sec$

C. $2.18 \times 10^{16} cm/\sec$

D. $36559 \times 10^8 cm/\sec$

Answer: A

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299. The energy that is needed to remove an electron from the 1st Bohr orbit or Hydrogen atom is

A. 2.72 ev

B. 40.8 ev

C. 13.6 ev

D. 54.4 ev

Answer: C

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300. The speed of an electron in the inner most orbit of the hydrogen (Bohr radius = 52.9 pm, me $= 9.11 \times 10^{-31} kg$) is

A. $2.19x10^{14}m.s^{-1}$

B. $2.19 \times 10^{6}m.s^{-1}$

C. $2.19 \times 10^{7}m.s^{-1}$

D. $2.19 \times 10^{8}m.s^{-1}$

Answer: B

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301. The energy of an electron present in Bohr's second orbit of hydrogen atom is

A. $-1312\ \text{J atom}^{-1}$

B. $-328\ \text{kJ mol}^{-1}$

C. $-328\ \text{J mol}^{-1}$

D. $-164\ \text{kJ mol}^{-1}$

Answer: B

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302. The first use of quantum theory' to explain the structure of atom was made by

A. Planck

B. Einstein

C. Bohr

D. Heisenberg

Answer: C

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303. Bohr's theory is applicable to

A. Li^{+2}

B. Li^{+}

C. He^+

D. Both 1 and 3

Answer: D

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304. Total number of spectral lines when electron jumps from 8^{th} orbit to 2^{nd} orbit

A. $\frac{3}{3}$th of its ionization energy

B. $\frac{1}{2}$nd of its ionization energy

C. $\frac{1}{4}$th of its ionization energy

D. $\frac{1}{9}$th of its ionization energy

Answer: A

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305. The potential energy of the electron present in the ground state of Li^{+2} ion is represented by :

A. $\frac{+3e^2}{4\pi\varepsilon_0 r}$

B. $\frac{-3e}{4\pi\varepsilon_0 r}$

C. $\frac{-3e^2}{4\pi\varepsilon_0 r}$

D. $\frac{-9e^2}{4\pi\varepsilon_0 r}$

Answer: C

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306. Which of the following statements is (are) correct in Bohr's model if the mass of an electron becomes 10 times its original mass ?

A. Velocity of the electron increases by 10 times

B. Orbit radius decreases by 10 times

C. Energy of electron increases by 10 times

D. Wave length of the electron will remain same

Answer: D

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307. $n = 2$ to $n = 1$ transition of the following emit a photon with smallest wave length.

A. H

B. He^{+}

C. Li^{2+}

D. Be^{3+}

Answer: D

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308. Bohr's theory is not applicable to

A. H

B. He^+

C. Li^{2+}

D. H^+

Answer: D

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309. The ground state energy in J, of hydrogen atom is -X. The minimum energy in J, required to promote an electron from n=1 to n=2 in He^+ is

A. $3X$

B. $\frac{4X}{3}$

C. $\frac{3X}{4}$

D. $\frac{X}{3}$

Answer: A

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310. The radius (in nm) of first orbit of He^{+} is :

A. 0.0529

B. 0.02645

C. 0.01322

D. 0.529

Answer: B

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311. A cricket ball of mass 0.5 kg is moving with a velocity of $100ms^{-1}$, the wavelength associated with its motion is

A. $13.25 \times 10^{-26} m$

B. $13.25 \times 10^{-34} m$

C. $13.25 \times 10^{-36} m$

D. $6.6 \times 10^{-34} m$

Answer: C

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312. If the Planck's constant $h = 6.6 \times 10^{-34} Js$, the de-Broglie wave length of a particle having momentum of $3.3 \times 10^{-24} kg.\, ms^{-1}$ will be

A. $2 \times 10^{-10} m$

B. $1 \times 10^{-15} m$

C. $10^{-5} m$

D. $4 \times 10^{-10} m$

Answer: A

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313. The de Broglie wave length associated with a particle of mass 1 mg moving with a velocity of 1m/sec is

A. $6.63 \times 10^{-29} m$

B. $6.63 \times 10^{-31} m$

C. $6.63 \times 10^{-28} m$

D. $6.63 \times 10^{-22} m$

Answer: C

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314. The de Broglie wavelength of a tennis ball of mass 60 g moving with a velocity of 10 metres per second is approximately

A. 10^{-33} metres

B. 10^{-31} metres

C. 10^{-16} metres

D. 10^{-25} metres

Answer: A

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315. If the uncertainity in velocity of a moving object is $1.0 \times 10^{-6} ms^{-1}$ and the uncertainty in its position is 58m, the mass of this object is approximately equal to that of

$\left(h = 6.626 \times 10^{-34} Js\right)$

A. Helium

B. Deuterium

C. Lithium

D. Electron

Answer: D

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316. The de-Broglie equation treats an electron to be

A. particle

B. wave

C. ray

D. (1) and (2)

Answer: D

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317. Wavelength of the wave associated with a moving electron

A. Decreases with increase in speed of electron

B. Increases with increase in speed of electron

C. Remains same irrespective of speed of electron

D. Remains is zero.

Answer: A

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318. The uncertainity principle and the concept of wave nature of matter were proposed by----- and ---- respectively

A. Pauli, Hund

B. Heisenberg, Aufbau

C. Heisenberg, de Broglie

D. Heisenberg, Planck

Answer: C

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319. If the radius of first Bohr orbit of H atom is x, then de Broglie wavelength of electron in 3^{rd} orbit is nearly

A. $2\pi x$

B. $6\pi x$

C. $9x$

D. $x/3$

Answer: B

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320. An electrons is moving in Bohr's fourth orbits De-Broglie wavelength s λ.What is the circumference of the fourth orbit?

A. λ

B. 2λ

C. 3λ

D. 4λ

Answer: C

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321. Bohr's postulate that $mvr = \frac{nh}{2\pi}$ is proved mathematically by

A. Pauli's exclusion principle

B. de Broglie wave nature of the electron

C. Heisenberg's uncertainity principle

D. Sommerfield theory

Answer: B

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322. Find the momentum of a particle whose de Broglie wavelengh is 1Å.

A. 6.625×10^{-27}

B. 6.627×10^{-19}

C. 6.625×10^{-16}

D. 6.625×10^{-23}

Answer: B

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323. The de Broglie wavelength of a particle with mass 1 g and velocity 100 m/s is

A. $6.63 \times 10^{-33} m$

B. $6.63 \times 10^{-34} m$

C. $6.63 \times 10^{-35} m$

D. $6.63 \times 10^{-36} m$

Answer: A

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324. The de Broglie wave length of a riffle bullet of mass 2 grams moving with a velocity of 2m/sec of

A. $\frac{6.6 \times 10^{-34}}{2 \times 2} m$

B. $\frac{6.6 \times 10^{-27}}{2 \times 10^{-3} \times 2} cm$

C. $\frac{6.6 \times 10^{-34}}{2 \times 10^{-3} \times 2} m$

D. $\frac{6.6 \times 10^{-27}}{2 \times 2} m$

Answer: C

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325. Mass of electron $= 9.1 \times 10^{-3} kg$. The kinetic energy of an electron is $4.55 \times 10^{-25} J$. What is its wavelength (in nm) ?

A. 728

B. 850

C. 896

D. 786

Answer: A

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326. The uncertainity in momentum of an electron is $1 \times 10^{-5} kg.\, m/s$. The uncertainity in its position will be $\left(h = 6.62 \times 10^{-34} kg.\, m/s\right)$

A. $1.05 \times 10^{-28} m$

B. $1.05 \times 10^{-26} m$

C. $5.27 \times 10^{-30} m$

D. $5.27 \times 10^{-28} m$

Answer: C

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327. Uncertainity in the position of an electron (mass $= 9.1 \times 10^{-31} kg$) moving with a velocity $300 ms^{-1}$ accurate upto 0.001% will be $\left(h = 6.63 \times 10^{-34} Js\right)$

A. $3.84 \times 10^{-2} m$

B. $19.2 \times 106(- 2)m$

C. $5.76 \times 10^{-2} m$

D. $1.92 \times 10^{-2} m$

Answer: D

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328. The uncertainty in the momentum of a particle is $3.31 \times 10^{-2} kgms^{-1}$. The uncertainity in its position is (in metres)

A. 1.59×10^{-33}

B. 0.33×10^{-30}

C. 0.4×10^{-20}

D. 3.3×10^{-24}

Answer: A

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329. Uncertainity in position of a minute particle of mass 25 g in space is $10^{-5}m$. What is the uncertainity in its velocity (in ms^{-1}) ? $\left(h = 6.6 \times 10^{-34} Js\right)$

A. 2.1×10^{-34}

B. 0.5×10^{-34}

C. 2.1×10^{-28}

D. 0.5×10^{-23}

Answer: C

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330. If uncertainity in position is zero, the uncertainity in momentum of an electron will be

A. Zero

B. Infinity

C. Unity

D. Negative

Answer: B

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331. Identify the correct set from the following for fundamental particles

LIST - A	LIST - B
I) Decreasing order of masses	a) $e^- > p > n$
II) Decreasingorder of e/m values	b) $p > e^- > n$
III) Decreasing order of de-Broglie's wavelength with same velocities	c) $n > p > e^-$
IV) Decreasingorder of uncertainity in velocity when Δx is same	d) $n > e^- > p$

The correct match is `

A. *I - c, II - a, III - d, IV - a*

B. *I - c, II - a, III - a, IV - a*

C. *I - c, II - d, III - b, IV - a*

D. *I - c, II - b, III - d, IV - a*

Answer: B

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332. Maximum number of electrons may be present in one 4f-orbital

A. 2

B. 4

C. 7

D. 14

Answer: A

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333. An atomic orbital

A. defines exactly the position of an electron relative to the nucleus

B. has a shape dependent on the spin of the electron

C. is always spherical in shape

D. represents the probability of finding an electron at a certain distance from the nucleus.

Answer: D

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334. The number of nodes in radial distribution curve of 4s sublevel is

A. 1

B. 2

C. 3

D. 4

Answer: C

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335. The orbital without nodal planes is

A. 1s

B. 2p

C. 3d

D. 3p

Answer: A

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336. The no. of spherical nodes in a 4s orbital is

A. Zero

B. 1

C. 2

D. 3

Answer: D

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337. Which d-orbitals has its four lobes along the axes

A. d_{xy}

B. $d_{x^2-y^2}$

C. d_{z^2}

D. d_{xz}

Answer: B

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338. The density of electron cloud of the orbital d_{xy} in yz plane is

A. Zero

B. Maximum

C. Not determined

D. None

Answer: A

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339. The probability of finding an electron in p_y orbital along the x-axis is

A. Maximum

B. Zero

C. Not determined

D. Infinite

Answer: B

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340. The number of nodes and nodal planes in 4p orbital are respectively

A. 2, 1

B. 1, 2

C. 2, 3

D. 3, 2

Answer: A

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341. The number of nodes possible in radial probability distribution curve of 3d orbital is

A. 1

B. 2

C. 3

D. 0

Answer: D

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342. The number of nodal planes 'd' orbital has

A. Zero

B. one

C. two

D. three

Answer: C

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343.

LIST - 1	LIST-2
A) Bohr's atomic model	1) Fine spectrum of Hydrogen
B) de-Broglie's concept	2) Atomic orbital
C) Sommerfield atomic model	3) Dual nature of any particle in motion
D) Schrodinger wave equation	4) Quantisation of angular momentum

The correct match is

A.
A	B	C	D
2	3	4	1

B.
A	B	C	D
4	3	2	1

C.
A	B	C	D
4	3	1	2

D.
A	B	C	D
3	4	2	1

Answer: C

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344. A 4f orbital has

A. one node

B. two nodes

C. three nodes

D. four nodes

Answer: C

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345. According to Schrodinger model, nature of electron in an atom is as

A. Particles only

B. Wave only

C. Both simultaneously

D. Sometimes waves and sometimes particles

Answer: C

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346. Which one of the following expressions represent the electron probability function (D)

A. $4\pi r \text{ dr } \Psi^2$

B. $4\pi r^2 \text{ dr } \Psi$

C. $4\pi r^2 \text{ dr } \Psi^2$

D. $4\pi r \ dr \ \Psi$

Answer: C

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347. Radial part of the wave function depends on quantum numbers

A. n and s

B. l and m

C. l and s

D. n and l

Answer: D

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348. In a given n, p-orbitals are --- fold degenerate

A. Two

B. Three

C. Four

D. Five

Answer: B

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349. Number of nodal planes that a p-orbital has

A. 0

B. 1

C. 2

D. 3

Answer: B

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350. Which of the following is correct with respect to 'p' orbitals?

A. Spherical shape

B. Strong directional character

C. Five fold degenerate

D. No directional character

Answer: B

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351. The maximum number of electrons accommo dated in all 5f orbitals

A. 5

B. 10

C. 14

D. 18

Answer: C

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352. For a f-orbital, the values of m are

A. $-1, 0, +1$

B. $0, +1, +2, +3$

C. $-2, -1, 0, +1, +2$

D. $-3, -2, -1, 0, +1, +2, +3$

Answer: D

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353. When n = 3, 1=1, the designation given to he orbital is

A. $4s$

B. $4p$

C. $3s$

D. $3p$

Answer: D

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354. Which of the following orbital designation is impossible?

A. $4f$

B. $5g$

C. $2d$

D. $6p$

Answer: C

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355. Value of $l = 3$, then the values of magnetic quantum numbers are

A. $\pm 1, \pm 2, \pm 3$

B. $0, \pm 1, \pm 2, \pm 3$

C. $-1, -2, -3$

D. $0, +1, +2, +3$

Answer: B

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356. The two electrons occupying an orbital are distinguished by

A. Principal quantum number

B. Azimuthal quantum number

C. Magnetic quantum number

D. Spin quantum number

Answer: D

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357. The impossible set of quantum numbers is

A. $n = 2, 1 = 0, m = 0, s = +1/2$

B. $n = 2, 1 = 1, m = 0, s = +1/2$

C. $n = 2, 1 = 0, m = 1, = -1/2$

D. $n = 3, 1 = 1, m = -1, s = -1/2$

Answer: C

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358. Which of the following quantum numbers are not possible ?

A. $n = 2, 1 = 1, m = -1, s = -1/2$

B. $n = 3, 1 = 2, m = -3, s = +1/2$

C. $n = 2, 1 = 0, m = 0, s = +1/2$

D. $n = 3, 1 = 2, m = -2, s = +1/2$

Answer: B

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359. The correct set of quantum numbers for the unpaired electron of chlorine atom is

A.

n	l	m
2	1	0

B.

n	l	m
2	1	1

C.

n	l	m
3	1	0

D.

n	l	m
3	0	0

Answer: D

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360. The values of quantum numbers n, 1 and m for the fifth electron of boron is

A. $n = 2, l = 1, m = -1$

B. $n = 2, l = 0, m = -1$

C. $n = 2, l = 2, m = -1$

D. $n = 1, l = 2, m = -1$

Answer: A

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361. Which of the following sets of quantum number is correct for an electron in 4f orbitals ?

A. n = 4,1 = 3, m = + 4, S = +1/2

B. n = 3, 1 = 2, m = -2, s = +1/2

C. n = 4,1 = 3, m = +1, s = +1/2

D. n = 4,1 = 4, m = - 4, s = - 1/2

Answer: C

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362. The set of quantum numbers not applicable to an electron is

A. $1, 1, 1, +1/2$

B. $1, 0, 0, +1/2$

C. $1, 0, 0, -1/2$

D. $2, 0, 0, +1/2$

Answer: A

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363. All electrons in a d-orbital must have the quantum number

A. $l = 2$

B. $m = 2$

C. $n = 3$

D. $n = 4$

Answer: A

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364. For the p_z orbital, conventionally m is

A. -2

B. +2

C. 0

D. Any of these

Answer: C

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365. For the d_{z^3} orbital, the value of m may be

A. -3

B. -2

C. 0

D. None

Answer: C

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366. The qunatum number not obtained from the Schrodinger's wave equation is

A. n

B. l

C. m

D. s

Answer: D

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367. A given orbital is labelled by the magnetic quantum number, m = -1. This can not be

A. s - orbital

B. p - orbital

C. d - orbital

D. f - orbital

Answer: A

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368. The shape of orbital for which l = 1 is

A. Spherical

B. Dumb - bell

C. Double dumb - bell

D. Circular

Answer: B

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369. The maximum number of electrons in a sub-shell is given by the expression.

A. $(l + 2)$

B. $(2l + 2)$

C. $(4l + 2)$

D. $(l + 2)$

Answer: C

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370. The magentic quantum number, m for the outermost electron in the sodium atom is

A. 1

B. 0

C. 2

D. -1

Answer: B

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371. For the configuration $1s^2 2s^1$, the quantum numbers for the outermost electron are

A. $2, 1, 0, -1/2$

B. $2, 0, 0, +1/2$

C. $2, 1, 0, +1/2$

D. $2, 0, 1, +1/2$

Answer: B

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372. The maximum number of electrons that a p-orbital can accommodate is

A. 6

B. 2

C. 10

D. 14

Answer: B

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373. The number of orbitals in the quantum level n = 4 is

A. 4

B. 9

C. 16

D. 18

Answer: C

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374. The quantum number which is equal for all the d-electrons in an atom is

A. l

B. m

C. s

D. n

Answer: A

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375. Correct set of four quantum numbers for the valence electron of Rubidium (Z=37) is

A. $5, 0, 0, +1/2$

B. $5, 1, 0, +1/2$

C. $5, 1, 1, +1/2$

D. $6, 0, 0, +1/2$

Answer: A

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376. n, l and m values of the $2p_z$ orbital are

A. 3, 2, 1

B. 2, 1, 0

C. 1, 2, 0

D. 2, 0, 1

Answer: B

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377. What is the maximum number of orbitals that can be identified with the following quantum numbers? $n = 3, 1 = 1, m_l = 0$

A. 3d

B. 3p

C. 3s

D. 4s

Answer: B

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378. The azimuthal quantum number for the last electron in sodium atom is

A. 1

B. 2

C. 0

D. 3

Answer: C

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379. Which of the following is not a possible value of azimuthal quantum number (l) for an electron with $n = 3$?

A. zero

B. 1

C. 2

D. 3

Answer: D

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380. Maximum number of electrons that can be present in M and N - shells respectively are

A. 18, 32

B. 8, 18

C. 32, 50

D. 32, 48

Answer: A

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381. What is the maximum number of electrons that can be theoretically present in the seventh orbit ?

A. 49

B. 32

C. 72

D. 98

Answer: D

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382. The correct set of quantum numbers for a 4d electrons is

A. $4, 3, 2, +1/2$

B. $4, 2, 1, 0$

C. $4, 3, -2, +1/2$

D. $4, 2, 1, -1/2$

Answer: D

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383. Which of the following sets of quantum numbers is correct for an electron is 4f - orbital ?

A. $n = 4, l = 3, m = 4, s = +1/2$

B. $n = 4, l = 4, m = 4, s = -1/2$

C. $n = 4, l = 3, m = +1, s = +1/2$

D. $n = 3, l = 2, m = -2, s = +1/2$

Answer: C

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384. The maximum probability of finding an electron of a particular energy in an orbital is about

A. 80 %

B. 85 %

C. 95 %

D. 99 %

Answer: C

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385. The number of nodal planes for P_x orbital is

A. 1

B. 2

C. 3

D. 0

Answer: A

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386. The number of radial nodes for a 3p orbital is

A. 0

B. 1

C. 2

D. 3

Answer: B

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387. Which of the following is indicated by the magnetic quantum number ?

A. Size

B. Orbital sphape

C. Spatial orientation

D. Spin

Answer: C

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388. Principal quantum number is related to

A. Size of the orbit

B. Spin angular momentum

C. Orbital angular momentum

D. Orientation of orbital in space

Answer: A

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389. The spin quantum number has a value of

A. $1/2$

B. $+1/2$

C. $1/2$

D. either $+1/2$ or $-1/2$

Answer: D

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390. When there are two electrons in the same orbital they have ..... Spins

A. $+\frac{1}{2}, +\frac{1}{2}$

B. $-\frac{1}{2}, -\frac{1}{2}$

C. $+\frac{1}{2}, -\frac{1}{2}$

D. 0, 0

Answer: C

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391. For complete description of an electron in an atom, the number of quantum numbers required is

A. one

B. Two

C. Three

D. Four

Answer: A

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392. The azimuthal quantum number indicates .....of the orbital

A. Size

B. Shape

C. Orientation

D. Spin

Answer: B

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393. Which of the following sets of quantum num bers represents the least energy of an atom ?

A. n = 3,1 = 0, m = 0, s = +1/2

B. n = 4,1 = 0, m = 0, s = +1/2

C. n = 3,1 = 2, m = 1, s = + 1/2

D. n = 3,1 = 1, m = 1, s = +1/2

Answer: A

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394. Which one of the following statements is correct?

A. For hydrogen and hydrogen like species, the energy and size of an orbit depends on 'l' only

B. The total number of orbitals associated with the principal qunatum number, n = 4 is 16

C. For a given value of 'n', the total number of 'l' values is (n + 1)

D. For a given principal shell ‘n’, the total number of sub-shells is (n + 1)

Answer: B

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395. Which of the folllowing is an acceptable set of qunatum numbers (in the order n, l, m, m)

A. $2, 1, 0, 0$

B. $2, 2, 0, 1/2$

C. $2, 0, 2, +1/2$

D. $2, 1, -1, 1/2$

Answer: B

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396. The correct set of quantum number for the unpaired electron of chlorine atom is

A. $2, 1, -1, +\frac{1}{2}$

B. $2, 0, 0, +\frac{1}{2}$

C. $3, 1, 1, \pm\frac{1}{2}$

D. $3, 0, 0, \pm\frac{1}{2}$

Answer: C

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397. An element M has an atomic mass 19 and atomic number 9. Its ion is represented by

A. M^+

B. M^{2+}

C. M^-

D. M^{2-}

Answer: C

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398. Which of the following element's outermost orbits Ist electron has magnetic quantum number m = 0 ?

A. Na

B. O

C. Cl

D. N

Answer: A

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399. Atomic number of the element which has diffe rentiating electron enters into a d-subshell for the first time

A. 4s

B. 4p

C. 4f

D. 5s

Answer: B

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400. Number of unpaired electrons in the electronic configuration $1s^2 2s^2 2p^4$ are

A. 2

B. 3

C. 4

D. 6

Answer: A

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401. The configuration $1s^2 2s^2 2p^6 3s^2 3p^3$ corres ponds to

A. S

B. P

C. Na

D. Ar

Answer: B

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402. The configuration $1s^2 2s^1 2p_x^1 2p_y^1 2p_z^1$ represents

A. Nitrogen atom (ground state)

B. Carbon atom (ground state)

C. An excited carbon atom

D. An excited nitrogen atom

Answer: C

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403. The total number of 'p' electrons present in phosphorous atom is

A. 9

B. 2

C. 8

D. 3

Answer: A

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404. The valence electron configuration of an element with atomic number 23 is

A. $3d^5$

B. $3d^3 4s^2$

C. $3d^2 4s^1 4p^1$

D. $3d^2 4s^2 4p^1$

Answer: B

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405. The number of unpaired electrons in $1s^2 2s^2 2p^3$ is

A. 1

B. 2

C. 3

D. 5

Answer: C

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406. The number of unpaired electrons in the valence shell of silicon is

A. 2

B. 3

C. 1

D. 0

Answer: A

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407. Which of the following electronic configuration corresponds to an inert gas?

A. $1s^2 2s^2 2p^5$

B. $1s^2 2s^2 2p^6$

C. $1s^2 2s^2 2p^6 3s^1$

D. None

Answer: B

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408. The rule that explain the reason for chromium to have $[Ar]3d^5 4s^1$ configuration instead of $[Ar]3d^4, 4s^2$ is

A. Pauli's exclusion principle

B. Aufbau principle

C. more exchange energy

D. Heisenberg's principle

Answer: C

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409. Which of the following configuration is not possible ?

A. $2p^2$

B. $3f^7$

C. $3d^5$

D. $4p^6$

Answer: B

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410. The correct set of quantum numbers for 4d electrons is

A. $4, 3, 2, +\frac{1}{2}$

B. $4, 2, 1, 0$

C. $4, 3, -2, +\frac{1}{2}$

D. $4, 2, 1, -\frac{1}{2}$

Answer: D

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411. The highest number of unpaired electrons are present in

A. Fe^0

B. Fe^{4+}

C. Fe^{2+}

D. Fe^{3+}

Answer: D

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412. Which of the following ions is not isoelectronic with O^{2-}

A. N^{3-}

B. F^{-}

C. Ti^{+}

D. Na^{+}

Answer: C

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413. Number of valence electrons in carbon is

A. 3

B. 1

C. 4

D. 0

Answer: C

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414. The number of unpaired electrons in Fe^{+} ion are

A. 1

B. 0

C. 4

D. 5

Answer: D

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415. In potassium the order of energy levels is

A. $4s > 4d$

B. $4sg < 3d$

C. $4s < 3p$

D. $4s = 3d$

Answer: B

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416. The number of d-electrons retained in Fe^{3+} (At. No. of Fe = 26) ion is

A. 3

B. 4

C. 5

D. 6

Answer: C

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417. The configuration of chromium atom in ground state is

A. $[Ar]3d^4 4s^2$

B. $[Ar]3d^5 4s^1$

C. $[Ar]3d^6 4s^2$

D. $[Ar]3d^7 4s^2$

Answer: B

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418. Which of the following has least number of unpaired electrons ?

A. Fe^{3+}

B. Fe^{2+}

C. Co^{2+}

D. Co^{3+}

Answer: C

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419. The electronic configuration $1s^2 2s^2 2p^6 3s^1$ represents

A. Ground state

B. 1st excited state

C. 2nd excited state

D. 3rd excited state

Answer: C

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420. No two electrons in an orbital can have parallel spin. This statement emerges from

A. Hund's rule

B. Aufbau principle

C. Pauli's exclusion principle

D. (n+1) rule

Answer: C

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421. Electrons never pair, if there are empty orbitals in a given sub-shell. This is

A. Aufbau principle

B. Paulis exclusion principle

C. Hund's rule of maximum multiplicity

D. Heisenberg's uncertainity principle

Answer: C

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422. The number of d-electrons present in Fe^{2+} ion is

A. 6

B. 3

C. 4

D. 5

Answer: A

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423. The number of electrons present in M-shell of chromium atom is

A. 24

B. 13

C. 2

D. 8

Answer: B

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424. Which of the following explains the sequence of filling electrons in different subshells?

A. Hund's rule

B. Aufbau principle

C. Pauli's principle

D. All of these.

Answer: B

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425. Nitrogen atom has 3 unpaired electrons in its ground state. It can be explained by

A. Aufbau principle

B. Paulis principle

C. Hund's rule

D. None of these

Answer: C

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426. The electronic configuration of sodium is

A. $[Ne]3s^2$

B. $[Ne]3s^1$

C. $[Ar]4s^1$

D. $[Ar]4s^2$

Answer: B

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427. Which of the following configuration may represent the ground state of nitrogen atom ?

A.

B.

C.

D.

Answer: B

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428. Electronic configuration of the element with atomic number 56 and mass number 138 is

A. $[Xe]6s^2$

B. $[Kr]5s^2$

C. $[Xe]6s^26p^2$

D. $[Xe]3d^25d^2$

Answer: A

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429. If Hunds rule is not obeyed by some elements given below then which atom has maximum magnetic moment

A. Fe

B. Cu

C. Cr

D. Mn

Answer: C

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430. The energy of the electron in the hydrogen atom depends on

A. The principal quantum number only

B. All the quantum numbers

C. The Azimuthal quantum number

D. The principal and azimuthal quantum numbers

Answer: A

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431. The electronic configuration $1s^2 2s^2 2p^6 3s^1 3p^3 3d^2$ represents

A. Ground state

B. Ist excited state

C. 2nd excited state

D. 3rd excited state

Answer: C

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432. The correct valence electronic configuration for $Cu(Z = 29)$ is

A. $3d^9 4s^2$

B. $3d^{10} 4s^1$

C. $3d^{10} 4s^2$

D. $3d^8 4s^2$

Answer: B

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433. Which one of the following pairs of ions have the same electronic configuration

A. Cr^{3+}, Fe^{3+}

B. Fe^{3+}, Mn^{2+}

C. Fe^{3+}, Co^{3+}

D. Sc^{3+}, Cr^{3+}

Answer: B

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434. The $(n + l)$ value for 4f-sub shell is

A. 4

B. 5

C. 6

D. 7

Answer: D

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Objective Exericse - 2A

1. Ratio of masses of proton and electron is

A. 1.8

B. 1.8×10^3

C. Infinite

D. None of these

Answer: B

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2. The charge of an electron is 1.6×10^{-19} coulombs. What will be the value of charge o Na^{+} ion

A. $1.6 \times 10^{-19} C$

B. $3.2 \times 10^{-19} C$

C. $2.4 \times 10^{-19} C$

D. $11 \times 1.6 \times 10^{-19} C$

Answer: A

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3. The costancy of e/m ratio for electron shows that

A. Electron's mass is $1/1837^{th}$ of the mass of proton

B. Electrons are universal particles of all matter

C. Electrons are produced in discharge tubes only

D. None of the above

Answer: B

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4. The increasing order of e/m value for electron, proton, neutron and alpha particle is

A. e, p, n, α

B. n, p, e, α

C. n, p, α, e

D. n, α, p, e

Answer: D

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5. The ratio between the neutrons present in carbon atom and silicon atoms with mass number 12 and 28 is

A. $7:3$

B. $3:7$

C. $1:2$

D. $2:1$

Answer: B

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6. The number of nucleons in the isotope of an atom . ${}_{Z}X^{m}$ are

A. m

B. Z

C. $m + Z$

D. $m - Z$

Answer: A

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7. An oxide of nitrogen has a molecular weight of 30. Total number of electrons in one molecule of the compound is

A. 15

B. 30

C. 45

D. 60

Answer: A

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8. Maximum sum of the number of neutrons and protons in an isotope of hydrogen

A. 6

B. 5

C. 4

D. 3

Answer: D

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9. Consider the following pairs of ions

(A) Sc^{+3} and Ti^{+4} (B) Mn^{+2} and Fe^{+2}

(C) Fe^{+2} and Co^{+3} (D) Cu^{+} and Zn^{+2}

Among these pairs of ions, isoelectronic pairs would include

A. B, C and D

B. A, C and D

C. A, B and D

D. A, B and C

Answer: B

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10. According to Planck's Quantun theory, the correct statements are

(a) The vibrating particle in the black body does not emit continuously

(b) Radiation is emitted in the form of small packets called Quanta

(c) Energy associated with emmitted radiations is inversely proportional to frequency.

(d) The emitted radiant energy is propagated in the form of waves.

A. a,b,c

B. b,c

C. a,b,d

D. b,d,c

Answer: C

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11. Which of the following statements is incorrect ?

A. Particle nature of radiations can be experimentally demonstrated by Compton effect

B. Wave nature of electrons can be experimentally domonstrated by diffraction experiment

C. The value of Planck's constant, h is $6.62 \times 10^{-34} Js$.

D. Intensity of light is directly proportional to its frequency.

Answer: D

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12. Energy equal to the mass of one electrons is

A. 8.2×10^{-7} ergs

B. 9.2×10^{-8} erg

C. 8.2×10^{-10} erg

D. 4.1×10^{-8} erg

Answer: A

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13. The ratio of energies of photons with wavelengths $2000A^0$ and $4000A^0$ is

A. $1:4$

B. $4:1$

C. $1:2$

D. $2:1$

Answer: D

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14. The energy of an electromagnetic radiation is 3×10^{-12} ergs. What is its wavelength in nanometers ? ($h = 6.625 \times 10^{-27}$ erg.sec, $C = 3 \times 10^{10} cm.\ \sec^{-1}$

A. 400

B. 228.3

C. 3000

D. 662.5

Answer: D

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15. Which of the following statements regarding spectral series is correct ?

A. The lines in the Balmer series corresponds to the electronic transition from higher energy level two n = 1 energy level.

B. Paschen series appears in the infra-red region

C. The lines of Lyman series appear in the visible region

D. Transition from higher energy level to 4th energy level produces Pfund series which fall in the infrared region.

Answer: B

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16. According to the Moseley's law, the frequency of a spectral line in X-ray spectrum varies as.

A. I-a, II-e, III-d, IV-b

B. I-e, II-e, III-d, IV-d

C. I-c, II-e, III-d, IV-b

D. I-c, II-e, III-d, IV-b

Answer: C

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17. In a series in the line spectrum of hydrogen the wavelength of radiation is 6,563Å. The name of the series and the orbits in which electron transition takes place are

A. Balmer series, 3rd to 2nd orbit

B. Lyman series, 2nd to 1st orbit

C. Pfund series, 6th to 5th orbit

D. Paschen series, 4th to 4rd orbit

Answer: A

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18. The frequency of the spectral line obtained when the electron in n = 3 of Hydrogen atom drops to the ground state is

A. 2.925×10^{15} Hertz

B. 2.925×1^{13} Hertz

C. 2.925×1^{14} Hertz

D. 2.925×1^{10} Hertz

Answer: A

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19. Assertion (A) : The energy of ultraviolet radiation is greater than the energy of infrared radiation

Reason (R) : The velocity of ultraviolet radiation is greater than the velocity of infrared radiation

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: C

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20. The wavelength of the first member of the Balmer series in hydrogen spectrum is x Å. Then the wave length (in Å) of the first member of Lyman series in the same spectrum is

A. $\frac{5}{27}x$

B. $\frac{4}{3}x$

C. $\frac{27}{5}x$

D. $\frac{5}{36}x$

Answer: A

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21. Which of the following transitions will have minimum wavelength ?

A. $n_4 \rightarrow n_1$

B. $n_2 \rightarrow n_1$

C. $n_4 \rightarrow n_2$

D. $n_3 \rightarrow n_1$

Answer: A

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22. The ratio of wavelength values of series limit lines $\left(n_2 = \infty\right)$ of Balmer series and Paschen series are

A. $4:9$

B. $9:4$

C. $2:3$

D. $3:2$

Answer: A

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23. The minimum and maximum values of wavelength in the Lyman series of a H atom are, respectively

A. 364.3 nm and 653.4 nm

B. 91.2 nm and 121.5 nm

C. 41.2 nm and 102.6 nm

D. 9.12 nm and 121.5 nm

Answer: B

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24. Which of the following transitions of an electron in hydrogen atom emits of the lowest wavelength?

A. $n_2 = \infty$ to $n_1 = 2$

B. $n_2 = 4$ to $n_1 = 3$

C. $n_2 = 2$ to $n_1 = 1$

D. $n_2 = 5$ to $n_1 = 3$

Answer: C

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25. In a hydrogen atom the electron and proton are at a distance of 0.5Å. The dipole moment of the system is .

A. $\frac{3h}{2\pi}$

B. $\frac{h}{2\pi}$

C. $\frac{h}{\pi}$

D. $\frac{2h}{\pi}$

Answer: A

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26. The total energy of electron in an atom is a combination of potential energy and kinetic energy. If total energy is -E for an electron in an atom, then its K.E. and P.E. respectively are

A. 2E, -E

B. 2E, E

C. E, -2E

D. E, -E

Answer: C

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27. The radius of which of the following orbit is same as that of the first Bohr's orbit of hydrogen atom?

A. He^+ (n=2)

B. Li^{2+} (n=2)

C. $Li^{2+}(n = 3)$

D. $Be^{3+}(n = 2)$

Answer: D

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28. An electron in the ground state of hydrogen atom is revolving in anti clockwise direction in circular orbit of radius · R'. The orbital magnetic dipole moment of the electron will be

A. $\frac{Ze^2}{r}$

B. $\frac{Ze^2}{r^2}$

C. $\frac{-Ze^2}{r}$

D. $\frac{mv^2}{r}$

Answer: C

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29. The change in velocity when electron jumps from the first orbit to the second orbit is

A. Half its original velocity

B. Twice its original velocity

C. One fourth its original velocity

D. Equal to its original velocity

Answer: A

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30. Which one of the following statements is not correct ?

A. Rydberg constant and wave number have same units

B. Lyman series of hydrogen spectrum occurs in the ultraviolet region

C. The angular momentum of the electron in the ground state of hydrogen atom is equal to h/2p

D. The radius of the first Bohr orbit of hydrogen atom is $2.116 \times 10^{-8} cm$

Answer: D

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31. As an electron is brought from an infinite distance close to nucleus of atom, the energy of electron

A. Increses to a greater +ve value

B. Decreses to a smaller +ve value

C. Increses to a smaller -ve value

D. Decreses to a greater -ve value

Answer: D

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32. In Bohr series of lines of hydrogen spectrum, the third line from the red end corresponds to which one of the following inter - orbit jumps of the electron for Bohr orbits in an atom of hydrogen ?

A. $1:4:9$

B. $9:4:1$

C. $1:2:3$

D. $3:2:1$

Answer: A

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33. The radius of the hydrogen atom in the ground state is of the order of

A. 1.06.06 Å

B. 0.265 Å

C. 0.175 Å

D. 0.53 Å

Answer: C

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34. The ground state energy of hydrogen atom is - 13.6eV. The kinetic energy of the electron in this state is:

A. 2.116 Å

B. 0.529 Å

C. 1.587 Å

D. 21.16 Å

Answer: A

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35. Radius of 3rd Bohr orbit is

A. 0.79 Å

B. 1.59 Å

C. 3.18 Å

D. 4.77 Å

Answer: D

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36. The energy of second Bohr'orbit of hydrogen atom is $-328kJmol^{-1}$, hence energy of fourth Bohr orbit would be

A. $-41kJmol^{-1}$

B. $-82kJmol^{-1}$

C. $-164kJmol^{-1}$

D. $-1312kJmol^{-1}$

Answer: B

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37. Which of the following transistions in hydrogen atom will require the highest amount of energy

A. n = 1 to n = 2

B. n = 1 to n=3

C. n=2 to n=1

D. n=3 to n=4

Answer: B

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38. The energy of an electron in the first Bohr's orbit of a hydrogen atom is $-2.18 \times 10^{-18} J$. Its energy in the second orbit would be

A. $-1.09 \times 10^{-18} J$

B. $-4.36 \times 10^{-18} J$

C. $-5.45 \times 10^{-18} J$

D. $-8.72 \times 10^{-18} J$

Answer: C

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39. The de Broglie wavelength associated with a moving particle of fixed mass is inversely proportional to

A. Its kinetic energy

B. Square root of its kinetic energy

C. Square of its kinetic energy

D. Cube of its kinetic energy

Answer: B

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40. Ratio of the distance travelled in 1 second, 2 seconds, 3 seconds

A. $\lambda = \sqrt{\frac{h}{m}}$

B. $\lambda = \frac{h}{p^2}$

C. $\lambda = \frac{h}{m}$

D. $\lambda = \sqrt{\frac{h}{p}}$

Answer: A

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41. The de Broglie wavelength of a particle with mass 1 g and velocity 100 m/s is

A. 1836

B. $1/1836$

C. 3672

D. $1/3672$

Answer: C

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42. A hydrogen molecule and helium atom are moving with the same velocity. Then the ratio of their de Broglie wavelength is

A. $1:1$

B. $1:27$

C. $2:1$

D. $2:3$

Answer: C

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43. Wavelength of an electron is 5Å. Velocity of the electron is

A. $1.45 \times 10^{8} cm/s$

B. $1.6 \times 10^{-8} cm/s$

C. $3.2 \times 10^{-27} cm/s$

D. $3.2 \times 10^{27} cm/s$

Answer: A

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44. The wavelength associated with a golf ball weighing 200g and moving at a speed of 5 m/h is of the order

A. $10^{-10}m$

B. $10^{-20}m$

C. $10^{-30}m$

D. $10^{-40}m$

Answer: C

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45. The size of a microscopic particle 1 micron and its mass is $6 \times 10^{-13}g$. If its position may be measured to within 0.1% of its size, the uncertainity in velocity (in cm^{-1}) is approximately

A. $\frac{10^{-7}}{4\pi}$

B. $\frac{10^{-5}}{4\pi}$

C. 10^{-5}

D. 10^{-8}

Answer: A

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46. The uncertainities in then velocities of two particle A and B are 0.05 and $0.02 ms^{-1}$ respectively.The mass of B is five times to that of A.What is the ratio of uncertainities $\left[\frac{\Delta x_A}{\Delta x_B}\right]$ in their positions?

A. 2

B. 0.25

C. 4

D. 1

Answer: A

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47. Calculate the wave length of an electron of mass $9.1 \times 10^{-31} kg$, moving with a velocity of $2.05 \times 10^{7} ms^{-1}$.

A. 1.92 cm

B. 7.67 cm

C. 0.175 cm

D. 3.84 cm

Answer: C

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48. There is no difference between a 2p and a 3p orbital regarding

A. Value of n

B. size

C. energy

D. shape

Answer: D

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49. The probability of finding electron in XY plane for P_Z - orbital is

A. 100 %

B. 50 %

C. 99.9 %

D. 0 %

Answer: D

Watch Video Solution

50. (A) : The radial probability of 1s electron first increases, till it is maximum at 0.53 Å, and then decreases.

(R) : Bohr's radius for the first orbit is 0.53 Å.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: B

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51. The maximum number of electrons that can be filled into all the orbitals corresponding to the azimuthal quantum number, 1 = 3 is

A. 2

B. 6

C. 10

D. 14

Answer: D

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52. The number of sub levles in the quantum level n = 3 is

A. 1

B. 2

C. 3

D. 4

Answer: C

Watch Video Solution

53. The number of different spatial arrangements for the orbital with 1=2 is

A. 1

B. 3

C. 5

D. 7

Answer: C

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54. An electron in an atom has m = -2 value. Then

(I) its 'n' value should be greater thn 2

(II) its 's' value should +1/2

(III) its 'l' value should be 2

(IV) its 'l' value shoul be greater than 1

A. I and II are correct

B. II and III are correct

C. III and IV are correct

D. I and IV are correct

Answer: D

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55. The maximum number of electrons that can be present in an orbit with s = +1/2 and 1=2

A. 1

B. 3

C. 5

D. 7

Answer: C

Watch Video Solution

56. The maximum number of electrons with s = +1/2 in an orbital for which 1=2 is

A. 1

B. 3

C. 5

D. 7

Answer: A

Watch Video Solution

57. (A) : The energy of electrons is largely determined by its principal quantum number.

(R) : The principal quantum number is a measure of most probable distance of finding the electron around the nucleus

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

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58. If the value of principal quantum number is 3, the total possible values for magnetic quantum number will be

A. 5

B. 9

C. 8

D. 10

Answer: B

Watch Video Solution

59. For a particular value of azimuthal quantum number (l), the total number of magnetic quantum number values (m) is given by

A. $1 = \frac{m + 1}{2}$

B. $1 = \frac{m - 1}{2}$

C. $1 = \frac{2m + 1}{2}$

D. $n = \frac{2l + 1}{2}$

Answer: B

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60. How many electrons maximum can have n+1 = 4 in an atom.

A. 8

B. 2

C. 6

D. 18

Answer: A

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61. (A) : For n = 3,l may be 0,1,2 and 'm' may be 0, (± 1 and 0), (± 2, ± 1 and 0)

(R) : For each value of n there are 0 to (n-1) possible values of 1. For each value of 1 'm' values are -1.....0,.....+1

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

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62. If magnetic quantum number of a given electron is represented -3, then what will be its principal number ?

A. 2

B. 3

C. 4

D. 1

Answer: C

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63. The radial probability distribution curve obtained for an orbital wave function has 3 peaks and 2 radial nodes. The valence electron of which one of the following metals does this wave function correspond to ?

A. Cu

B. Li

C. K

D. Na

Answer: D

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64. The configuration $1s^2 2s^2 2p^5 3s^1$ shows

A. Ground state of fluorine atom

B. Excited state of fluorine atom

C. Excited state of neon atom

D. Excited state of oxygen atom

Answer: C

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65. The incorrect electronic arrangment is

A. 2,8,13,1

B. 2,8,12,2

C. 2,8,8,1

D. 2,8,8,2

Answer: B

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66. Given this set of quantum numbers for a multi electron atom $2, 0, 0, \text{ and } -1/2$. The next higher allowed set of n and 1 for this atom in its ground state

A. n=2, l=0

B. n=1, l=1

C. n=3, l = 10

D. n=3, l=1

Answer: B

Watch Video Solution

67. Which one of the following pairs of atoms/ions have identical ground state configurations ?

A. Li^+ and He^+

B. Cl^- and Ar

C. Na and K

D. F^+ and Ne

Answer: B

Watch Video Solution

68. How many 'd' electrons are present in Cr^{2+} ion?

A. 4

B. 5

C. 6

D. 3

Answer: A

Watch Video Solution

69. The atomic number of the element with the maximum number of unpaired 2p electrons in the ground state is

A. 1

B. 7

C. 13

D. 8

Answer: B

Watch Video Solution

70. The total number of electrons present in all the 's' orbitals, all the 'p' ortitals and all the 'd' orbitals of cesium ion are respectively

A. 8,26,10

B. 10,24,20

C. 8,22,24

D. 12,20,22

Answer: B

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71. Which atom has as many 's' electrons as P-electrons

A. H

B. N

C. Na

D. Mg

Answer: D

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72. An element has 2 electrons in its K-shell. 8 electrons in L-shell, 13 electrons in M-shell and one electron in N-shell. The element is

A. Cr

B. Fe

C. V

D. Ti

Answer: A

Watch Video Solution

73. The electronic configuration $1s^2 2s^2 2p^6 3s^1 3p^3 3d^2$ represents

A. Ground state

B. 1st excited state

C. 2nd excited state

D. 3rd excited state

Answer: C

Watch Video Solution

74. The atomic number of an element M is 20. How many electrons are present in the M-shell of the element in its M^{3+} state ?

A. 11

B. 15

C. 14

D. 13

Answer: D

Watch Video Solution

75. Consider the ground state of Cr atom (Z = 24). The numbers of electrons with the azimuthal quantum numbers, $l = 1$ and 2 are,

respectively

A. 12 and 4

B. 16 and 5

C. 16 and 4

D. 12 and 5

Answer: D

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76. Which is the first element to have 4d-electron in its electronic configurations

A. Ca

B. Sc

C. Y

D. La

Answer: C

Watch Video Solution

77. In the ground state, an element has 13 electrons in its "M - shell". The element is

A. Copper

B. Chromium

C. Nickel

D. Iron

Answer: B

Watch Video Solution

78. (A) : The electronic configuration of Cr is $[Ar]3d^5 4s^1$ but not $[Ar]3d^4 4s^2$

(R) : Lowering energy with configuration $[Ar]3d^5 4s^1$ is more than that

with configuration $[Ar]3d^4 4s^2$

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

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79. The electrons identified by quantum number n and l are

(I) n = 1, l = 2 (II) n = 4, l = 0

(III) n = 3, l = 2 (IV) n = 3, l=1

can be placed in order of increasing energy as

A. $IV < II < III < I$

B. $II < IV < I < III$

C. $I < III < II < IV$

D. $III < I < IV < II$

Answer: A

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80. (A) : Fe^{3+} (g) is more stable than Fe^{2+} (g).

(R) : Fe^{3+} (g) has more number of unpaired electrons than Fe^{++} (g)

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: B

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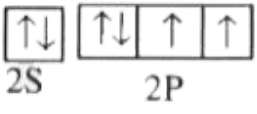
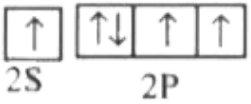
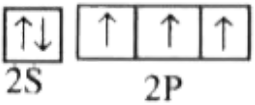
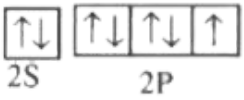
81. In which of the following Aufbau principle is violated?

A. 

B. 

C. 

D. 

Answer: B

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82. Which of the following electronic configuration is not possible?

A. $1s^2 2s^2 2p^6$

B. $1s^2 2s^2 2p^7$

C. $1s^2 2s^2$

D. $1s^2 2s^2 2p^5$

Answer: B

Watch Video Solution

83. The configuration $1s^2 2s^2 2p^5 3s^1$ shows

A. Ground sttae of fluorine

B. excited state of fluorine

C. Excited state of neon atom

D. Excited state of region

Answer: C

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84. Which of the following has maximum unpaired d-electrons?

A. Zn^+

B. Fe^{2+}

C. Ni^{3+}

D. Cu^+

Answer: B

Watch Video Solution

85. Consider the ground state of Cr atom (Z = 24). The numbers of electrons with the azimuthal quantum numbers, $l = 1$ and 2 are, respectively

A. 12,4

B. 12,5

C. 16,4

D. 16,5

Answer: B

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Objective exercise - 2B

1. Calculate the mass of one mole of electrons?

A. 1.008 g

B. 0.55 mg

C. 0.184 mg

D. 1.673 mg

Answer: B

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2. The specific charge for anode rays is much less than the specific charge for cathode rays. This is because

A. anode rays are less positively charged.

B. Anode rays are made of cations whose mass is higher than electrons

C. Both 1 and 2

D. Neither 1 nor 2

Answer: B

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3. The ratio of charge and mass would be greater for

A. Proton

B. Electrons

C. Neutron

D. Alpha particle

Answer: B

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4. When the speed of electron increases, its specific charge

A. Increases

B. Decreases

C. Remains unchanged

D. Increases and then decreases

Answer: B

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5. Nitride ion in Li_3N is composed of

A. 7 protons +7 electrons

B. 10 protons +7 electrons

C. 7 protons + 10 electrons

D. 10 protons + 10 electrons

Answer: C

Watch Video Solution

6. The electronic configuration of an ion M^{2+} is $1s^2 2s^2 2p^6 3s^2 3d^6$ and the atomic weight of M is 56. The number of neutrons in the nucleus of M^{2+} is

A. 24

B. 26

C. 28

D. 30

Answer: D

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7. The wave length of two photons A and B are 100 Å and 100 nm. The ratio of their energies will be

A. $1:1$

B. $2:1$

C. $10:1$

D. $1:10$

Answer: C

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8. The kinetic energy of photo electrons depends on

(A) Frequency of incident radiation

(B) Velocity of incident radiation

(C) Intensity of incident radiation

(D) Wavelength of incident radiation

A. Both (A) and B

B. Both A and D

C. Both B and C

D. Both C and D

Answer: B

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9. The perimeter of two similar triangles are in 4:9 ratio, the ratio of their corresponding sides is.....

A. I-b, II-c, III -a, IV-a

B. I-c, II-c, III-a, IV-c

C. I-b, II-b, III-a, IV-c

D. I-b, II-b, III-b, IV-b

Answer: B

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10. (A) : In photoelectric effect, when the frequency of incident light is doubled kinetic energy is more than doubled

(R) : Photo current increases when the intensity of incident light is increased and is independent of frequency

A. Both (A) and B

B. Both A and D

C. Both B and C

D. Both C and D

Answer: B

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11. The electron in the Hydrogen atom is excited to the 5^{th} orbit, the number of spectral lines it is expected to emit is

A. 6

B. 10

C. 12

D. 20

Answer: B

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12. The wavelength of spectral line emitted by hydrogen atom in the Lyman series is $\frac{16}{15R}$ cm.

What is the value of n_2?(R-Rydberg constant)

A. 2

B. 3

C. 4

D. 1

Answer: C

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13. The longest wave length in Balmer series is

A. 6563 Å

B. 18,650 Å

C. 7700 Å

D. 3.600 Å

Answer: A

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14. If the wave length of the first member of Balmer series of a hydrogen atom is 6300Å, that of the second member will be nearly

A. 4700 Å

B. 5400 Å

C. 6800 Å

D. 7200 Å

Answer: A

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15. What is the lowest energy of the spectral line emitted by the hydrogen atom in the Lyman series ? (h = Planck constant, c = Velocity of light, R = Rydberg constant)

A. $\frac{5hcR}{36}$

B. $\frac{4hcR}{3}$

C. $\frac{3hcR}{4}$

D. $\frac{7hcR}{144}$

Answer: C

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16. (A) : Limiting line in Balmer series has a wavelength of 364.4 nm

(R) : Limiting line is obtained when electron jump from $n = \infty$ orbit

A. Both (A) and B

B. Both A and D

C. Both B and C

D. Both C and D

Answer: A

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17. The wave number of the first line is Balmer series of hydrogen in $152000 cm^{-1}$. The wave number of the first line in the Balmer series of Li^{2+} is

A. $15200 cm^{-1}$

B. $60800 cm^{-1}$

C. $76000 cm^{-1}$

D. $136, 800 cm^{-1}$

Answer: D

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18. The electron in a hydrogen atom makes a transition from an excited state to the ground state. Which of the following statements is true ?

A. 2p

B. 3s

C. 1s

D. 4p

Answer: C

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19. In a hydrogen atom, if energy of an electron in ground state is 13.6 eV, then the energy in the 2nd excited state is

A. 1.51 eV

B. 3.4 eV

C. 6.04 eV

D. 13.6 eV

Answer: A

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20. The velocity of an electron in the fourth Bohr's orbit of hydrogen is v. The velocity of the electron in the first orbit would be :

A. 4v

B. 16v

C. v/4

D. v/16

Answer: A

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21. As the quantum number increases, the difference of energy between consecutive energy leveles

A. Decreases

B. Remains the same

C. Increases

D. Some tines increases and sometines decreases

Answer: A

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22. The ionization potential of H atoms is 13.6 V. The energy difference between n = 2 and n = 3 levels is nearest to

A. 1 and 2

B. 2 and 3

C. 3 and 4

D. 4 and 5

Answer: A

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23. If the electron falls from n = 3 to n = 2, in hydrogen atom then emitted energy is

A. 10.2 eV

B. 12.09 eV

C. 1.9 eV

D. 0.65 eV

Answer: C

Watch Video Solution

24. Which of the following transistions in hydrogen atom will require the highest amount of energy

A. n=1 to n=2

B. n=2 to n=3

C. $n = \infty$ to n=1

D. n=3, to n=5

Answer: A

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25. The value of first Bohr's radius of hydrogen atom is

A. 0.529 Å

B. $0.529 \times 10^{-8} cm$

C. $0.529 \times 10^{-1} nm$

D. Any of the above

Answer: D

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26. The radius of the first orbit of Hydrogen is 0.53 Å. The radius of second orbit of He^+ would be

A. 0.265 Å

B. 1.06 Å

C. 2.12 Å

D. 0.53 Å

Answer: B

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27. The radius of the second Bohr orbit is

A. 3.6 nm

B. 0.036 nm

C. 36 nm

D. 0.36 nm

Answer: D

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28. The energy of an electron present in Bohr's second orbit of hydrogen atom is

A. x/16

B. 16x

C. x/4

D. x/2

Answer: D

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29. in the Bohr hydrogen atom, the electronic transition emmiting light of longest wavelength is

A. n=2 to n=3

B. n=4 to n=3

C. n=3 to n=2

D. n=2 to n=1

Answer: B

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30. Radius of first orbit of hydrogen is 0.53Å. The radius in fourth orbit is:

A. 4.77 Å

B. 1.06 Å

C. 0.13 Å

D. 2.22 Å

Answer: D

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31. If the radius of first Bohr' orbit be α_0, then the radius of the third orbit of hydrogen would be

A. $3\alpha_0$

B. $6\alpha_0$

C. $9\alpha_0$

D. $\frac{1}{3}\alpha_0$

Answer: C

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32. An electron is moving in Bohr's fourth orbit. Its de Broglie wavelength is λ. What is the circumference of the fourth orbit ?

A. $\frac{2}{\lambda}$

B. 2λ

C. 4λ

D. $\frac{4}{\lambda}$

Answer: C

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33. What is the wavelength (in m) of a particle of mass $6.62 \times 10^{-29} g$ moving with a velocity of $10^{3} m.s^{-1}$? $\left(h = 6.62 \times 10^{-34} J.s\right)$

A. 6.62×10^{-4}

B. 6.62×10^{-3}

C. 10^{-5}

D. 10^{5}

Answer: C

View Text Solution

34. The number of waves made by an electron moving in an orbit having a maximum magnetic quantum number of +4 is

A. 4

B. 5

C. 3

D. 6

Answer: B

Watch Video Solution

35. The mass of hydrogen atom is $1.66 \times 10^{-24} g$ and Planck's constant is 6.64×10^{-27} erg.sec. The de Broglie wavelength of a hydrogen atom moving with a velocity half that of light of

A. $2.66 \times 10^{-5} Å$

B. $2.66 \times 10^{-13} Å$

C. 2.66×10^{-10}Å

D. 2.66×10^{-27}Å

Answer: A

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36. Uncertainity in the position of an electron (mass $= 9.1 \times 10^{-31} kg$) moving with a velocity $300 ms^{-1}$ accurate upto 0.001% will be $\left(h = 6.63 \times 10^{-34} Js\right)$

A. $3.84 \times 10^{-2} m$

B. $19.2 \times 10^{-2} m$

C. $5.76 \times 10^{-2} m$

D. $1.92 \times 10^{-2} m$

Answer: D

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37. (A) : The radial probability distribution curves of $1s$, $2p$, $3d$ orbitals are identical in shape

(R) : The number of nodal planes present in these orbitals is different

A. Both (A) and B

B. Both A and D

C. Both B and C

D. Both C and D

Answer: B

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38. The radial distribution curve of 2s sublevel consists of x nodes, x is

A. 1

B. 3

C. 2

D. 0

Answer: A

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39. Which pair of orbitals have electronic density along the axis

A. d_{xz}, d_{yz}

B. $d_{x^2-y^2}, d_{z^2}$

C. d_{xy}, d_{yz}

D. d_{xy}, d_{z^2}

Answer: B

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40. The maximum number of sub-level, orbital and electrons in N shell of an atom are respectively

A. 4,12,32

B. 4,16,30

C. 4,16,32

D. 4,32,64

Answer: C

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41. The values of four quantum numbers of valence electron of an element are n=4, l = 0, m = 0, and s = +1/2. The element is

A. K

B. Ti

C. Na

D. Sc

Answer: A

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42. Number of electrons with +1/2 spin in n=3 is

A. 18

B. 9

C. 3

D. 1

Answer: B

Watch Video Solution

43. Number of electrons with -1/2 spin in n=4 is

A. 32

B. 16

C. 8

D. 9

Answer: B

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44. For which one of the following sets of quantum numbers an electron will have the highest energy ?

A. 3,2,1,1/2

B. 5,1,+1,+1/2

C. 4,1,0,-1/2

D. 4,2,+2,+1/2

Answer: B

Watch Video Solution

45. Which of the following sets of quantum numbers represents the highest energy of an atom ?

A. n = 3, l = 2, m = 1, s = +1/2

B. n = 4, l = 0, m = 0, s = +1/2

C. n = 3, l = 0, m = 0, s = +1/2

D. n = 3, l = 1, m = 1, s = +1/2

Answer: A

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46. Which of the following elements has least number of electrons in its "M" shell ?

A. K

B. Mn

C. Ni

D. Sc

Answer: A

Watch Video Solution

47. The atomic number (Z) of an element is 25. In its ground state, how many electrons are present in "N" shell ?

A. 13

B. 2

C. 15

D. 3

Answer: B

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48. The following species has the lowest number of electrons in the valence shell

A. O^{2-}

B. S

C. N^{3-}

D. Cl^{-}

Answer: B

Watch Video Solution

49. The number of unpaired electrons present in the first excited state of chlorine atom is

A. 1

B. 3

C. 5

D. 2

Answer: B

Watch Video Solution

50. The number of electrons in M-shell of an element with atomic number 24 is

A. 24

B. 13

C. 2

D. 8

Answer: B

Watch Video Solution

51. The atomic number of an element is 35. what is the total number of electrons present in all the p-orbitals of the ground state atom of that element ?

A. 6

B. 11

C. 17

D. 23

Answer: C

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52. If the atomic number of an element is 36, the number of electrons present in the M-shell is

A. 18

B. 19

C. 10

D. 14

Answer: A

Watch Video Solution

53. The number of unpaired electrons present in palladium (Z=46) atom is

A. 1

B. 2

C. Zero

D. 3

Answer: C

Watch Video Solution

54. Which of the following has maximum number of unpaired electrons (atomic number of Fe is 26)

A. Fe

B. Fe(II)

C. Fe(III)

D. Fe(IV)

Answer: C

Watch Video Solution

55. Which one of the following has more number of unpaired d-electrons ?

A. Zn

B. Fe^{2+}

C. Ni^{3+}

D. Cu^{+}

Answer: B

Watch Video Solution

56. Which of the following statements is relation to the hydrogen atom is correct ?

A. 3s and 3d orbitals are of lower energy than 3p orbitals

B. 3p orbitals is lower in energy than 3 orbital

C. 3s and 3p orbitals are of lower energy than 3d orbital

D. 3s, 3p and 3d orbitals all have the same energy.

Answer: D

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57. Which of the following pair of atoms/atom, ions having identical ground state configuration

A. Li^+ and He^+

B. Cl^- and Ar

C. Na and K

D. F^+ and Ne

Answer: B

Watch Video Solution

58. The number of d-electrons in Fe^{2+} ion is

A. 6

B. 3

C. 4

D. 5

Answer: A

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59. Which one of the following ions has same number of unpared electrons as that of V^{3+} ion ?

A. Cr^{3+}

B. Mn^{2+}

C. Ni^{2+}

D. Fe^{3+}

Answer: C

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60. Fe is converted to Fe^{2+}, the decreases in the number of electrons with magnetic quantum number zero are

A. 0

B. 1

C. 2

D. 4

Answer: C

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61. Hydride ions is isoelectronic with

A. He^+

B. H^+

C. Be^+

D. He

Answer: D

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62. The electronic configuration of Gadolinium (At. No.64) is

A. $[Xe]4f^{8}5d^{9}6s^{2}$

B. $[Xe]4f^{7}5d^{1}6s^{2}$

C. $[Xe]4f^{3}5d^{5}6s^{2}$

D. $[Xe]4f^{6}5d^{2}6s^{2}$

Answer: B

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63. Which of the following has maximum number of unpared electrons?

A. Fe^{3+}

B. Fe^{2+}

C. Co^{2+}

D. Co^{3+}

Answer: A

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64. Which of the following ions is not isoelectronic with O^{2-}

A. N^{3-}

B. F^{-}

C. Ti^{+}

D. Na^{+}

Answer: C

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Objective Exercise - 3

1. Mass numbers of Li, Be and B are 7,9 and 10 respectively. Which of the following has two electrons, three protons and four neutrons ?

A. B^+

B. Be^{2+}

C. Li^+

D. Be

Answer: C

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2. The energy required to melt 1g. Ice is 33J. The number of quanta of radiation of frequency $4.67 \times 10^{13} \text{sec}^{-1}$ that must be absorbed to melt 10g ice is

A. 1.065×10^{22}

B. 3.205×10^{23}

C. 9.076×10^{20}

D. None

Answer: A

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3. (A) : A spectral line will be seen for $2p_x$ to $2p_y$ transition.

(R) : Energy is released in the form of wave of light when electron drops from $2p_x$ to $2p_y$ orbital.

A. Both (A) and B

B. Both A and D

C. Both B and C

D. Both C and D

Answer: D

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4. When a greater number of electrons from excited hydrogen atoms reach the ground state, then

A. The intensity of spectral lines in Lyman series increases

B. The number of lines in Lyman series increases

C. Both the intensity and number lines in Lyman series increases.

D. There is no observable change in spectrum

Answer: A

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5. The wavelength of the spectral line, For the transition n = 2 to n=1 in the hydrogen emission spectrum is 'X' . Which of the following spectral line also has a wavelength of X

A. $'H_{\alpha}'$ line in the Balmer series of spectrum of 'H'

B. 'H_β' line in the Balmer series of spectrum of 'H'

C. 'H_α' line in the Balmer series of spectrum of 'He^+'

D. 'H_β' line in the Balmer series of spectrum of 'He^+'

Answer: D

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6. What electronic transition in Li^{+2} produces the radiation of the same wave length as the first line Lyman series of hydrogen ?

A. n = 4 to n=2

B. n=9 to n=6

C. n=9 to n=3

D. n=6 to n=3

Answer: D

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7. The ratio of the wave lengths of the first line in the Lyman series of the spectrum of Hydrogen atom and the first line in the Balmer series of the spectrum of He^+ is

A. $20/27$

B. $27/20$

C. $27/5$

D. $5/27$

Answer: A

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8. In a certain electronic transition from the quantum level, 'n' to the ground state in atomic hydrogen in one or more steps, no line belonging to the Bracket series is observed. What wave number may be observed in the Balmer series ? (R = Rydberg Constant)

A. $\frac{8R}{9}, \frac{5R}{36}$

B. $\frac{3R}{16}, \frac{8R}{9}$

C. $\frac{5R}{36}, \frac{3R}{16}$

D. $\frac{3R}{4}, \frac{3R}{16}$

Answer: C

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9. In Bohr series of lines of hydrogen spectrum, the third line from the red end corresponds to which one of the following inter - orbit jumps of the electron for Bohr orbits in an atom of hydrogen ?

A. $3 \rightarrow 2$

B. $5 \rightarrow 2$

C. $4 \rightarrow 1$

D. $2 \rightarrow 5$

Answer: B

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10. Kinetic energy of electron in a mono electronic species is +1313 lJ/mole. Then which of the following statements are correct

(I) The electron is present in the 2^{nd} orbit of He^{+} ions

(II) The electron is present in the 2^{nd} orbit of H atom

(III) The electron is present in the 3^{rd} orbit of Li^{+2} ion

(IV) The electron is present in the 4^{th} orbit of He^{+} ion

A. I and II

B. II and III

C. I and III

D. III and IV

Answer: C

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11. Ionisation energy of He^+ is 19.6×10^{-18}J atom^{-1} The energy of the first stationary state of Li^{2+} is

A. $-4.41 \times 10^{-18} J$ atom^{-1}

B. $-4.41 \times 10^{-17} J$ atom^{-1}

C. $-4.41 \times 10^{-16} J$ atom^{-1}

D. $-8.72 \times 10^{-18} J$ atom^{-1}

Answer: B

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12. The kinetic energy of an electron in an orbit of hydrogen atom is 3.4 ev/atom. Then identify the correctly matched set for that electron

	LIST - I		LIST - II
(*A*)	Potential energy	(1)	$1.09 \times 10^{8} cm/\sec$
(*B*)	Total energy	(2)	$2.11 \times 10^{-8} cm$
(*C*)	Velocity	(3)	-6.8 ev/atom
(*D*)	Its distance from nucleus	(4)	-3.4 ev/atom

The correct match is

A. A-4,B-3, C-2, D-1

B. A-3, B-4, C-1, D-2

C. A-2, B-1, C-4, D-3

D. A-3, B-4, C-2, D-1

Answer: B

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13. The ionisation potential of Hydrogen is 2.17×10^{-11} erg/atom. The energy of the electron in the second orbit of the hydrogen atom is

A. $-\frac{2.17 \times 10^{-11}}{2}$

B. $-\frac{2.17 \times 10^{-11}}{2^2}$

C. $-\frac{2.17 \times 10^{17}}{2^2}$

D. $-\frac{2.17 \times 10^{11}}{2^2}$

Answer: B

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14. (A) : In an atom the velocity of electron as it moves into higher orbits keeps on decreasing

(R) : Velocity of electron is inversely proportional to the radius of orbit

A. Both (A) and B

B. Both A and D

C. Both B and C

D. Both C and D

Answer: C

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15. The wavelength of radiation required to remove the electron of hydrogen atom $\left(\text{Ionisation energy } 21.7 \times 10^{-12}\text{erg}\right)$ from n=2 orbit to $n = \infty$is

A. $3.664 \times 10^{-4} cm$

B. $3.66 \times 10^{-5} cm$

C. $3.66 \times 10^{-6} cm$

D. $3.664 \times 10^{-7} cm$

Answer: B

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16. The radii of two of the first four Bohr orbits of the hydrogen atom are in the ratio 1:4. The energy difference between them may be

A. 0.85 eV

B. 10.2 eV

C. 3.40 eV

D. 13.6 eV

Answer: B

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17. Choose the correct statement (s)

(i) The energy of an electron in an atom is always negative, because it is negatively charged.

(ii) The charge of an electron in an atom is positive

(iii) When an electron is at an infinite distance from the nucleus so that there is no electrical interaction , then orbitarily the energy of electron is taken to be zero

(iv) As the electron moves closer to the nucleus, energy is released and so its energy becomes less than zero i.e., negative.

A. all are correct

B. (ii) & (iv) are correct

C. ii is correct

D. No statement is correct

Answer: B

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18. The velocity of electron in hydrogen atom is 7.29×10^7 cm/sec The potential energy of that electron is

A. $-13.6eV$

B. $-3.4eV$

C. $-3.02eV$

D. $-1.70eV$

Answer: C

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19. A particle of mass one microgram is confined to move along one direction (x-axis) within a region 1 mm is extension. What is the uncertainity in its velocity ?

A. $3.313 \times 10^{-20} cm^{-1}$

B. $5.012 \times 10^{-20} cm^{-1}$

C. $8.325 \times 10^{-20} cm^{-1}$

D. $5.27 \times 10^{-21} cm^{-1}$

Answer: D

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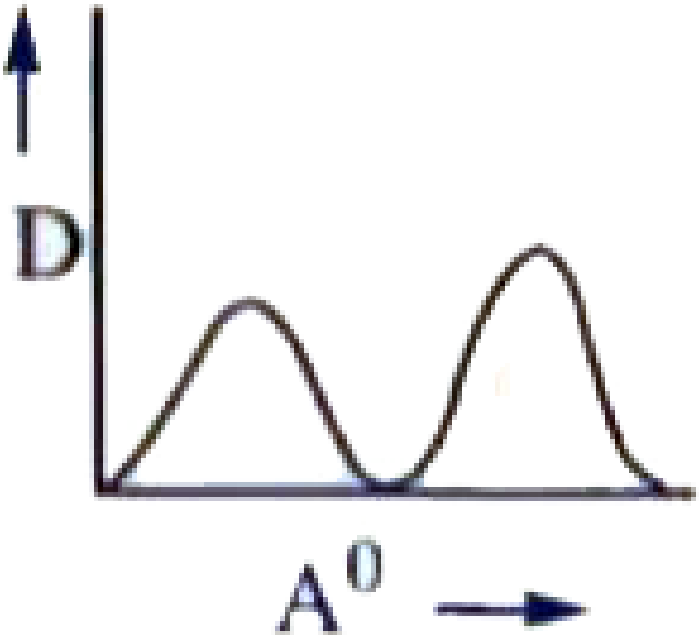
20. The set of quantum numbers 'n' and 'l' possible for the orbital shown in the radial probability curve are



A. n=3, l=2

B. n=4, l=1

C. n=2, l=0

D. n=3, l=3

Answer: C

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21. In a multi-electron atom, which of the following orbitals described by the three quantum numbers will have the same energy in the absence of magnetic and electric field

(i) n=1, l=0, m=0

(ii) n=2, l=0, m=0

(iii) n=2, l=1, m=1

(iv) n=3, l=2, m=1

(v) n=3, l=2, m=0

A. I and ii

B. ii and iii

C. III and IV are correct

D. iv and v

Answer: D

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22. An electron has magnetic quantum number as '-3'. Its principal quantum number is

A. 3

B. 2

C. 1

D. 4

Answer: D

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23.

List-1	List-2
A) + 3 Oxidation state	1) Nitrogen
B) + 1 Oxidation state	2) Nitrous oxide
C) 0 Oxidation state	3) Nitrate ion
D) + 5 Oxidation state	4) Hydroxylamine
	5) Nitrite ion

The correct match is

A. A-I

B. B-II

C. C-III

D. D-I

Answer: C

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24. Which one of the following statements is correct ?

A. 2S orbital is spherical with two nodal planes

B. The de-Broglie wavelength of a particle of mass 'm' and velocity 'v' is equal to mv/h

C. The principal quantum number (n) indicates the shape of the orbital

D. The electronic configuration of phosphorus is given by $[Ne]3s^2 3p_x^1 3p_y^1 p_z^1$

Answer: D

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25. Which orbitals gives an electron the greatest probability of closer to the nuelcus ?

A. 3p

B. 3d

C. 3s

D. equal

Answer: D

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26. A radiation of wave length 3000 Å is required to remove an electron from a metal atom. If a radiation of wave length 2000Å is allowed to

incident on the metal surface, the kinetic energy of the emitted electron in k/J mole is

A. 1.98×10^2

B. 3.3×10^{-19}

C. 3.3×10^{-20}

D. 19.8

Answer: A

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27. When a certain metal was irradiated with light of frequency 3.2×10^{16} Hz, the photoelectrons emitted had twice the kinetic energy as did photoelectrons when the same metal was irradiated with light of frequency $2.0 \times 10^{16} Hz$. The threshold frequency for the metal is

A. $1.2 \times 10^{16} Hz$

B. $8s \times 10^{15} Hz$

C. $8 \times 10^{16} Hz$

D. $1.2 \times 10^{15} Hz$

Answer: B

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28. If a metal is irradiated with light of frequency $3 \times 10^{19} \text{sec}^{-1}$, electron is emitted with kinetic energy of $6.625 \times 10^{-15} J$. The threshold frequency of the metal is

A. $2 \times 10^{19} \text{sec}^{-1}$

B. $1.25 \times 10^{19} \text{sec}^{-1}$

C. $6.625 \times 10^{35} \text{sec}^{-1}$

D. $6.625 \times 10^{19} \text{sec}^{-1}$

Answer: A

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29. True statements among the following are

(A) Number of wave generated by the electrons in the 5th orbit is five

(B) As the temperature increases maximum intensity of radiation emitted by the black body shifts towards lower wavelength side

(C) As the intensity of incident radiation increases kinetic energy of photo electrons increases

A. A and B

B. B and C

C. A and C

D. A, B and C

Answer: A

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30. The wavelength of the electron in the first orbit of the Hydrogen atom is x. The wave length of the electron in the third orbit and the circumference of the third orbit of the Hydrogen atom are respectively

A. 3x, 9x

B. 9x, 27x

C. x, 3x

D. x/3,x

Answer: A

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31. If the radius of first Bohr orbit of H atom is x, then de Broglie wavelength of electron in 3^{rd} orbit is nearly

A. $2\pi x$

B. $6\pi x$

C. 9x

D. x/3

Answer: B

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32. Uncertainity in the position of an electron (mass $= 9.1 \times 10^{-31} kg$) moving with a velocity $300 ms^{-1}$ accurate upto 0.001% will be $\left(h = 6.63 \times 10^{-34} Js\right)$

A. $19.2 \times 10^{-2} m$

B. $5.76 \times 10^{-2} m$

C. $1.92 \times 10^{-2} m$

D. $3.84 \times 10^{-2} m$

Answer: C

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33. Assertion (A) : The orbital angular momentum of 2s-electron is equal to that of 3s-electron.

Reason (R) : The orbital angular momentum is given by the relation $\sqrt{l(l+1)}\frac{h}{2\pi}$ and the value of 1 is same for 2s-electron and 3s-electron.

A. Both (A) and B

B. Both A and D

C. Both B and C

D. Both C and D

Answer: A

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34. If the Nitrogen atom had electronic configuration $1s^7$, it would have energy lower than that of the normal ground state configuration

$1s^2 2s^2 2p^3$, because the electrons would be closer to the nucleus. Yet, $1s^7$ is not observed because it violates.

A. Heisenberg uncertainity principle

B. Hund's rule

C. Pauli exclusion principle

D. Bohr postulate of stationary orbits

Answer: C

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35. match the following .

Inequation	Solution set
I. $x^2 - 7x + 12 \geq 0$	a) $\varnothing$
II. $x^2 + 3x - 4 \leq 0$	b) $(-2, 1/2)$
III. $2x^2 + 3x < 2$	c) $[-4, 1]$
IV. $x^2 - 2x + 2 < 0$	d) $(-\infty, 3] \cup [4, \infty)$

A. 1-A

B. 2-B

C. 3-C

D. 4-D

Answer: C

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36. The expression for the Bohr's radius of hydrogen like species is

A. $n^2\left[\frac{h^2}{4\pi^2 m\left(Ze^2/4\pi \in_0\right)}\right]$

B. $\frac{1}{n^2}\left[\frac{h^2}{4\pi^2 m\left(Ze^2/4\pi \in_0\right)}\right]$

C. $n^2\left[\frac{4\pi^2 mh^2}{\left(Ze^2/4\pi \in_0\right)}\right]$

D. $\frac{1}{n^2}\left[\frac{4\pi^2 mh^2}{\left(Ze^2/4\pi \in_0\right)}\right]$

Answer: A

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37. The potential energy of the electron present in the ground state of Li^{2+} ion is represented by

A. $+\frac{3e^2}{4\pi \in_0 r}$

B. $\frac{-3e}{4\pi \in_0 r}$

C. $\frac{-3e^2}{4\pi \in_0 r^2}$

D. $\frac{-3e^2}{4\pi \in_0 r}$

Answer: D

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38. Calculate the mass of a photon with wavelength 3.6 Å.

A. $6.135 \times 10^{29} kg$

B. $6.135 \times 10^{-29} kg$

C. $6.135 \times 10^{19} kg$

D. $6.135 \times 10^{16} kg$

Answer: B

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39. A microscope using suitable photons is employed to locate an electron in an atom within a distance of 0.1 Å . What is the uncertainty involved in the measurement of its velocity ?

A. $0.79 \times 10^{6} ms^{-1}$

B. $5.79 \times 10^{16} ms^{-1}$

C. $5.79 \times 10^{6} ms^{-1}$

D. $5.79 ms^{-1}$

Answer: C

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40. What possibly can the ratio be of the de Broglie wavelengths for two electrons having the same initial energy and accelerated through 50 volts and 200 volts ?

A. $3:10$

B. $10:3$

C. $1:2$

D. $2:1$

Answer: D

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Exercise On Passages

1. (A) Balmer series lies in the visible region of electromagnetic spectrum

(R): $\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{n^2}\right)$ where n = 3,4,5

A. 2651 Å

B. 1641.1 Å

C. 6569 Å

D. 3249 Å

Answer: B

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2. The observed wavelengths in the line spectrum of hydrogen atom were first expressed in terms of a series by Johann Jakob Balmer, a Swiss teacher. Balmer's empirical formula is

$\frac{1}{\lambda} = R_H\left[\frac{1}{2^2} - \frac{1}{n^2}\right] = n = 3, 4, 5\ldots$

$R_H = 109678 cm^{-1}$ is the Rydberg constant.

Niels Bohr derived this expression theoretically in 1913. The formula is a generalised to any on electron atom/ion.

How many lines in the spectrum will be observed when electrons returns from 7th shell to 2nd shell ?

A. 13

B. 14

C. 15

D. 16

Answer: C

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3. The observed wavelengths in the line spectrum of hydrogen atom were first expressed in terms of a series by Johann Jakob Balmer, a Swiss teacher. Balmer's empirical formula is

$$\frac{1}{\lambda} = R_H\left[\frac{1}{2^2} - \frac{1}{n^2}\right] = n = 3, 4, 5\ldots$$

$R_H = 109678 cm^{-1}$ is the Rydberg constant.

Niels Bohr derived this expression theoretically in 1913. The formula is a generalised to any on electron atom/ion.

The wavelength of first line of Balmer spectrum of hydrogen will be :

A. 4340 Å

B. 4101 Å

C. 6569 Å

D. 4861 Å

Answer: C

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4. The observed wavelengths in the line spectrum of hydrogen atom were first expressed in terms of a series by Johann Jakob Balmer, a Swiss teacher. Balmer's empirical formula is

$$\frac{1}{\lambda} = R_H\left[\frac{1}{2^2} - \frac{1}{n^2}\right] = n = 3, 4, 5\ldots$$

$R_H = 109678 cm^{-1}$ is the Rydberg constant.

Niels Bohr derived this expression theoretically in 1913. The formula is a generalised to any on electron atom/ion.

Which of the following is not correctly matched ?

A. H_α - 6569 Å (Red)

B. H_β - 4861 Å (Blue)

C. H_γ - 4340 Å (Orange)

D. H_δ -4101 Å (Violet)

Answer: C

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5. Spin angular momentum of an electron has no analog in classical mechanics. However, it turns out that the treatment of spin angular momentum is closely analogous to the treatment of orbital angular momentum.

Spin angular momentum $= \sqrt{s(s+1)h}$

Orbital angular momentum $= \sqrt{l(l+1)h}$

Total spin of an atom or ion is a multiple of $\frac{1}{2}$. Spin multiplicity is a factor to confirm the electronic configuration of an atom or ion.

Spin multiplicity $\left(2\sum s+1\right)$

Total spin of Mn^{2+} = (Z = 25) ion will be :

A. $\frac{3}{2}$

B. $\frac{1}{2}$

C. $\frac{5}{2}$

D. $\frac{7}{2}$

Answer: C

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6. Spin angular momentum of an electron has no analog in classical mechanics. However, it turns out that the treatment of spin angular momentum is closely analogous to the treatment of orbital angular momentum.

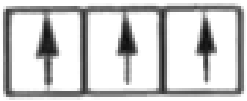
Spin angular momentum $= \sqrt{s(s+1)h}$

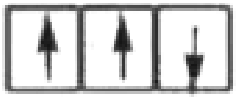
Orbital angular momentum $= \sqrt{l(l+1)h}$

Total spin of an atom or ion is a multiple of $\frac{1}{2}$. Spin multiplicity is a factor to confirm the electronic configuration of an atom or ion.

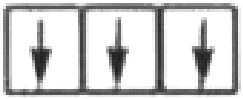
Spin multiplicity $\left(2\sum s + 1\right)$

The orbital angular momentum for a 2p-electron is :

A. 

B. 

C.

D. 

Answer: A

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7. Spin angular momentum of an electron has no analog in classical mechanics. However, it turns out that the treatment of spin angular momentum is closely analogous to the treatment of orbital angular momentum.

Spin angular momentum $= \sqrt{s(s+1)h}$

Orbital angular momentum $= \sqrt{l(l+1)h}$

Total spin of an atom or ion is a multiple of $\frac{1}{2}$. Spin multiplicity is a factor to confirm the electronic configuration of an atom or ion.

Spin multiplicity $\left(2\sum s+1\right)$

In any subshell, the maximum number of electrons having same value of spin quantum number is :

A. $\sqrt{l(l+1)}$

B. l+2

C. 2l+1

D. 4l+2

Answer: C

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8. Spin angular momentum of an electron has no analog in classical mechanics. However, it turns out that the treatment of spin angular momentum is closely analogous to the treatment of orbital angular momentum.

Spin angular momentum $= \sqrt{s(s+1)h}$

Orbital angular momentum $= \sqrt{l(l+1)h}$

Total spin of an atom or ion is a multiple of $\frac{1}{2}$. Spin multiplicity is a factor to confirm the electronic configuration of an atom or ion.

Spin multiplicity $\left(2\sum s+1\right)$

The orbital angular momentum for a 2p-electron is :

A. $\sqrt{3h}$

B. $\sqrt{6h}$

C. zero

D. $\sqrt{2h}$

Answer: D

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9. Dual nature of matter was proposed by de Broglie in 1923, it was experimentally verified by Davisson and Germer by diffraction experiment. Wave haracter of matter has significance only for microscopic particles. De Broglie wavelength (λ) can be calculated using the relation, $(\lambda) = \frac{h}{mv}$ where 'm' and 'v' are the mass and velocity of the particle.

Planck's constant has same dimension as that of

A. work

B. energy

C. power

D. angular momentum

Answer: D

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10. Dual nature of matter was proposed by de Broglie in 1923, it was experimentally verified by Davisson and Germer by diffraction experiment. Wave haracter of matter has significance only for microscopic particles. De Broglie wavelength (λ) can be calculated using the relation, $(\lambda) = \frac{h}{mv}$ where 'm' and 'v' are the mass and velocity of the particle.

de Broglie equation is obtained by combination of which of the following theories ?

A. Planck's quantum theory

B. Einstein's theory of mass - energy equivalence

C. Theory of interference

D. Theory of diffraction

Answer: A::B

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11. Dual nature of matter was proposed by de Broglie in 1923, it was experimentally verified by Davisson and Germer by diffraction experiment. Wave haracter of matter has significance only for microscopic particles. De Broglie wavelength (λ) can be calculated using the relation, $(\lambda) = \frac{h}{mv}$ where 'm' and 'v' are the mass and velocity of the particle.

The wavelength of matter waves associated with a body of mass 1000g moving with a velocity of 100m/sec is :

A. $6.62 \times 10^{-39} cm$

B. $6.62 \times 10^{-36} cm$

C. $6.626 \times 10^{-36} cm$

D. $3.31 \times 10^{32} m$

Answer: C

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12. Dual nature of matter was proposed by de Broglie in 1923, it was experimentally verified by Davisson and Germer by diffraction experiment. Wave haracter of matter has significance only for microscopic particles. De Broglie wavelength (λ) can be calculated using the relation, $(\lambda) = \frac{h}{mv}$ where 'm' and 'v' are the mass and velocity of the particle.

Which among the following is not used to calculate the de Broglie wavelength ?

A. $\lambda = \frac{c}{v}$

B. $\lambda = \frac{h}{mv}$

C. $\lambda = \frac{h}{\sqrt{2Em}}$

D. $\lambda = \frac{h}{\sqrt{2qVm}}$

Answer: A

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13. The hydrogen like species Li^{2+} is in a spherically symmetric state S_1 with one radial node. Upon absorbinf light the ion undergoes transition to a state S_2 The state S_2 has one radial node and its energy is equal to the ground state energy of the hydrogen atom.

The state S_1 is

A. 1s

B. 2s

C. 2p

D. 3s

Answer: B

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14. The hydrogen like species Li^{2+} is in a spherically symmetric state S_1 with one radial node. Upon absorbinf light the ion undergoes transition to a state S_2 The state S_2 has one radial node and its energy is equal to

the ground state energy of the hydrogen atom.

Energy of the state S_1 units of the hydrogen atom ground state energy is

A. 0.75

B. 1.50

C. 2.25

D. 4.50

Answer: C

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15. The hydrogen like species Li^{2+} is in a spherically symmetric state S_1 with one radial node. Upon absorbinf light the ion undergoes transition to a state S_2 The state S_2 has one radial node and its energy is equal to the ground state energy of the hydrogen atom.

The orbital angular momentum quantum number of the state S_2 is

A. 0

B. 1

C. 2

D. 3

Answer: B

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16. Electronic configuration of multielectron atoms can be written by the use of four quantum numbers and also by following certain principles. Pauli's exclusion principle suggests that maximum capacity of an atomic orbital is two. Auf bau principle suggests that the lower energy orbitals are filled first and hence stability can be attained. Hunds rule of maximum multiplicity suggests that pairing occurs with one electron. The arrangement of electrons in the space around the nucleus can be understood only after writing the electronic configuration. Thus writing electronic configuration is more important in the structure of an atom. Auf-bau principle is first violated for the element with atomic numbers

A. 21

B. 24

C. 26

D. 29

Answer: B

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17. Electronic configuration of multielectron atoms can be written by the use of four quantum numbers and also by following certain principles. Pauli's exclusio principle suggests that maximum capacity of an atomic orbital is two. Auf bau principle suggests that the lower energy orbitals are filled first and hence stability can be attained. Hunds rule of maximum multiplicity suggests that pairing occurs with one electron. The arrangement of electrons in the space around the nucleus can be understood only after writing the electronic configuration. Thus writing electronic configuration is more important in the structure of an atom.

Applying Hunds rule of maximum multiplicity, the maximum number of electrons that can posses spin quantum number +1/2 in 4p orbitals is

A. 1

B. 3

C. 4

D. 6

Answer: A

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18. Electronic configuration of multielectron atoms can be written by the use of four quantum numbers and also by following certain principles. Pauli's exclusion principle suggests that maximum capacity of an atomic orbital is two. Auf bau principle suggests that the lower energy orbitals are filled first and hence stability can be attained. Hunds rule of maximum multiplicity suggests that pairing occurs with one electron. The arrangement of electrons in the space around the nucleus can be

understood only after writing the electronic configuration. Thus writing electronic configuration is more important in the structure of an atom. The set of quantum numbers not possible for electrons present in potassium atom in its ground state

A. $n = 2, l = 1, m = +1, s = +\frac{1}{2}$

B. $n = 3, l = 0, m = 0, s = -\frac{1}{2}$

C. $n = 3, l = 2, m = -1, s = +\frac{1}{2}$

D. $n = 4, l = 0, m = 0, s = +\frac{1}{2}$

Answer: C

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19. Electronic configuration of multielectron atoms can be written by the use of four quantum numbers and also by following certain principles. Pauli's exclusion principle suggests that maximum capacity of an atomic orbital is two. Auf bau principle suggests that the lower energy orbitals are filled first and hence stability can be attained. Hunds rule of maximum

multiplicity suggests that pairing occurs with one electron. The arrangement of electrons in the space around the nucleus can be understood only after writing the electronic configuration. Thus writing electronic configuration is more important in the structure of an atom. Six unpaired electrons are present in the ground state electronic configuration of the element

A. Carbon

B. Oxygen

C. Manganese

D. Chromium

Answer: D

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Level - I (EAMCET) (Exercise - I (Fundamental particle , Atomic number and mass number , Atomic models, Nature of light , Spectra))

1. Which one of the following is an isobar of ${}_6C^{14}$?

A. ${}_6C^{13}$

B. ${}_6C^{12}$

C. ${}_7N^{14}$

D. ${}_7N^{15}$

Answer: C

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2. Number of protons in the nucleus of carbon atom is

A. 7

B. 8

C. 4

D. 6

Answer: D

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3. The number of nucleons present in chlorine -37 is

A. 17

B. 20

C. 54

D. 37

Answer: D

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4. The nucleus of an atom contains

A. Electrons and protons

B. Protons and neutrons

C. Electrons and beta particles

D. Protons and alpha particles

Answer: B

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5. The siotopes of neutral atom of an element differ in

A. Atomic number

B. Mass number

C. Number of electrons

D. Chemical properties

Answer: B

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6. The nucleus of tritium consists of

A. 1 proton +1 neutron

B. 1 proton +3 neutron

C. 1 proton + zero neutron

D. 1 proton +2 neutron

Answer: D

Watch Video Solution

7. Sodium ion is isoelectronic with.....atom

A. Mg^{2+}

B. Al^{3+}

C. Ne

D. N^{3-}

Answer: C

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8. An atom differs from its ion in

A. Nuclear charge

B. Mass number

C. Number of electrons

D. Number of neutrons

Answer: C

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9. In C^{14} isotope the number of nuetrons would be

A. 6

B. 14

C. 8

D. 10

Answer: C

Watch Video Solution

10. The number of neutrons in the dipositive zinc ion (Mass no. of Zn = 65)

A. 35

B. 33

C. 65

D. 67

Answer: A

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11. Line spectrum is characteristic of

A. Atoms

B. Molecules

C. Any substance in solid state

D. Any substance in liquid state

Answer: A

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12. The spectrum obtained from incandescent solids is

A. Continuous

B. Line

C. Band

D. absorption

Answer: A

Watch Video Solution

13. The wavelengths of which series lie in the ultraviolet region ?

A. Lyman

B. Balmer

C. Paschen

D. None of the above

Answer: A

Watch Video Solution

14. (A) : Hydrogen has only one electron in its orbit but produces several spectral lines

(R) : There are many excited energy levels available in a sample of Hydrogen gas

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

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15. When electron jumps from 5^{th} energy level to 1^{st} energy level, to which series the spectral line belongs?

A. Balmer

B. Lyman

C. Paschen

D. Pfund

Answer: B

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16. When the electron in the 'H' atom jumps from the fifth orbit to the second orbit, the spectral line emitted is found in ---- region.

A. Visible region

B. Utraviolet region

C. Near IR region

D. Far IR region

Answer: A

Watch Video Solution

17. The following series of lines is found in the ultraviolet region of hydrogen atomic spectrum

A. Balmer

B. Paschen

C. Brakett

D. Lymans

Answer: D

Watch Video Solution

18. Brakett series is produced when the electrons from outer orbits jumps to

A. Third orbit

B. Second orbit

C. Fourth orbit

D. Fifth orbit

Answer: C

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19. The equation corresponding to the wave number of spectral lines if Pfund series is

A. $R\left[\frac{1}{4^2} - \frac{1}{5^2}\right]$

B. $R\left[\frac{1}{3^2} - \frac{1}{4^2}\right]$

C. $R\left[\frac{1}{2^2} - \frac{1}{3^2}\right]$

D. $R\left[\frac{1}{5^2} - \frac{1}{6^2}\right]$

Answer: D

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20. The value of n_1 in Balmer series is

A. 2

B. 1

C. 3

D. 0

Answer: A

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21. The value of Rydberg constant is

A. $109677 cm^{-1}$

B. $109700 cm^{-1}$

C. $10968 cm^{-1}$

D. 10970 m

Answer: A

Watch Video Solution

22. A spectral line of hydrogen with $\lambda = 4938\text{Å}$ belongs to the series

A. Lyman

B. Balmer

C. Paschen

D. Pfund

Answer: B

Watch Video Solution

23. Among the first lines of Lyman,Balmer, paschen and Brackett series in hydrogen atomic spectra,which has the highest energy?

A. Lyman

B. Balmer

C. Paschen

D. Bracket

Answer: A

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24. What are the values of n_1 and n_2 respectively for H_b line in the Lyman series of hydrogen atom sepctrum ?

A. 3 and 5

B. 2 and 3

C. 1 and 3

D. 2 and 4

Answer: C

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25. The fourth line of the Balmer series corresponds to the electronic transition between two orbits the H atom, Identify the orbits.

A. 3 and 1

B. 5 and 1

C. 5 and 2

D. 6 and 2

Answer: D

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26. In a H-atom, the transition takes place from L to K shell. If $R = 1.08 \times 10^7 m^{-1}$, the wave length the light emitted is nearly

A. 4400 Å

B. 1250 Å

C. 1650 Å

D. 1850 Å

Answer: B

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27. The wave lengths of first member of Balmer series of a hydrogen atom is nearly (The value Rydberg constant is $1.08 \times 10^7 m^{-1}$)

A. 4400 Å

B. 5500 Å

C. 6600 Å

D. 7700 Å

Answer: C

Watch Video Solution

28. The wave length of H_δ line of Balmer series of a hydrogen atom is nearly $\left(R = 1.08 \times 10^7 m^{-1}\right)$

A. 4090 Å

B. 5400 Å

C. 6800 Å

D. 7200 Å

Answer: A

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29. The first emision line of hydrogen atomic spectrum in the Balmer series appear at(R=Rydberg constant)

A. $\frac{5R}{36} cm^{-1}$

B. $\frac{3R}{4} cm^{-1}$

C. $\frac{7R}{144} cm^{-1}$

D. $\frac{9R}{400} cm^{-1}$

Answer: A

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30. What is the wave length of H_b line Balmer series of hydrogen spectrum ? (R = Rydberg constant)

A. 36/5R

B. 5R/36

C. 3R/16

D. 16/3R

Answer: D

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31. If in Hydrogen atom, an electron jumps from $n_2 = 2$ to $n_1 = 1$ in Bohr.r orbit, then the value of wave number of the emitted photon will be $\left(R = 109700 cm^{-1}\right)$

A. $54850 cm^{-1}$

B. $82275 cm^{-1}$

C. $62875 cm^{-1}$

D. $10970 cm^{-1}$

Answer: B

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Level - I (EAMCET) (Exercise -II (Bohr theory))

1. The first use of quantum theory to explain the structure of atom was made by

A. Planck

B. Einstein

C. Bohr

D. Heisenberg

Answer: C

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2. Bohr.s theory is applicable to

A. Li^{+2}

B. Li^{+}

C. He^{+}

D. Both 1 and 3

Answer: D

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3. Bohr.s theory is not applicable to

A. H

B. He^{+}

C. Be^{3+}

D. H^{+}

Answer: D

Watch Video Solution

4. (A) : Bohr.s orbits are called stationary orbits

(R) : Electrons remain stationary in these orbitss

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: C

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5. If the electron of a hydrogen atom is present in the first orbit. The total energy of the electrons is

A. $\frac{-e^2}{r}$

B. $\frac{-e^2}{r^2}$

C. $\frac{-e^2}{2r}$

D. $\frac{-e^2}{2r^2}$

Answer: C

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6. The angular momentum of an electron present in the excited state of hydrogen is $1.5h/\pi$. The electron is present in

A. Third orbit

B. Second orbit

C. Fourth orbit

D. Fifth orbit

Answer: A

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7. According to Bohr.s theory, the angular momentum of electron in 5th orbit is

A. $2.5h/p$

B. $25h/p$

C. $1.0h/p$

D. $10h/p$

Answer: A

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8. The angular momentum of a revolving electron in an orbit is equal to

A. $\frac{nh}{2\pi}$

B. $\frac{h}{2\pi}$

C. $\left(\frac{nh}{2\pi}\right)^2$

D. $\frac{n\pi}{2h}$

Answer: A

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9. Energy of an electron in n^{th} Bohr orbit is given as

A. $-\frac{n^2h^2}{4\pi^2mZe^2}$

B. $-\frac{2n^2Z^2me^4}{n^2h^2}$

C. $-\frac{2\pi Ze^2}{nh}$

D. $-\frac{n^2h^2}{2\pi^2Z^2me^4}$

Answer: B

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10. The energy of the electron when it is at an infinite distance from the nucleus is

A. Infinity

B. Zero

C. Minimum

D. Can not be predicted

Answer: B

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11. According to Bohr.s theory, when ever the electron drops from a higher energy level to a lower energy level, the frequency of radiation emitted is related to the energy change as

A. $\lambda = \frac{h}{mv}$

B. $mvr = \frac{nh}{2\pi}$

C. $\upsilon = \frac{\Delta E}{h}$

D. $\upsilon = \frac{h}{\Delta E}$

Answer: C

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12. In an atom when an electron jumps from K-shell to M-shell

A. Energy is absorbed

B. Energy is emitted

C. Energy is neither absorbed nor emitted

D. Sometimes energy is absorbed and some times emitted

Answer: A

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13. The expression for radius of a Bohr orbit in hydrogen atom is

A. $\frac{nh}{2\pi mr}$

B. $\frac{n^2h^2}{4\pi^2me^2}$

C. $-\frac{2\pi^2me^4}{n^2h^2}$

D. $\frac{n^2}{4\pi^2mhe^2}$

Answer: B

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14. As the electron moves away from the nucleus its potential energy ---- and kinetic energy -----

A. Decreases, increases

B. Increases, increases

C. Decreases, decreases

D. Increases, decreases

Answer: D

Watch Video Solution

15. Identify the correctly matched set from the following lists

	List - A		List - B
(*I*)	Energy	(*a*)	$\frac{2\pi ze^2}{nh}$
(*II*)	Velocity	(*b*)	$-\frac{2\pi^2 mz^2e^4}{n^2h^2}$
(*III*)	Rydberg constant	(*c*)	$\frac{2\pi^2 mz^2e^4}{h^3c}$
(*IV*)	Radius	(*d*)	$\frac{n^2h^2}{4\pi^2 mze^2}$
		(*e*)	$-\frac{4\pi^2 mz^2e^4}{n^2h^2}$

A. I-e, II - a, III - c, IV - d

B. I-b, II-a, III-c, IV-d

C. I-e, II-b, III-c ,IV-d

D. I-b, II-a, III-d, IV-c

Answer: B

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16. Bohr.s model can explain

A. The spectrum of hydrogen atom only

B. Spectrum of an atom or ion containing one electron only

C. The spectrum of hydrogen molecule

D. The solar specturm

Answer: B

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17. Splitting of spectral lines under the influence of strong magnetic field is called

A. Stark effect

B. Zeeman effect

C. Photoelectric effect

D. None of these

Answer: B

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18. Radius of tenth Bohr orbit of the Hydrogen atoms is

A. 0.53 Å

B. 5.3 Å

C. 53 Å

D. $5.3 \times 5Å$

Answer: C

Watch Video Solution

19. Radius of 3^{rd} Bohr orbit is

A. 6.529 Å

B. 2.116 Å

C. 4.761 Å

D. 8.464 Å

Answer: C

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20. Velocity of the electron in the 1^{st} Bohr orbit

A. $2.18 \times 10^8 cm/\sec$

B. $2.18 \times 10^8 m/\sec$

C. $2.18 \times 10^{16} cm/\sec$

D. 36559×10^8 cm/sec

Answer: A

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Level - I (EAMCET) (Exercise -III (De-Broglie.s Theory , Heisenberg Principle , Schrodinger equations & orbitals))

1. The de-Broglie equation treats an electron to be

A. a particle

B. a wave

C. ray

D. both (1) and (2)

Answer: D

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2. Wavelength of the wave associated with a moving electron

A. Decreases with increase in speed of electron

B. Increases with increase in speed of electron

C. Remains same irrespective of speed of electron

D. is zero

Answer: A

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3. The uncertainity principle and the concept of wave nature of matter were proposed by----- and ---- respectively

A. Pauli, Hund

B. Heisenberg, Aufbau

C. Heisenberg, de Broglie

D. Heisenberg, Planck

Answer: B

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4. Bohr's postulate that $mvr = \frac{nh}{2\pi}$ is proved mathematically by

A. Pauli.s exclusion principle

B. de Broglie wave nature of the electron

C. Heisenberg uncertainity principle

D. Sommerfield theory

Answer: C

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5. The momentum of a particle of wave length 1 Å is

A. $6.625 \times 10^{-27} g.cm.s^{-1}$

B. $6.625 \times 10^{-19} g.cm.s^{-1}$

C. $6.625 \times 10^{-16} g.cm.s^{-1}$

D. $6.625 \times 10^{-23} g.cm.s^{-1}$

Answer: B

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6. The de Broglie wavelength of a particle with mass 1 g and velocity 100 m/s is

A. $6.63 \times 10^{-33} m$

B. $6.63 \times 10^{-34} m$

C. $6.63 \times 10^{-35} m$

D. $6.63 \times 10^{-36} m$

Answer: B

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7. The de Broglie wave length of a riffle bullet of mass 2 grams moving with a velocity of 2m/sec of

A. $\frac{6.6 \times 10^{-34}}{2 \times 2} m$

B. $\frac{6.6 \times 10^{-27}}{2 \times 10^{-3} \times 2} cm$

C. $\frac{6.6 \times 10^{-34}}{2 \times 10^{-3} \times 2} m$

D. $\frac{6.6 \times 10^{-27}}{2 \times 2} m$

Answer: A

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8. A cricket ball of mass 0.5 kg is moving with a velocity of $100 ms^{-1}$, the wavelength associated with its motion is

A. $13.25 \times 10^{-26} m$

B. $13.25 \times 10^{-34} m$

C. $13.25 \times 10^{-36} m$

D. $6.6 \times 10^{-34} m$

Answer: C

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9. If the Planck's constant $h = 6.6 \times 10^{-34} Js$, the de-Broglie wave length of a particle having momentum of $3.3 \times 10^{-24} kg.\, ms^{-1}$ will be

A. $2 \times 10^{-10} m$

B. $1 \times 10^{-15} m$

C. $10^{-5} m$

D. $4 \times 10^{-10} m$

Answer: C

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10. The de Broglie wave length associated with a particle of mass 1 mg moving with a velocity of 1m/sec is

A. $6.63 \times 10^{-29} m$

B. $6.63 \times 10^{-31} m$

C. $6.63 \times 10^{-28} m$

D. $6.63 \times 10^{-22} m$

Answer: A

Watch Video Solution

11. According to Schrodinger model, nature of electron in an atom is as

A. Particles only

B. Wave only

C. Both simultaneously

D. Sometimes waves and sometimes particles

Answer: C

Watch Video Solution

12. Which one of the following expressions represent the electron probability function (D)

A. $4\pi r dr\psi^2$

B. $4\pi r^2 dr\psi$

C. $4\pi r^2 dr\psi^2$

D. $4\pi r dr\psi$

Answer: C

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13. Radial part of the wave function depends on quantum numbers

A. n and s

B. 1 and m

C. 1 and s

D. n and 1

Answer: C

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14. A given p-orbitals is_____fold degenerated

A. Two

B. Three

C. Four

D. Five

Answer: B

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15. Number of nodal planes that a p-orbital has

A. 0

B. 1

C. 2

D. 3

Answer: B

Watch Video Solution

16. Which of the following is correct with respect to .p. orbitals ?

A. Spherical

B. Strong directional character

C. Five fold degenerate

D. No directional character

Answer: B

Watch Video Solution

17. The maximum number of electrons accomodated in 5f orbitals

A. 5

B. 10

C. 14

D. 18

Answer: C

Watch Video Solution

18. The maximum probability of finding an electron of a particular energy in an orbital is about

A. 80 %

B. 0.85

C. 0.95

D. 0.99

Answer: C

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19. Number of nodes spaces in 4s orbital is

A. 0

B. 1

C. 2

D. 3

Answer: C

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20. (A) : The p-orbital has dumb-bell shape

(R) : Electron present in p-orbital can have any one of the three values of magnetic number (0, +1, -1)

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: B

Watch Video Solution

21. The number of nodal planes .d. orbital has

A. Zero

B. one

C. two

D. three

Answer: C

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22. In the radial probability distribution curve for the 2s orbital of the hydrogen atom, the minor maximum, the node and the major maximum occur at the following distances from the nucleus respectively

A. 1.1Å, 0.53 Å, 2.6Å

B. 0.53Å, 1.1 Å, 2.6 Å

C. 2.6Å, 1.1 Å, 0.53 Å

D. 0.53Å, 2.116Å, 2.6 Å

Answer: B

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23. (A) There are two noda regions in 3s-orbital

(R) : There is no nodal plane in 3s orbital

The correct answer is

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: B

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24. Match the following columns

List-1	List-2
A) Bohr's atomic model	1) Fine spectrum of Hydrogen
B) de-Broglie's concept	2) Atomic orbital
C) Sommer field atomic	3) Dual nature of model any particle in motion
D) Schrodinger wave	4) Quantisation of equation angular momentum

A. A-2, B-3, C-4, D-1

B. A-4, B-3, C-2, D-1

C. A-4, B-3, C-1, D-2

D. A-3, B-4, C-2, D-1

Answer: B

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Level - I (EAMCET) (Exercise -IV (Quantum numbers))

1. The maximum number of electrons that p-orbital can accommodate is

A. 6

B. 2

C. 10

D. 14

Answer: A

Watch Video Solution

2. The number of orbitals in the quantum level n = 4 is

A. 4

B. 9

C. 16

D. 18

Answer: C

Watch Video Solution

3. The quantum number which is equal for all the d-electrons in an atom is

A. l

B. m

C. s

D. n

Answer: A

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4. Correct set of four quantum numbers for the valence electron of Rubidium (Z=37) is

A. 5,0,0,+1/2

B. 5,1,0,+1/2

C. 5,1,1,+1/2

D. 6,0,0,+1/2

Answer: A

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5. n, l and m values of the $2p_z$ orbital are

A. 3,2,1

B. 2,1,0

C. 1,2,0

D. 2,0,1

Answer: B

Watch Video Solution

6. Which of the following is not a possible value of azimuthal quantum number (l) for an electron with n = 3?

A. zero

B. 1

C. 2

D. 3

Answer: C

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7. The azimuthal quantum number for the last electron in sodium atom is

A. 1

B. 2

C. 0

D. 3

Answer: D

Watch Video Solution

8. Maximum number of electrons that can be present in M and N - shells respectively are

A. 18, 32

B. 8, 18

C. 32, 50

D. 32, 48

Answer: A

Watch Video Solution

9. What is the maximum number of electrons that can be theoretically present in the seventh orbit ?

A. 49

B. 32

C. 72

D. 98

Answer: D

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10. The correct set of quantum numbers for a 4d electrons is

A. 4,3,2,+1/2

B. 4,2,1,0

C. 4,3,-2,+1/2

D. 4,2,1,-1/2

Answer: D

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11. Which of the following sets of quantum numbers is correct for an electron is 4f - orbital ?

A. $n = 4, l = 3, m = 4, s = +1/2$

B. $n = 4, l = 4, m = -1, s = +1/2$

C. $n = 4, l = 3, m = +1, s = +1/2$

D. $n = 3, l = 2, m = -2, s = +1/2$

Answer: C

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12. The number of different spatial arrangements for the orbital with 1 = 2 is

A. 1

B. 3

C. 5

D. 7

Answer: C

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13. An electron in an atom has m = -2 value. Then

(I) its 'n' value should be greater thn 2

(II) its 's' value should +1/2

(III) its 'I' value should be 2

(IV) its 'l' value shoul be greater than 1

A. I and II are correct

B. II and III are correct

C. III and IV are correct

D. I and IV are correct

Answer: D

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14. The maximum number of electrons that can be present in an orbit with s = +1/2 and l=2

A. 1

B. 3

C. 5

D. 7

Answer: C

Watch Video Solution

15. The maximum number of eletrons with s = +1/2 in an orbital for which l=2 is

A. 1

B. 3

C. 5

D. 7

Answer: A

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16. (A) : The energy of electron is largely determined by its principal quantm number.

(R) : The principal quantum number is a measure of most probable distance of finding the arond the nucleus

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

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17. If the value of principal quantum number is 3, the total possible values for magnetic quantum number will be

A. 5

B. 9

C. 8

D. 10

Answer: A

Watch Video Solution

18. For a particular value of azimuthal quantum number (l), the total number of magnetic quantum number values (m) is given by

A. $l = \frac{m + 1}{2}$

B. $l = \frac{m - 1}{2}$

C. $l = \frac{2m + 1}{2}$

D. $n = \frac{2l + 1}{2}$

Answer: B

Watch Video Solution

19. How many electrons maximum can have $n + 1 = 4$ in an atom.

A. 8

B. 2

C. 6

D. 18

Answer: A

Watch Video Solution

20. (A) : For n = 3, 1 may be 0,1,2 and .m. may be 0, (± 2, ± 1 and 0)

(R) : For each value of n there are 0 to (n-1) possible values of 1 and for each value of l values of .m. are -1....0....+1

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

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21. If magnetic quantum number of a given electron is represented -3, then what will be its principal quantum number ?

A. 2

B. 3

C. 4

D. 1

Answer: C

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Level - I (EAMCET) (Exercise - V (Electronic configuration , Aufbau principle, Pauli.s Exclusion principle and Hund.s rule))

1. The configuration $1s^2 2s^2 2p^5 3s^1$ shows

A. Ground state of fluorine atom

B. Excited state of fluorine atom

C. Excited state of neon atom

D. Excited state of oxygen atom

Answer: C

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2. The incorrect electronic arrangment is

A. 2,8,13,1

B. 2,8,12,2

C. 2,8,8,1

D. 2,8,8,2

Answer: B

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3. Given this set of quantum numbers for a multi electron atom $2, 0, 0,$ and $-1/2$. The next higher allowed set of n and 1 for this atom in its ground state

A. n=2, l=0

B. n=2, l=1

C. n=3, l=0

D. n=3, l=1

Answer: B

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4. Which one of the following pairs of atoms/ions have identical ground state configuration ?

A. Li^+ and He^+

B. Cl^- and Ar

C. Na and K

D. F^+ and Ne

Answer: B

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5. How many 'd' electrons are present in Cr^{2+} ion?

A. 4

B. 5

C. 6

D. 3

Answer: A

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6. The atomic number of the element with the maximum number of unpaired 2p electrons in the ground state is

A. 1

B. 7

C. 13

D. 8

Answer: B

Watch Video Solution

7. The total number of electrons present in all the 's' orbitals, all the 'p' ortitals and all the 'd' orbitals of cesium ion are respectively

A. 8, 26,10

B. 10,24,20

C. 8,22,24

D. 12,20,22

Answer: B

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8. Which atom has as many 's' electrons as P-electrons

A. H

B. N

C. Na

D. Mg

Answer: D

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9. An element has 2 electrons in its K-shell. 8 electrons in L-shell, 13 electrons in M-shell and one electron in N-shell. The element is

A. Cr

B. Fe

C. V

D. Ti

Answer: A

Watch Video Solution

10. The electronic configuration $1s^2 2s^2 2p^6 3s^1 3p^3 3d^2$ represents

A. Ground state

B. 1^{st} excited state

C. 2^{nd} excited state

D. 3^{rd} excited state

Answer: C

Watch Video Solution

11. The atomic number of an element 'M' is 26. How many electrons are present in the M-shell of the element in its M^{3+} state ?

A. 11

B. 15

C. 14

D. 13

Answer: D

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12. Consider the ground state of Cr atom (Z = 24). The numbers of electrons with the azimuthal quantum numbers, $l = 1$ and 2 are, respectively

A. 12 and 4

B. 16 and 5

C. 16 and 4

D. 12 and 5

Answer: D

Watch Video Solution

13. Which is the first element to have 4d-electron in its electronic configurations

A. Ca

B. Sc

C. Y

D. La

Answer: C

Watch Video Solution

14. In the ground state, an element has 13 electrons in its "M - shell". The element is

A. Copper

B. Chromium

C. Nickel

D. iron

Answer: B

Watch Video Solution

15. (A) : The electronic configuration of Cr is $[Ar]3d^5 4s^1$ but not $[Ar]3d^4 4s^2$

(R) : Lowering energy with configuration $[Ar]3d^5 4s^1$ is more than that with configuration $[A]3d^4 4s^2$

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

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16. The electrons identified by quantum numbers n and l are

I) n = 4, l = 1 (II) n = 4, l = 0 (III) n = 3,l =2 (IV) n = 3, l = 1

can be placed in order of increasing energy as

A. $IV < II < III < I$

B. $II < IV < I < III$

C. $I < III < II < IV$

D. $III < I < IV < II$

Answer: A

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17. (A) : Fe^{3+} (g) is more stable than Fe^{2+} (g)

(R) : Fe^{3+} (g) has more number of unpaired electrons than Fe^{++} (g)

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: B

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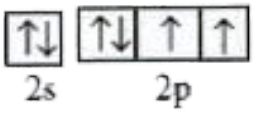
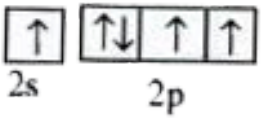
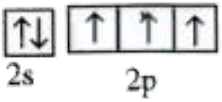
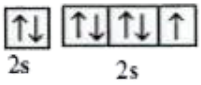
18. In which of the following Aufbau principle is violated?

A. 

B. 

C. 

D. 

Answer: B

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19. Which of the following electronic configuration is not possible?

A. $1s^2 2s^2 2p$

B. $1s^2 2s^2 2p^7$

C. $1s^2 2s^2$

D. $1s^2 2s^2 2p^5$

Answer: B

Watch Video Solution

20. The configuration $1s^2 2s^2 2p^5 3s^1$ shows

A. Ground state of fluorine

B. Excited state of fluorine

C. Exited state of neon atoms

D. Excited state of argon

Answer: C

Watch Video Solution

21. Which of the following has maximum unpaird d-electrons ?

A. Zn^+

B. Fe^{2+}

C. Ni^{3+}

D. Cu^+

Answer: B

Watch Video Solution

22. Consider the ground state of Cr atom (Z = 24). The numbers of electrons with the azimuthal quantum numbers, $l = 1$ and 2 are, respectively

A. 12,4

B. 12,5

C. 16,4

D. 16,5

Answer: B

Watch Video Solution

23. Mass number of Li, Be and B are 7,9 and 10 respectively. Which of the following has two electron three protons and four neutrons ?

A. B^+

B. Be^{2+}

C. Li^+

D. Be

Answer: C

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24. The energy required to melt 1g. Ice is 33J. The number of quanta of radiation of frequency $4.67 \times 10^{13} \text{sec}^{-1}$ that must be absorbed to melt 10g ice is

A. 1.065×10^{22}

B. 3.205×10^{23}

C. 9.076×10^2

D. None

Answer: A

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25. (A) : A spectral line will be seen for $2p_x$ to $2p_y$ transition.

(R) : Energy is released in the form of wave of light when electron drops from $2p_x$ to $2p_y$ orbital.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: D

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26. When a greater number of electrons from excited hydrogen atoms reach the ground state, then

A. The intensity of spectral lines in Lyman series increases

B. The number of lines in Lyman series increases

C. Both the intensity and number lines in Lyman series increase.

D. There is no observable change in spectrum

Answer: A

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27. What electronic transition in Li^{+2} produces the radiation of the same wave length as the first line in the Lyman series of hydrogen ?

A. n = 4 to n = 2

B. n = 9 to n = 6

C. n = 9 to n = 3

D. n = 6 to n = 3

Answer: D

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28. The wavelength of the spectral line, for the transition n = 2 to n=1 in the hydrogen emission spectrum is .X.. Which of the following spectral line also has a wavelength of X

A. . H_{α}. line in the Balmer series of spectrum of .H.

B. . H_{β}. line in the Balmer series of spectrum of .H.

C. . H_{α}. line in the Balmer series of spectrum of . He^{+}.

D. . H_{β}. line in the Balmer series of spectrum of . He^{+}.

Answer: D

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29. The ratio of the wave lengths of the first line in the Lyman series of the spectrum of Hydrogen atom and the first line in the Balmer series of the spectrum of He^+ is

A. $20/27$

B. $27/20$

C. $27/5$

D. $5/27$

Answer: A

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30. In Bohr series of lines of hydrogen spectrum, the third line from the red end corresponds to which one of the following inter - orbit jumps of the electron for Bohr orbits in an atom of hydrogen ?

A. $3 \rightarrow 2$

B. $5 \rightarrow 2$

C. $4 \rightarrow 1$

D. $2 \rightarrow 5$

Answer: B

Watch Video Solution

Level - I (EAMCET) (Exercise - VI (Miscellaneous))

1. Which of the following statement 1s wrong about electrons ?

A. it is a particle

B. It has wave nature

C. it emits energy while revolving in an orbit

D. Its motion is effected by magnetic field

Answer: C

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2. Quantum number value for 2p sub shell are ?

A. n=2, l=0

B. n=3, l=1

C. n=2, l=1

D. n=2, l=2

Answer: C

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3. Alomost the entire mass of an atom is concentrated in the _____.

A. proton

B. electron

C. nucleus

D. neutron

Answer: C

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4. Electron was discovered by

A. Chadwick

B. Thomson

C. Goldstein

D. Bohr

Answer: B

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5. An atom has a mass number of 23 and atomic number 11. The number of protons are _____

A. 23

B. 11

C. 12

D. 44

Answer: B

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6. The mass of the atom is determined by _____.

A. neutrons

B. neutron and proton

C. electron

D. electron and neutron

Answer: B

Watch Video Solution

7. The K, L and M shells of an atom are full. Its atomic number is _____.

A. 18

B. 20

C. 10

D. 12

Answer: A

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8. Cathode rays are deflected towards_____.

A. positive electrode

B. negative electrode

C. both electrodes

D. none of the electrodes

Answer: A

Watch Video Solution

9. The proton is heavier than an electron by _____.

A. 1850 times

B. 1840 times

C. 1000 times

D. 100 times

Answer: B

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10. Carbon-12 atoms has _____.

A. 6 electrons, 6 protons, 6neutrons

B. 6 electrons, 12 protons, 6 neutrons

C. 12 electrons, 6 protons, 6 neutrons

D. 18 electrons, 6 protons, 6 neutrons

Answer: A

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11. Chadwick got the Nobel Prize for the discovery of _____.

A. protons

B. neutrons

C. electrons

D. mesons

Answer: B

Watch Video Solution

12. The volume of the nucleus of an atom when compared to the extra nuclear part is _____.

A. heavier

B. Smaller

C. Same size

D. Unpredictable

Answer: B

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13. The correct set of four quantum numbers for the valence electron of rubidium atom (Z = 37) is

A. 5,0,0,+1/2

B. 5,1,0,1/2

C. 5,1,1,+1/2

D. 6,0,0,+1/2

Answer: A

Watch Video Solution

14. Maximum number of electrons in a subshell wih l=3 and n=4 is

A. 10

B. 6

C. 14

D. 22

Answer: C

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15. Which of the following do not represent ground state electronic configuration of an atom ?

A. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^8 4s^2$

B. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9 4s^2$

C. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1$

D. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$

Answer: B

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16. Which of the following statements about electrons is incorrect ?

A. it is a negatively charged particle

B. its mass is equal to that of neutron

C. it is a basic constituent of all atoms

D. it is a constituent of cathode rays

Answer: B

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17. The number of radial nodes for a 3p orbital is

A. 4

B. 3

C. 2

D. 1

Answer: D

Watch Video Solution

18. Number of angular nodes for a 4d orbital is ____.

A. 4

B. 3

C. 2

D. 1

Answer: C

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19. Which of the following is responsible to rule out the existence of definite paths or trajectories of electrons ?

A. Pauli.s exclusion principle

B. Heisenberg uncertainity principle

C. Aufbau principle

D. Hund.s rule

Answer: B

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20. Total number of orbitals associated with third shel would be

A. 2

B. 4

C. 9

D. 3

Answer: C

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21. When 6d orbital is complete, the entering electron goes into

A. 7f

B. 7d

C. 7p

D. 7s

Answer: C

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22. Neutron is a fundamental particle which carries ?

A. no charge and no mass

B. $+1$ charge and one unit mass

C. -1 charge and one unit mass

D. no charge and one unit mass

Answer: D

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23. Most penetrating radiation of radioactive element is :

A. α rays

B. β rays

C. γ rays

D. X- rays

Answer: C

Watch Video Solution

24. The maximum number of electrons that can be accomodated by p - orbital is ?

A. 2

B. 10

C. 14

D. 6

Answer: D

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Level - I (MAIN) (Exercise -I (Fundamental particle , Atomic number and mass number , Atomic models, Nature of light , Spectra))

1. Which of the following is not a fundamental particle ?

A. Proton

B. Neutron

C. Alpha particle

D. electron

Answer: C

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2. A neutral atom (At.no. > 1) has

A. electron and protons

B. neutron and electron

C. neutron, electron and proton

D. neutron and proton

Answer: C

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3. The study of discharge of electricity through gases led to the discovery of

A. Structure of the atom

B. Nucleus

C. Spectral lines

D. Electron

Answer: D

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4. Electron is a particle having a

A. negative charge of one unit and zero mass

B. positive charge of one unit and zero mass

C. negative charge of one unit and a mass of about $9.1 \times 10^{-31} kg$

D. negative charge of one unit and a mass of about $1.67 \times 10^{-27} kg$

Answer: C

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5. The value of e/m for an electron is

A. 1.78×10^{8} c/g

B. 1.6724×10^{-24} c/g

C. 0.005486 c/g

D. 1.00866 c/g

Answer: A

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6. Charge of electron is

A. 1.602×10^{-10} Coulomb

B. 4.8×10^{-10} coulomb

C. 1.602×10^{-19} e.s.u

D. 4.8×10^{-10} e.s.u

Answer: D

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7. The e/m of proton is

A. 1.78×10^8 c/g

B. 9.57×10^4 c/g

C. 19.14×10^4 c/g

D. 0.478×10^4 c/g

Answer: B

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8. Atomic number is equal to the

A. number of neutrons in the nucleus

B. number of protons in the nucleus

C. sum of protons and neutrons

D. atomic mass of the element

Answer: B

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9. A and Z can be

A. negative

B. fractional

C. zero

D. whole number

Answer: D

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10. The number of protons, electrons and neutrons in $_{35}Br^{80}$ are respectively

A. 35,35,80s

B. 35,35,45

C. 80,80,35

D. 45,45,35

Answer: B

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11. Which one of the following is an isobar of ${}_6C^{14}$?

A. ${}_6C^{13}$

B. ${}_6C^{12}$

C. ${}_7C^{14}$

D. ${}_7N^{15}$

Answer: C

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12. Number of protons in the nucleus of carbon atom is

A. 7

B. 8

C. 4

D. 6

Answer: D

Watch Video Solution

13. The number of nucleons present in chlorine -37 is

A. 17

B. 20

C. 54

D. 37

Answer: D

Watch Video Solution

14. The nucleus of an atom contains

A. Electrons and protons

B. Protons and neutrons

C. Electrons and beta particles

D. Protons and alpha particles

Answer: B

Watch Video Solution

15. The siotopes of neutral atom of an element differ in

A. Atomic number

B. Mass number

C. Number of electrons

D. Chemical properties

Answer: B

Watch Video Solution

16. The nucleus of tritium consists of

A. 1 proton +1 neutron

B. 1 proton +3 neutron

C. 1 proton + zero neutron

D. 1 proton +2 neutron

Answer: D

Watch Video Solution

17. Sodium ion is isoelectronic with.....atom

A. Mg^{2+}

B. Al^{3+}

C. Ne

D. N^{3-}

Answer: C

Watch Video Solution

18. An atom differs from its ion in

A. Nuclear charge

B. Mass number

C. Number of electrons

D. Number of neutrons

Answer: C

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19. In C^{14} isotope the number of nuetrons would be

A. 6

B. 14

C. 8

D. 10

Answer: C

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20. Rutherford's alpha ray scattering experiment showed for the first time that that atom has

A. Nucleus

B. Protons

C. Electron

D. Neutron

Answer: A

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Level - I (MAIN) (Exercise - II (Bohr.s theory))

1. The minimum and maximum values of wavelength in the Lyman series of a H atoms are, respectively

A. 364.3 nm and 653.4 nm

B. 91.2 nm and 121.5 nm

C. 41.2 nm and 102.6 nm

D. 9.12 nm and 121.5 nm

Answer: B

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2. The ratio of wavelength values of series limit liens $\left(n_2 = \infty\right)$ of Balmer series and Paschen series are

A. $4:9$

B. $9:4$

C. $2:3$

D. $3:2$

Answer: A

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3. The total energy of electron in an atom is a combination of potential energy and kinetic energy. If total energy is $-E$ for an electron in an atom, then its K.E. and P.E. respectively are

A. 2E, -E

B. 2E, E

C. E, -2E

D. E, -E

Answer: C

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4. The radius of which of the following orbit is same

A. He^+ (n=2)

B. $Li^{2+}(n = 2)$

C. $Li^{2+}(n = 3)$

D. $Be^{3+}(n = 2)$

Answer: D

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5. When an electron with charge .e. and mass .m. moves with velocity .v. around the nucleus having nuclear charge .Z. in a circular orbit of radius .r., the potential energy of electron is

A. $\frac{Ze^2}{r}$

B. $\frac{Ze^2}{r^2}$

C. $\frac{-Ze^2}{r}$

D. $\frac{mv^2}{r}$

Answer: C

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6. The change in velocity when electron jumps from the first orbit to the second orbit is

A. Half its original velocity

B. Twice its original velocity

C. One fourth its original velocity

D. equal to its original velocity

Answer: A

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7. Which one of the following statements is not correct ?

A. Rydberg constant and wave number have same units

B. Lyman series of hydrogen spectrum occurs in the ultraviolet region

C. The angular momentum of the electrons in the ground state of hydrogen atom is equal to $h/2\pi$

D. The radius of the first Bohr orbit of hydrogen atom is $2.116 \times 10^{-8} cm$

Answer: D

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8. As an electron is brought from an infinite distance close to nucleus of atom, the energy of electron

A. Increases to a greater + ve value

B. Decreases to a smaller +ve value

C. Increases to a smaller -ve value

D. Decreases to a greater -ve value

Answer: D

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9. The ratio of the radii of the first three orbits in an atom of hydrogen is

A. $1:4:9$

B. $9:4:1$

C. $1:2:3$

D. $3:2:1$

Answer: A

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10. The radius of hydrogen atom in the ground state is 0.53 Å, the radius of Li^{2+} in the similar state is

A. 1.06 Å

B. 0.265 Å

C. 0.175 Å

D. 0.53 Å

Answer: C

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11. In hydrogen atom the kinetic energy of electrons in 3.4 eV. The distance of that electron from the nucleus

A. 2.116 Å

B. 0.529 Å

C. 1.587 Å

D. 21.16 Å

Answer: A

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12. The radius of first Bohr.s orbit for hydrogen is 0.53 Å. The radius of third Bohr.s orbit would be

A. 0.79 Å

B. 1.59 Å

C. 3.18 Å

D. 4.77 Å

Answer: D

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13. The energy of second Bohr orbit of hydrogen atom is -328 kJ. mol^{-1}, hence energy of fourth Bohr orbit would be

A. $-41kJmol^{-1}$

B. $-82kJmol^{-1}$

C. $-164kJmol^{-1}$

D. $-1312kJmol^{-1}$

Answer: B

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14. Which of the following transistions in hydrogen atom will require the highest amount of energy

A. n=1 to n=2

B. n=1 to n=3

C. n=2 to n=1

D. n=3 to n=4

Answer: B

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15. The energy of an electron in the first Bohr's orbit of a hydrogen atom is $-2.18 \times 10^{-18} J$. Its energy in the second orbit would be

A. $-1.09 \times 10^{-18} J$

B. $-4.36 \times 10^{-18} J$

C. $-5.45 \times 10^{-19} J$

D. $-8.72 \times 10^{-18} J$

Answer: C

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16. The speed of an electron in the inner most orbit of the hydrogen (Bohr radius = 52.9 pm, me $= 9.11 \times 10^{-31} kg$) is

A. $2.19 \times 10^{4} m.s^{-1}$

B. $2.19 \times 10^{6} m.s^{-1}$

C. $2.19 \times 10^{7} m.s^{-1}$

D. $2.19 \times 10^{8} m.s^{-1}$

Answer: B

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17. The energy of an electron present in Bohr's second orbit of hydrogen atom is

A. $-1312J\ \text{atom}^{-1}$

B. $-328kJmol^{-1}$

C. $-328Jmol^{-1}$

D. $-164kJmol^{-1}$

Answer: B

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18. The wave length having wave number $4000cm^{-1}$ is

A. $2.5\mu m$

B. $250\mu m$

C. $25\mu m$

D. $25nm$

Answer: A

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19. The energy of an electromagnetic radiation is $19.875 \times 10^{-13} erg$. What is its wave number in cm^{-1}? $\left(h = 6.625 \times 10^{-27} erg - s, c = 3 \times 10^{10} cms^{-1}\right)$

A. 1000

B. 10^6

C. 100

D. 10000

Answer: A

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Level - I (MAIN) (Exercise - III (De-Broglie.s Theory , Heisenberg Principle , Schrodinger equations & orbitals))

1. The de Broglie wavelength associated with a moving particle of fixed mass is inversely proportional to

A. Its kinetic energy

B. Square root of its kinetic energy

C. Square of its kinetic energy

D. Cube of its kinetic energy

Answer: B

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2. If the wavelength of the electron is numerically equal to the distance travelled by it in one second, then

A. $\lambda = \sqrt{\frac{h}{m}}$

B. $\lambda = \frac{h}{p^2}$

C. $\lambda = \frac{h}{m}$

D. $\lambda = \sqrt{\frac{h}{p}}$

Answer: A

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3. For an electron to have the same de Broglie wave length as that of a Deutron, its velocity should be times that Deutron

A. 1836

B. $1/1836$

C. 3672

D. $1/3672$

Answer: C

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4. A hydrogen molecule and helium atom are moving with the same velocity. Then the ratio of their de Broglie wavelength is

A. $1:1$

B. $1:27$

C. $2:1$

D. $2:3$

Answer: C

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5. Wavelength of an electron is 5Å Velocity of the electron is

A. 1.45×10^{8} cm/s

B. 1.6×10^{-8} cm/s

C. 3.2×10^{-27} cm/s

D. 3.2×10^{27} cm/s

Answer: A

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6. The wavelength associated with a golf ball weighing 200g and moving at a speed of 5 m/h is of the order

A. $10^{-10}m$

B. $10^{-20}m$

C. $10^{-30}m$

D. $10^{-40}m$

Answer: C

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7. The size of a microscopic particle is 1 micron and its mass is $6 \times 10^{-13}g$. If its position may be measured to within 0.1% of its size, the uncertainity

in velocity (in cm^{-1}) is approximately

A. $\frac{10^{-7}}{4\pi}$

B. $\frac{10^{-5}}{4\pi}$

C. 10^{-5}

D. 10^{-8}

Answer: A

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8. The uncertainity principle and the concept of wave nature of matter were proposed by----- and ---- respectively

A. 2

B. 0.25

C. 4

D. 1

Answer: A

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9. The uncertainity in the position of an electron (mass $9.1 \times 10^{28} g$) moving with a velocity of $3.0 \times 10^{4} cm^{-1}$ accurate up to 0.011%, will be

A. 1.92 cm

B. 7.68 cm

C. 0.175 cm

D. 3.84 cm

Answer: C

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10. There is no difference between a 2p and a 3p orbital regarding

A. value of n

B. Size

C. Energy

D. Shape

Answer: D

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11. The probability of finding electron in XY plane for P_Z - orbital is

A. 1

B. 0.5

C. 99.9 %

D. 0

Answer: D

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12. The de Broglie wavelength of a tennis ball of mass 60 g moving with a velocity of 10 metres per second is approximately

A. 10^{-33} metres

B. 10^{-31} metres

C. 10^{-16} metres

D. 10^{-25} metres

Answer: A

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13. The de Broglie wavelength associated with a ball of mass, 200g and moving at a speed of 5 metres/hour, is in the order of

$\left(h = 6.625 \times 10^{-34} Js\right)$

A. $10^{-15} m$

B. $10^{-20}m$

C. $10^{-25}m$

D. $10^{-30}m$

Answer: D

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14. If uncertainity in position is zero, the uncertainity in momentum of an electron will be

A. Zero

B. Infinity

C. Unity

D. Zero or infinity

Answer: B

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15. Identify the correct set from the following for fundamental particles

List-A	List-B
I) Decreasing order of masses	a) $e^- > p > n$
II) Decreasing order of e/m values	b) $p > e^- > n$
III) Decreasing order of de-Broglie's wavelength with same velocities	c) $n > p > e^-$
IV) Decreasing order of uncertainity in velocity when Δx is same	d) $n > e^- > p$

The correct match is

A. I-c, II-a, III-d, IV-a

B. I-c, II-a, III-a, IV-a

C. I-c, II-d,III-b, IV-a

D. I-c, II-b, III-d, IV-a

Answer: B

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16. Uncertainity in position of a minute particle of mass 25 g in space is $10^{-5}m$. What is the uncertainity in its velocity (in ms^{-1}) ? $\left(h = 6.6 \times 10^{-34}Js\right)$

A. 2.1×10^{-34}

B. 0.5×19^{-34}

C. 2.1×10^{-28}

D. 0.5×10^{-23}

Answer: C

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17. The uncertainity in momentum of an electron is 1×10^{-5} kg.m/s. The uncertainity in its position be ($h = 6.62 \times 10^{-34}$ kg.m/s)

A. $1.05 \times 10^{-28}m$

B. $1.05 \times 10^{-26}m$

C. $5.27 \times 10^{-30} m$

D. $5.27 \times 10^{-28} m$

Answer: C

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18. The uncertainity in the momentum of a particle is $3.31 \times 10^{-2} kgms^{-1}$.

The uncertainity in its position is (in metres)

A. 1.59×10^{-33}

B. 0.33×10^{-30}

C. 0.4×10^{-20}

D. 3.3×10^{-24}

Answer: A

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19. he number of nodal planes for P_x orbitals is

A. 1

B. 2

C. 3

D. 0

Answer: A

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20. Number of nodes in 3p orbital is

A. 0

B. 1

C. 2

D. 3

Answer: B

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21. The orbital without nodal planes is

A. 1s

B. 2p

C. 3d

D. 3p

Answer: A

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22. The no. of spherical nodes in a 4s orbital is

A. Zero

B. 1

C. 2

D. 3

Answer: D

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23. Which d-orbitals has its four lobes along the axes

A. d_{xy}

B. $d_{x^2-y^2}$

C. d_{z^2}

D. d_{xz}

Answer: B

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24. The density of electron cloud of the orbital d_{xy} in yz plane is

A. Zero

B. Maximum

C. Not determined

D. None

Answer: A

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25. The probability of finding an electron in p_y orbital along the x-axis is

A. Maximum

B. zero

C. Not determined

D. Infinite

Answer: B

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26. The number of nodes and nodal planes in 4p orbital are respectively

A. 2,1

B. 1,2

C. 2,3

D. 3,2

Answer: A

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27. The number of nodes possible in radial probability distribution curve of 3d orbital is

A. 1

B. 2

C. 3

D. 0

Answer: D

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Level - I (MAIN) (Exercise -IV (Quantum numbers))

1. For complete description of an electron in an atom, the number of quantum numbers required is

A. one

B. Two

C. Three

D. Four

Answer: D

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2. The azimuthal quantum number indicates_____of the orbital

A. Size

B. Shape

C. Orientation

D. Spin

Answer: B

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3. Principal quantum number is related to

A. Size

B. Shape

C. Spatial orientation

D. Spin

Answer: C

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4. Principal quantum number is related to

A. Size of the orbital

B. Spin angular momentum

C. Orbital angular momentum

D. Orientation of orbital in space

Answer: A

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5. The spin quantum number has a value of

A. $1/2$

B. $+1/2$

C. $-1/2$

D. either +1/2 or -1/2

Answer: D

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6. When there are two electrons in the same orbital they have the spins

A. $+\frac{1}{2}, +\frac{1}{2}$

B. $-\frac{1}{2}, -\frac{1}{2}$

C. $+\frac{1}{2}, -\frac{1}{2}$

D. 0,0

Answer: C

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7. The values of quantum numbers n, l and m for the fifth electron of boron is

A. n=2, l=1, m = -1

B. n=2, l=0, m = -1

C. n=2, l=2, m = -1

D. n=1, l=2, m = -1

Answer: A

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8. When n=3 and l=1, the designation given to the orbital is

A. 4s

B. 4p

C. 3s

D. 3p

Answer: D

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9. Which of the following designation is impossible ?

A. 4f

B. 5g

C. 2d

D. 6p

Answer: C

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10. l = 3, then the values of magnetic quantum numbers are

A. $\pm 1, \pm 2, \pm 3$

B. $0, \pm 1, \pm 2, \pm 3$

C. $-1, -2, -3$

D. $0, +1, +2, +3$

Answer: B

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11. For a of orbital, the values of m are

A. $-1, 0, +1$

B. 0, +1, +2, +3

C. $-2, -1, 0, +1, +2$

D. $-3, -2, -1, 0, +1, +2, +3$

Answer: D

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12. The impossible set of quantum number is

A. n=2, l=0, m=0, s = +1/2

B. n=2, l=1, m=0, s = +1/2

C. n=2, l=0, m=1, s = -1/2

D. n=3, l=1, m=-1, s = -1/2

Answer: C

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13. Which of the following quantum numbers are not possible ?

A. n=2, l=1, m=-1, s = -1/2

B. n=3, l=2, m=-3, s = +1/2

C. n=2, l=0, m=0, s = +1/2

D. n=3, l=2, m=-3, s = +1/2

Answer: B

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14. The correct set of quantum numbers for the unpaired electron of chlorine atom is

A. n=2, l=1, m=0

B. n=3, l=1, m=0

C. n=2, l=1, m=1

D. n=3, l=0, m=0

Answer: C

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15. The two electrons occupying an orbital are distinguished by

A. principal quantum number

B. Azimuthal quantum number

C. Magnetic quantum number

D. Spin quantum number

Answer: D

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16. Which of the following sets of quantum number is correct for an electrons in 4f orbital ?

A. n=4, l=3, m= +4, s = +1/2

B. n=3, l=2, m = -2, s = +1/2

C. n=4, l=3, m = +1, s = +1/2

D. n=4, l=4, m = -4, s = -1/2

Answer: C

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17. The set of quantum numbers not applicable to an electron is

A. 1,1,1,+1/2

B. 1,0,0, +1/2

C. 1,0,0,-1/2

D. 2,0,0,+1/2

Answer: A

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18. For the p_z orbital, conventionally m is

A. -2

B. +2

C. 0

D. Any of these

Answer: C

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19. For the d_{z^2} orbital the value of m may be

A. -3

B. -2

C. 0

D. None

Answer: C

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20. The quantum number not obtained from the Schrodinger.s wave equation is

A. n

B. l

C. m

D. s

Answer: D

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21. A given orbital is labelled by the magnetic quantum number , m = -1. This can not be

A. s-orbital

B. p-orbital

C. d-orbital

D. f-orbital

Answer: A

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22. The shape of orbital for which l = 1 is

A. Spherical

B. Dumb-bell

C. Double dumb-bells

D. Circular

Answer: B

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23. The maximum number of electrons in a sub-shell is given by the expression.

A. (l+2)

B. (2l+2)

C. (4l+2)

D. (l+1)

Answer: C

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24. The magentic quantum number, m for the outermost electron in the sodium atom is

A. 1

B. 0

C. 2

D. -1

Answer: B

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25. For the configuration $1s^2 2s^1$, the quantum numbers for the outermost electron are

A. 2,1,0,-1/2

B. 2,0,0,+1/2

C. 2,10,+1/2

D. 2,0,1,+1/2

Answer: B

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Level - I (MAIN) (Exercise - V (Electronic configuration , Aufbau principle, Pauli.s Exclusion principle and Hund.s rule))

1. No two electrons in an orbital can have parallel spin. This statement emerges from

A. Hund.s rule

B. Aufbau principle

C. Pauli.s exclusion principle

D. (n+1) rule

Answer: C

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2. Electrons never pair, if there are empty orbitals in a given sub-shell. This is

A. Aufbau principle

B. Pauli.s exclusion principle

C. Hund.s rule of maximum multiplicity

D. Heisenberg.s uncertainity principle

Answer: C

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3. Which of the following explains the sequence of filling electrons in different subshells ?

A. Hund.s rule

B. Aufbau principle

C. Pauli.s principle

D. All of these

Answer: B

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4. Nitrogen atom has 3 unpaired electrons in its ground state. It can be explained by

A. Auf-bau principle

B. Pauli.s principle

C. Hund.s rule

D. None of these

Answer: C

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5. The electronic configuration of sodium is

A. $[Ne]3s^2$

B. $[Ne]3s^1$

C. $[Ar]4s^1$

D. $[Ar]4s^2$

Answer: B

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6. Which of the following configuration may represent the ground state of nitrogen atom ?

A.

B.

C.

D.

Answer: B

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7. Electronic configuration of the element with atomic number 56 and mass number 138 is

A. $[Xe]6s^2$

B. $[Kr]5s^2$

C. $[Xe]6s^26p^2$

D. $[Xe]3d^25d^2$

Answer: A

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8. (A) : The electronic configuration of boron cannot be $1s^22s^3$

(R) : No two electrons in an atom can have the same set of all the four quantum numbers

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Boths

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

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9. The correct valence electronic configuration for Cu(Z=29) is

A. $3d^9 4s^2$

B. $3d^{10} 4s^1$

C. $3d^{10} 4s^2$

D. $3d^8 4s^2$

Answer: B

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10. Which one of the following pairs of ions have the same electron configuration

A. Cr^{3+}, Fe^{3+}

B. Fe^{3+}, Mn^{2+}

C. Fe^{3+}, Co^{3+}

D. Sc^{3+}, Cr^{3+}

Answer: B

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11. The (n+1) value for 4f sub shell is

A. 4

B. 5

C. 6

D. 7

Answer: D

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12. The energy of the electron in the hydrogen atom depends on

A. The principal quantum number only

B. All the quantum numbers

C. The Azimuthal quantum number

D. The principal and azimuthal quantum numbers

Answer: A

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13. After 3d-su level is completely filled the differentiating electron enters into ..... sub level.

A. 4s

B. 4p

C. 4f

D. 5s

Answer: A

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14. The correct ground state electronic configuration of chromium atom is

A. $[Ar]3d^5 4s^1$

B. $[Ar]3d^4 4s^2$

C. $[Ar]4s^6$

D. $[Ar]3d^5 4s^2$

Answer: A

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15. The configuration $1s^2 2s^2 2p^6 3s^2 3p^3$ corresponds to

A. S

B. P

C. Na

D. Ar

Answer: B

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16. The configuration $1s^2 2s^1 2p_x^1 2p_y^1 2p_2^1$ represents

A. Nitrogen atom (ground state)

B. Carbon atom (ground state)

C. An excited carbon atom

D. An excited nitrogen atom

Answer: C

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17. The total number of .p. electrons present in phosphorous atom is

A. 9

B. 2

C. 8

D. 3

Answer: A

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18. The valence electron configuration of an element with atomic number 23 is

A. $3d^5$

B. $3d^34s^2$

C. $3d^24s^14p^1$

D. $3d^24s^24p^1$

Answer: B

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19. Mg^{2+} and Al^{3+} have same

A. Protons

B. Neutrons

C. Electronic configuration

D. Nucleons

Answer: C

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20. The number of unpaired electrons in the valence shell of silicon is

A. 2

B. 3

C. 1

D. 0

Answer: A

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21. (A) : AN orbital can.t have more than two electrons

(R) : The first two electrons in a p-sub shell are having different magnetic quamtum numbers

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: B

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22. Which of the following electronic configuration corresponds to an inert gas ?

A. $1s^2 2s^2 2p^5$

B. $1s^2 2s^2 2p^6$

C. $1s^2 2s^2 2p^6 3s^1$

D. $1s^2 2s^2$

Answer: B

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23. The rule that explain the reason for chromium to have $[Ar]3d^5 4s^1$ configuration instead of $[Ar]3d^4, 4s^2$ is

A. Pauli.s exclusion principle

B. Aufbau principle

C. more exchange energy

D. Heisenberg.s principle

Answer: C

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24. Which of the following configuration is not possible ?

A. $2p^2$

B. $3f^7$

C. $3d^5$

D. $4p^6$

Answer: B

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25. Which of the following ions is not isoelectronic with O^{2-}

A. N^{3-}

B. F^-

C. Ti^+

D. Na^+

Answer: C

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Level - I (MAIN) (Exercise - VI (Miscellaneous))

1. (A) Schrodinger wave equation

(B) Heisenberg uncertainty principle

(C) Millikan oil drop experiment

(D) Chadwick.s discovery of neutron

Of the scientific milestones listed above, which is the most ancient and most modern respectively ?

A. A, D

B. C, D

C. B, A

D. C, A

Answer: B

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2. A gaseous mixture contains hydrogen atoms in the 4^{th} excited state, He^{+} ions in 3^{rd} excited state and Li^{2+} in 2^{nd} excited state. The number of spectral lines obtained in the emission spectrum of this sample when all these atoms/ions return to the ground state is

A. 19

B. 20

C. 16

D. 18

Answer: D

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3. When photons of energy 4.25 eV strike the surface of a metal A, the ejected photoelectrons have maximum kinetic energy, T_A (expressed in eV) and de Broglie wavelength λ_A. The mximum kinetic energy of photoelectrons liberated from another metal B by photons of energy 4.20

eV is $T_B = T_A - 1.50eV$. If the de Broglie wavelength of these photoelectrons is $\lambda_B = 2\lambda_A$, then which is not correct :

A. The work function of A is 2.25 eV

B. The work function of B is 3.70 eV

C. $T_A = 2.00eV$

D. $T_B = 2.75eV$

Answer: D

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4. Let A_n be the area enclosed by n^{th} orbit in the H-atoms. The graph ln $\left(\frac{A_n}{A_l}\right)$ against ln(n)

A. will pass through origin

B. will be straightline with slope = 6

C. will be monotonically increasing non-linear curve

D. will be a circle

Answer: A

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5. Which of the following is incorrect for d-subshell (or) orbital

A. d-orbital contains maximum of two electrons with opposite spins

B. d-subshell is five fold degenerate

C. d_{z^2} - orbital is symmetrical along xy plane

D. d - orbital contain only one nodal plane

Answer: D

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6. Maximum probability of finding an electron along xy orbital is

A. Along x-axis

B. In between x & y axis

C. Along y - axis

D. Along z axis

Answer: B

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7. Which of the following relationship is correct ?

A. E_1 of $H = \frac{1}{2}E_2$ of $He^+ = \frac{1}{3}E_3$ of $Li^{+2} = \frac{1}{4}$ of E_4 of Be^{+3}

B. E_1 of $H = E_2$ of $He^+ = E_3$ of $Li^{+2} = E_4$ of Be^{+3}

C. E_1 of $H = 2E_2$ of $He^+ = 3E_3$ of $Li^{+2} = 4E_4$ of Be^{+3}

D. E_1 of $H = \frac{2}{3}E_2$ of $He^+ = \frac{4}{3}E_3$ of $Li^{+2} = \frac{5}{4}E_4$ of Be^{+3}

Answer: B

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8. How many electrons in atom can have n =4, =2, m=-2 and $s = +\frac{1}{2}$?

A. 1

B. 2

C. 3

D. 4

Answer: A

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9. The quantum numbers of four electrons $\left(e_1 \text{ to } e_4\right)$ are given below :

	n	l	m	s		n	l	m	s
e_1	3	0	0	+1/2	e_2	4	0	0	+1/2
e_3	3	2	2	-1/2	e_4	3	1	-1	+1/2

Correct order of decreasing energy of these electrons is

A. $e_4 > e_3 > e_2 > e_1$

B. $e_2 > e_3 > e_4 > e_1$

C. $e_3 > e_2 > e_4 > e_1$

D. $e_1 > e_4 > e_2 > e_3$

Answer: C

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10. A metal surface having v_0 as threshold frequency is incident by light of frequency v, then select the correct statement

A. $u = \sqrt{\frac{2h.\, c\left(\lambda_0 - \lambda\right)}{m\lambda_0\lambda}}$

B. $u = \sqrt{\frac{2h\left(v - v_0\right)}{m}}$

C. $u = \sqrt{\frac{2h\left(\lambda_0 - \lambda\right)}{m}}$

D. $u = \sqrt{\frac{2(hv - W)}{m}}$

Answer: A

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11. Which statement are correct ?

A. The energies of the virous sub-levels in the same shell of H-atom are in order $s > p > d > f$.

B. s-orbital in non-directional

C. Electrons in motion behave as if they are particles

D. An orbital can accommodate a maximum of two electrons with parallel spins.

Answer: B

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12. The work function (ϕ) of some metals is listed below. The number of metals which will show photoelectric effect when light of 300 nm

wavelength falls metal is one the

Metal	Li	Na	K	Mg	Cu	Ag	Fe	Pt	W
ϕeV	2.4	2.3	2.2	3.7	4.8	4.3	4.7	6.3	4.75

A. 3

B. 4

C. 5

D. 6

Answer: B

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13. The orbital angular momentum of 3p electrons is :

A. $\sqrt{3}h$

B. $\sqrt{6}h$

C. zero

D. $\sqrt{2}\frac{h}{2\pi}$

Answer: D

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14. H-atoms in ground state (13.6 eV) are excited by monochromatic radiation of photon of energy 12.1 eV. Find the number of spectral lines emitted in H-atom.

A. 2

B. 3

C. 4

D. 5

Answer: B

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15. Balmer series spectral lines are observed in visible region, in the spectrum of which of the following

A. Hydrogen

B. He^{+}

C. Li^{2+}

D. Be^{3+}

Answer: A

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16. The potential energy of an electron in the hydrogen atom is -6.8 eV. Indicate in which excited state, the electron is present ?

A. first

B. second

C. third

D. fourth

Answer: A

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17. Which of the following rules could explains the presence of three unpaired electrons in N-atoms ?

A. Hund.s rule

B. Aufbau principle

C. Heisenberg.s uncertainty principle

D. Pauli.s exclusion principle

Answer: A

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18. Number of waves produced by an electron in one complete revolution in n^{th} orbit is :

A. n

B. n^2

C. (n+1)

D. (2n+1)

Answer: A

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19. The mass of a particle is $10^{10}g$ and its radius is $2 \times 10^{-4}cm$. If its velocity is $10^{-6}cm\sec^{-1}$ with 0.0001% uncertainty in measurement, the uncertainty in its position is :

A. $5.2 \times 10^{-8}m$

B. $5.2 \times 10^{-7}m$

C. $5.2 \times 10^{-6} m$

D. 5.2×10^{-9}

Answer: A

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20. What is the shortest wavelength line in the Paschen series of Li^{2+} ion ?

A. $\frac{R}{9}$

B. $\frac{9}{R}$

C. $\frac{1}{R}$

D. $\frac{9R}{4}$

Answer: C

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21. The radii of maximum probability for 3s, 3p and 3d electrons are in the order :

A. $\left(r_{\max}\right)_{3d} > \left(r_{\max}\right)_{3p} > \left(r_{\max}\right)_{3s}$

B. $\left(r_{\max}\right)_{3d} > \left(r_{\max}\right)_{3s} > \left(r_{\max}\right)_{3p}$

C. $\left(r_{\max}\right)_{3s} > \left(r_{\max}\right)_{3p} > \left(r_{\max}\right)_{3d}$

D. $\left(r_{\max}\right)_{3p} > \left(r_{\max}\right)_{3s} > \left(r_{\max}\right)_{3d}$

Answer: C

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22. If the subsidiary quantum number of a subenergy level is 4, the maximum and minimum values of the spin multiplicities are :

A. 9,1

B. 10,1

C. 10,2

D. 8,1

Answer: B

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23. The iron atom, how many electrons atom have n=3 and l= 2 ?

A. 2

B. 4

C. 6

D. 8

Answer: C

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Level - II (Type-I) (Lecture Sheet - 1 (Section-A : More than one correct answer type questions))

1. Which of the following statement are correct ?

A. Visible region of electromagnetic radiations have wavelength from 400 nm to 800 nm

B. The energy of photon having wavelentgth 800 nm is larger than that having 400 nm

C. Balmer spectral series lies in the visible portion of the electromagnetic radiation.

D. Lyman spectral series lies in the visible portion of the electromagnetic radiation

Answer: A::C

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2. Which of the following statements are incorrect ?

A. In absorption spectrum, the bright lines are formed on dark back ground

B. In emission spectrum, dark spectral lines are formed on bright ground

C. Hydrogen spectrum is an example of absorption spectrum

D. The intensity of spectral lines depends on population of energy levels between which electronic transition takes place.

Answer: A::B::C

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3. During the Rutherfore.s α-particle scattering experiment

A. Distance of closest approach is of the order of $10^{14}m$

B. At the distance of closest approach, the kinetic energy of the α-particle is transformed into electrostatic potential

C. The α-particles moving towards the nucleus will stop and start retracing its path

D. Maximum number of α-particles went straight through metal foil

Answer: A::B::C::D

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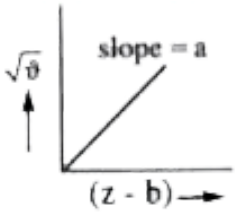
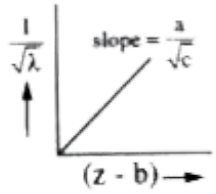
4. Which of the following graphs represents Moseley.s Law ?

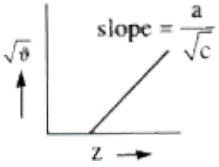
A.

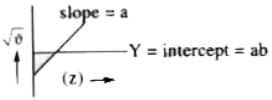


B.



C.



D. 

Answer: A::B::D

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5. Which of the following statements are correct ?

A. The absorption spectrum is formed due to absorbing radiant energy by the matter in lower energy states

B. The emission spectrum is formed due to the emission of radiant energy by the excited matter

C. Hydrogen spectrum is an example of line spectrum

D. Li^+ ion spectrum is equivalent to H atom spectrum.

Answer: A::B::C

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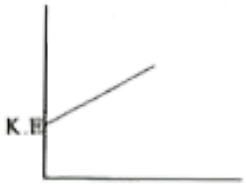
6. When a beam of photons of a suitable frequency strikes the metal surface, electrons are emitted from metal. This process is called photoelectric effect. The effect occurs when energy of incident beam is greater than that of the work function.

Which of the following graphs represents photoelectric effect ?

A.



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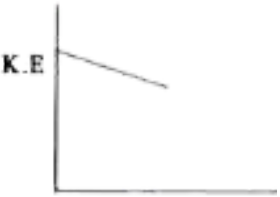

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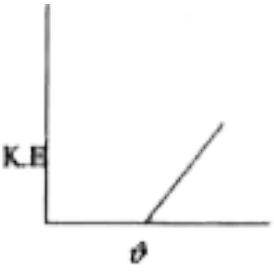

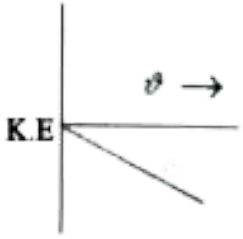

D.

Answer: C

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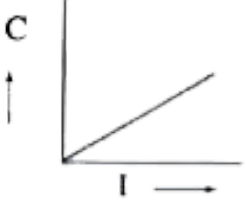
Level - II (Type-I) (Lecture Sheet - 1 (Section - B : Linked comprehension Type questions))

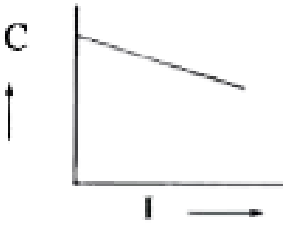
1. When a beam of photons of a suitable frequency strikes the metal surface, electrons are emitted from metal. This process is called photoelectric effect. The effect occurs when energy of incident beam is greater than that of the work function.

Kinetic energy of photoelectron varies with

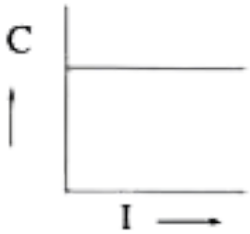
A.



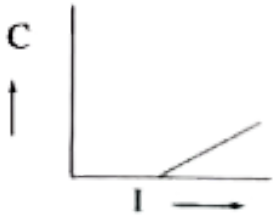
B.



C.



D.



Answer: A

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2. When a beam of photons of a suitable frequency strikes the metal surface, electrons are emitted from metal. This process is called photoelectric effect. The effect occurs when energy of incident beam is greater than that of the work function.

Kinetic energy of photoelectron varies with

A. Nature of metal

B. Intensity

C. Amplitude

D. Both a & c

Answer: A

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3. To explain the nature of radiation, James Clark Maxwell in 1864 put forward .Electromagnetic wave theory.. This theory could explain the phenomena of interference and diffraction but could not explain

phenomena of black body radiation and photoelectric effect. Also, after the advent of electromagnetic wave theory, Rutherford.s model of atom suffered a serious drawback. To explain the phenomena of black body radiation and photoelectric effect, Max planck in 1900 put forward Planck.s quantum theory. BAsed on this theory, Neils Bohr in 1913 put forward Bohr.s model of atom which could overcome the drawback of Rutherford.s model and also explain the line spectral elements, especially the line spectra of hydrogen and hydrogen-like particles.

Which of the following statements is incorrect about electromagnetic wave theory ?

A. Energy is emiited continuously from the source

B. Radiations are associated with electric and magnetic fields

C. Radiations can travel even through vacuum

D. The velocity of any radiation depends upon the nature of the radiation.

Answer: D

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4. To explain the nature of radiation, James Clark Maxwell in 1864 put forward .Electromagnetic wave theory.. This theory could explain the phenomena of interference and diffraction but could not explain phenomena of black body radiation and photoelectric effect. Also, after the advent of electromagnetic wave theory, Rutherford.s model of atom suffered a serious drawback. To explain the phenomena of black body radiation and photoelectric effect, Max planck in 1900 put forward Planck.s quantum theory. BAsed on this theory, Neils Bohr in 1913 put forward Bohr.s model of atom which could overcome the drawback of Rutherford.s model and also explain the line spectral elements, especially the line spectra of hydrogen and hydrogen-like particles.

Kinetic energy of the electron ejected when yellow light of frequency $5.2 \times 10^{14} s^{-1}$ falls on the surface of potassium metal (threshold frequency $= 5 \times 10^{14} s^{-1}$) is

A. $1.325 \times 10^{-13} J$

B. $1.325 \times 10^{-20} J$

C. $1.325 \times 10^{-27} J$

D. $1.325 \times 10^{-34} J$

Answer: B

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Level - II (Type-I) (Lecture Sheet - 1 (Section -C : Matching/Straight objective type questions))

1. If the shortest wavelength of spectral line of H-atom in Lyman series is x. Then match the following for Li^{2+}

Column-I	Column-II
A) Shortest wavelength in Lyman series	P) $\frac{4x}{5}$
B) Longest wavelength in Lyman series	Q) $\frac{4x}{9}$
C) Shortest wavelength in Balmer series	R) $\frac{x}{9}$
D) Longest Wavelength in Balmer series	S) $\frac{4x}{27}$

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2. Match the following columns

Column-I	Column-II
A) $\vartheta < \vartheta_0$	P) photoelectron emitted
B) $\lambda < \lambda_0$	Q) no photocurrent
C) $\vartheta > \vartheta_0$	R) K.E of photoelectron $= h(\vartheta - \vartheta_0)$
D) $\lambda > \lambda_0$	S) velocity of photo electron $= \sqrt{\frac{2ch}{m}\left(\frac{\lambda_0 - \lambda}{\lambda\lambda_0}\right)}$

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Level - II (Type-I) (Practice sheet - 1 (Section-A : More than one correct answer type questions))

1. The incorrect relations (s) about the velocity of photon is (are)

A. Dependent on its wavelength

B. Depend on its intensity

C. Equal to cube of its amplitude

D. Independent of its wavelength

Answer: A::B::C

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2. An electron in a hydrogen atom makes a transition $n_l \rightarrow n_2$, where n_1 and n_2 are principal quantum numbers of the states. Assume the Bohr's model to be valid. The time period of the electron in the initial state is eight times to that of final state. What is ratio of n_2/n_2

A. $n_1 = 4, n_2 = 2$

B. $n_1 = 8, n_2 = 2$

C. $n_1 = 8, n_2 = 1$

D. $n_1 = 6, n_2 = 3$

Answer: A::B

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3. The kinetic energy (KR) of photoelectron emitted on irradiating a metal surface with frequency . ϑ. is related by $KE = h\vartheta - IE$. The plots of K.E vs incident frequency is a straight line which shows

A. slope equal to planck.s constant

B. intercept on x-axis equal to the product of threshold frequency & planck.s constant

C. with extrapoloated on y-axis equal to IE

D. with intercept on x-axis equal to threshold frequency

Answer: A::C::D

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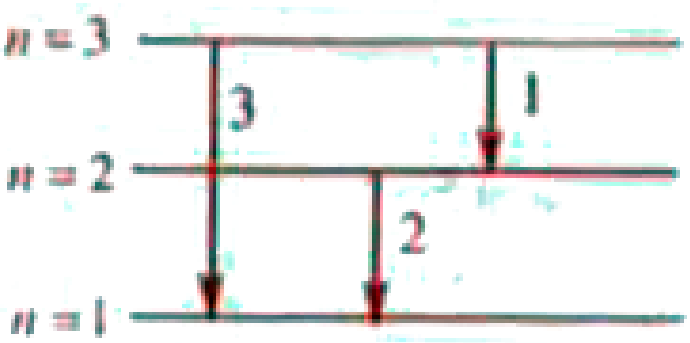
4.



For above transition in hydrogen like atoms, select the correct relations(s).

A. $v_3 = v_1 + v_2$

B. $v_3 = \frac{v_1 v_2}{v_1 + v_2}$

C. $\lambda_3 = \lambda_1 + \lambda_2$

D. $\lambda_3 = \frac{\lambda_1 \lambda_2}{\lambda_1 + \lambda_2}$

Answer: A::D

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5. Which of the following sets of physical phenomena are shown by dual natuer of radiation ?

A. Interference and photoelectric effect

B. Diffraction and photoelectric effect

C. Interference and diffraction

D. Scintillation and interference

Answer: A::B

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Level - II (Type-I) (Practice sheet - 1 (Section - B : Linked comprehension Type questions))

1. The only electron in the hydrogen atom resides under ordinary conditions on the first orbit. When energy is supplied, the electron moves to higher energy orbit depending on the amount of energy absorbed. When this electron returns to any of the lower orbits, it emits energy. Lyman series is formed when the electron returns to the lowest orbit while Balmer series is formed when the electron returns to second orbit. Similarly, Paschen, Brackett and Pfund series are formed when electron returns to the third, fourth orbits from higher energy orbits respectively (as shown in figure)

Maximum number of lines produced when an electron jumps from nth level to ground level is equal to $\frac{n(n-1)}{2}$. For example, in the case of n = 4, number of lines produced is 6. $(4 \rightarrow 3, 4 \rightarrow 2, 4 \rightarrow 1, 3 \rightarrow 2, 3 \rightarrow 1, 2 \rightarrow 1)$. When an electron returns

from n_2 to n_1 state, the number of lines in the spectrum will be equal to

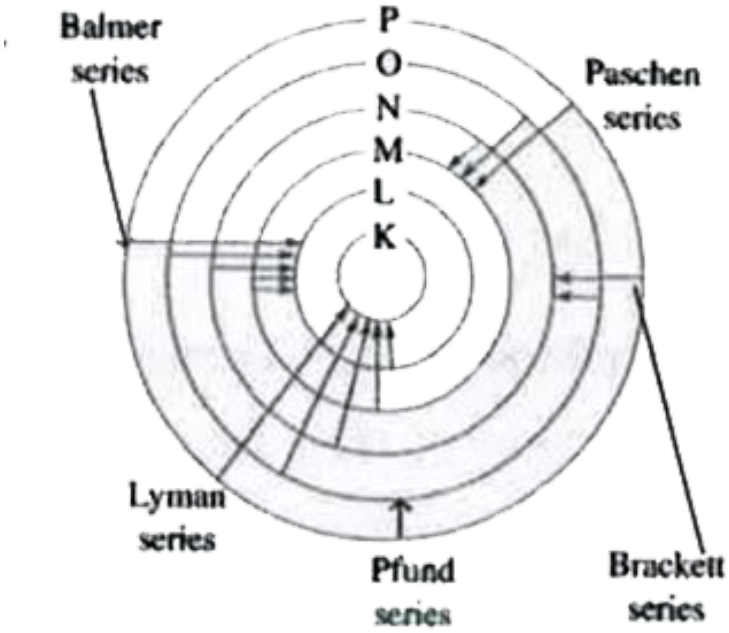
$$\frac{\left(n_2 - n_1\right)\left(n_2 - n_1 + 1\right)}{2}$$

If the electron comes back from energy level having energy E_2 to energy level having energy E_2 then the difference may be expressed in terms of energy of photon as $E_2 - E_1 = \Delta E, \lambda = \frac{hc}{\Delta E}$. Since h and c are constant, ΔE corresponds to definite energy, thus each transition from one energy level to another will prouce a higher of definite wavelength. THis is actually observed as a line in the spectrum of hydrogen atom. Wave number of the line is given by the formula $\bar{\nu} = RZ^2\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$

Where R is a Rydberg constant $\left(R = 1.1 \times 10^7\right)$

(i) First line of a series : it is called .line of logest wavelength. or .line of shortest energy..

(ii) Series limit of last of a series : It is the line of shortest wavelength or line of highest energy.



The wave number of electromagnetic radiation emitted during the transition of electron in between two levels of Li^{2+} ion whose principal quantum numbers sum if 4 and difference is 2 is

A. R

B. $\frac{R}{3^2}$

C. $\frac{3^2R}{4^2}$

D. 3^2R

Answer: A

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2. The only electron in the hydrogen atom resides under ordinary conditions on the first orbit. When energy is supplied, the electron moves to higher energy orbit depending on the amount of energy absorbed. When this electron returns to any of the lower orbits, it emits energy. Lyman series is formed when the electron returns to the lowest orbit while Balmer series is formed when the electron returns to second orbit. Similarly, Paschen, Brackett and Pfund series are formed when electron returns to the third, fourth orbits from higher energy orbits respectively (as shown in figure)

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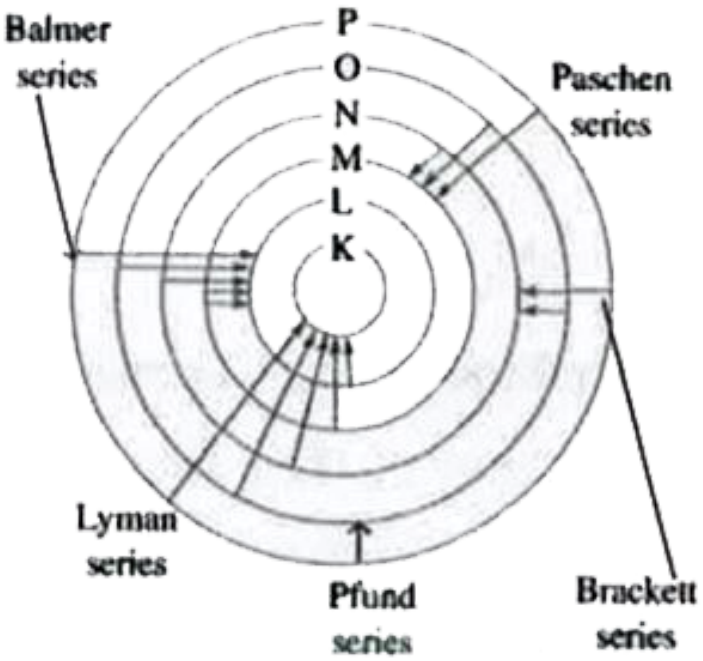

In a single isolated atom in electron makes transition from 5^{th} excited state to 2^{nd} state the maximum number of different types of photons observed as

A. 3

B. 4

C. 6

D. 15

Answer: B

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3. The only electron in the hydrogen atom resides under ordinary conditions on the first orbit. When energy is supplied, the electron moves to higher energy orbit depending on the amount of energy absorbed. When this electron returns to any of the lower orbits, it emits energy. Lyman series is formed when the electron returns to the lowest orbit while Balmer series is formed when the electron returns to second orbit. Similarly, Paschen, Brackett and Pfund series are formed when electron returns to the third, fourth orbits from higher energy orbits respectively (as shown in figure)

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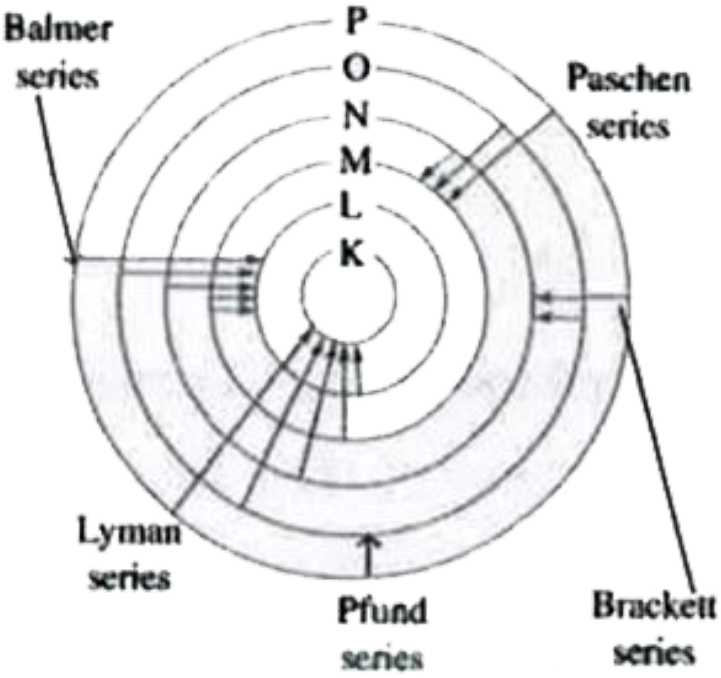

The difference in the wavelength of the 2^{nd} line of Lyman series and last line of Bracket series in a hydrogen sample is

A. $\frac{119}{8R}$

B. $\frac{1217}{8R}$

C. $\frac{219}{8R}$

D. None

Answer: A

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4. The only electron in the hydrogen atom resides under ordinary conditions on the first orbit. When energy is supplied, the electron moves to higher energy orbit depending on the amount of energy absorbed. When this electron returns to any of the lower orbits, it emits energy. Lyman series is formed when the electron returns to the lowest orbit while Balmer series is formed when the electron returns to second orbit. Similarly, Paschen, Brackett and Pfund series are formed when electron returns to the third, fourth orbits from higher energy orbits respectively (as shown in figure)

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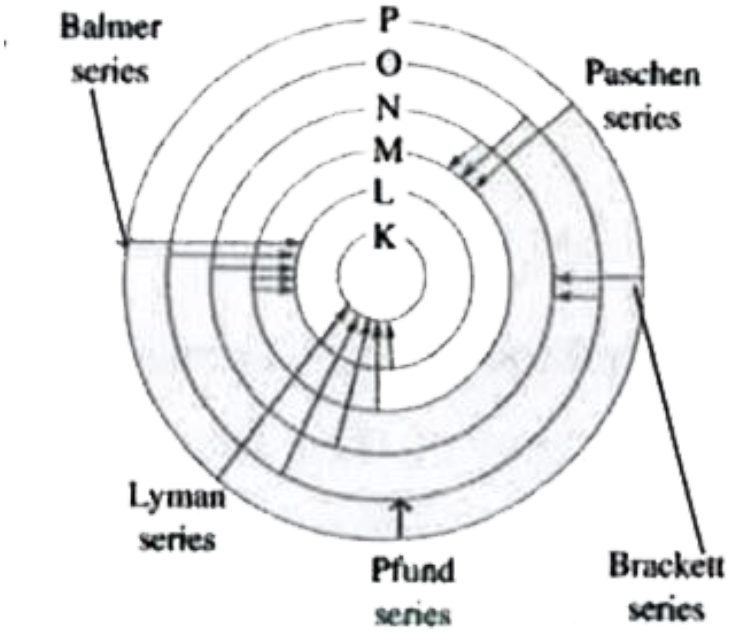

The wave number of electromagnetic radiation emitted during the transition of electron in between two levels of Li^{2+} ion whose principal quantum numbers sum if 4 and difference is 2 is

A. $3.5R_H$

B. $4R_H$

C. $8R_H$

D. $\frac{8}{9}R_H$

Answer: C

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5. The only electron in the hydrogen atom resides under ordinary conditions on the first orbit. When energy is supplied, the electron moves to higher energy orbit depending on the amount of energy absorbed. When this electron returns to any of the lower orbits, it emits energy. Lyman series is formed when the electron returns to the lowest orbit while Balmer series is formed when the electron returns to second orbit. Similarly, Paschen, Brackett and Pfund series are formed when electron returns to the third, fourth orbits from higher energy orbits respectively (as shown in figure)

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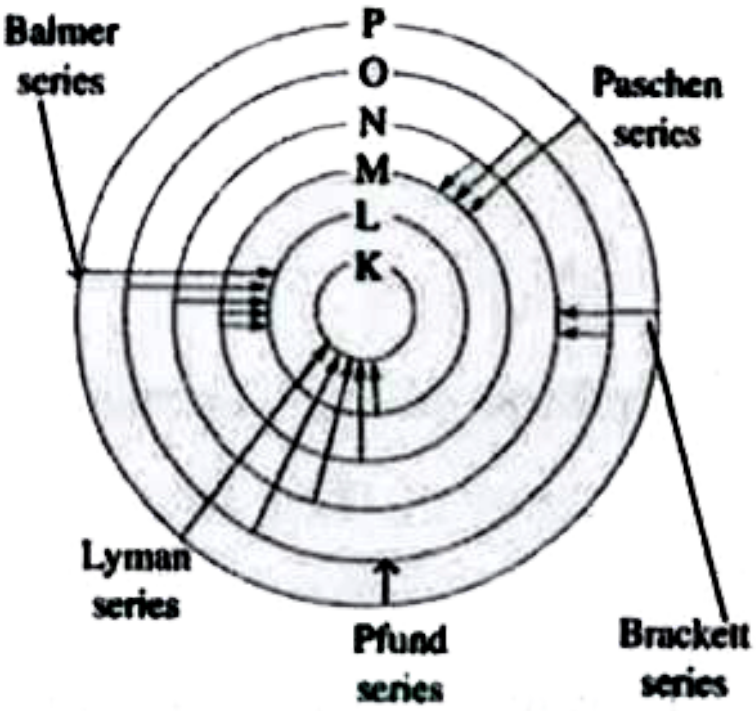

Let v_1 be the frequency of the series limit of the Lyman series, v_2 be the frequency of the first line of the Lyman series, and v_3 be the frequency of the series limit of the Balmer series

A. $v_1 - v_2 = v_3$

B. $v_2 - v_1 = v_3$

C. $v_3 = 1/2\left(v_1 - v_3\right)$

D. $v_1 + v_2 = v_3$

Answer: A

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Level - II (Type-I) (Practice sheet - 1 (Section -C : Matching/Straight objective type questions))

1.

Column-I	Column-II
A) Ratio of their energies	P) 1 : 1
B) Ratio of their frequency	Q) 2 : 3
C) Ratio of their velocity	R) 3 : 2
D) Ratio of their wave number	S) 2 : 9

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2. Match the following columns

Column-I	Column-II
A) Isotopes	P) Same no. of atoms and same no.of electrons
B) Isobars	Q) Different no. of protons but same no. of neutrons
C) Isotones	R) Different no. of protons and different no. of neutrons
D) Isosters	S) Same no. of protons but different no. of neutrons

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Level - II (Type-I) (Lecture Sheet - 2 (Section-A : More than one correct answer type questions))

1. According to Bohr model of atom

A. The radius of n^{th} orbit a n^2

B. The total energy of electron in n^{th} orbit $\alpha\frac{1}{n}$

C. The angular momentum electron is integral multiples of $h/2\pi$

D. The magnitude of potential energy of an electron is an orbit greater than kinetic energy

Answer: A::C::D

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2. To which of the following species, the Bohr theory is not applicable ?

A. He

B. Li^{2+}

C. He^{2+}

D. H atom

Answer: A::C

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3. According to Bohr.s atomic theory, which of the following relation (s) is (are) correct ?

A. Kinetic energy of electron $\propto \frac{Z^2}{n^2}$

B. The product of velocity of electron and the principal quantum number $\propto Z^2$

C. Frequency of revolution of the electron in an orbit $\propto \frac{Z^2}{n^3}$

D. Coulombinc force of attraction of the electron $\propto \frac{Z^3}{n^4}$

Answer: A::C::D

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4. The radius of certain orbit of H-atom is 2.12 A. Then the energy of that energy level is

A. $\frac{-13.6}{4}$ eV/atom

B. $\frac{2.18 \times 10^{-18}}{4}$ J/atom

C. $\frac{-1312}{4}$ KJ/ atom

D. $\frac{-1313.6}{4}$ Kcal/mole

Answer: A::B::D

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5. If the electron of the hdyrogen atom is replaced by another particle of same charge but of the double mass, then :

A. radii of different shells will increases

B. energy gap between two levels will become double

C. ionization energy of the atom will be double

D. speed of new particle in a shell will be lesser than the speed of electron in the same shell

Answer: C::D

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Level - II (Type-I) (Lecture Sheet - 2 (Section - B : Linked comprehension Type questions))

1. Bohr proposed his atomic model based on Planck.s quantum theory and derived following relations for one electron system in C.G.S. units : For H - atom :

$r_n = n^2 \times r_1, E_n = E_1 \times Z^2, u_n = \frac{u_1}{n}, u_1 = 2.19 \times 10^8 cm/\text{sec.}, E_1 = -13.6eV$

For 1 electron system, other than H

$r_n = \frac{n^2 \times r_{1H}}{Z}, E_N = \frac{E_{1H} \times Z^2}{n^2}, u_n = \frac{u_{1H} \times Z}{n}$. Later on de Broglie proposed the dual nature of electron and put forward his wave concept.

The wave length of electron in an orbit was given λ = h/mu

The circumference (in m) of 3^{rd} Bohr orbit in H-atom is :

A. 3.0×10^{-7}

B. 3.0×10^{-8}

C. 3.0×10^{-6}

D. 3.0×10^{-9}

Answer: D

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2. Bohr proposed his atomic model based on Planck.s quantum theory and derived following relations for one electron system in C.G.S. units :

For H -atom :

$r_n = n^2 \times r_1, E_n = E_1 \times Z^2, u_n = \frac{u_1}{n}, u_1 = 2.19 \times 10^8 cm/\text{sec.}, E_1 = -13.6eV$

For 1 electron system, other than H $r_n = \frac{n^2 \times r_{1H}}{Z}, E_N = \frac{E_{1H} \times Z^2}{n^2}, u_n = \frac{u_{1H} \times Z}{n}$. Later on de Broglie proposed the dual nature of electron and put forward his wave concept. The wave length of electron in an orbit was given λ = h/mu

The potential energy of electron in 3^{rd} Bohr orbit of H-atom is :

A. 1.0×10^{-9}

B. 2.0×10^{-7}

C. 1.0×10^{-7}

D. 1.0×10^{-8}

Answer: A

Watch Video Solution

3. Bohr proposed his atomic model based on Planck.s quantum theory and derived following relations for one electron system in C.G.S. units : For H -atom :

$r_n = n^2 \times r_1, E_n = E_1 \times Z^2, u_n = \frac{u_1}{n}, u_1 = 2.19 \times 10^8 cm/\text{sec.}, E_1 = -13.6eV$

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The wave length of electron in an orbit was given λ = h/mu

The potential energy of electron in 3^{rd} Bohr orbit of H-atom is :

A. -242×10^{-12} erg

B. -4.84×10^{-12} erg

C. $+4.84 \times 10^{-12}$ erg

D. $+2.42 \times 10^{-12}$ erg

Answer: B

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4. In a hydrogen like ion, nucleus has a positive charge Ze Bohr.s quantization rule is, the angular momentum of an electron about the

nucleus $l = \frac{nh}{2\pi}$, where n is a positive integer

If electron goes from ground state to 1^{st} excited state then change in energy of the hydrogen like ion is

A. $\frac{3}{32} = \frac{m_e x^2 e^4}{\in_0^2 h^2}$

B. $\frac{1}{32} = \frac{m_e z e^4}{\in_0^2 h^2}$

C. $\frac{3}{32} = \frac{m_e z e^2}{\in_0^2 h^2}$

D. $\frac{1}{32} = \frac{m_e z e^2}{\in_0^2 h^2}$

Answer: A

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5. In a hydrogen like ion, nucleus has a positive charge Ze Bohr.s quantization rule is, the angular momentum of an electron about the nucleus $l = \frac{nh}{2\pi}$, where n is a positive integer

If electron goes from ground state to 1^{st} excited state then change in energy of the hydrogen like ion is

A. $\frac{3}{32} = \frac{m_e z e^4}{\in_0^2 h^2}$

B. $\frac{-3}{32} = \frac{m_e z e^4}{\in_0^2 h^2}$

C. $\frac{1}{32} = \frac{m_e z e^2}{\in_0^2 h^2}$

D. $\frac{-1}{32} = \frac{m_e z e^2}{\in_0^2 h^2}$

Answer: B

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Level - II (Type-I) (Lecture Sheet - 2 (Section -C : Matching/Straight objective type questions))

1. According to Bohr.s theory, E_n = total energy, K_n = kinetic energy , V_n = potential energy, r_n = radius of n^{th} orbit. Match the following.

Column-I	Column-II
A) $V_n/K_n = ?$	P) 0
B) $r_n \propto E_n^x, x = ?$	Q) -1
C) Angular momentum in lowest orbital	R) -2
D) $\frac{1}{r_n} \propto Z^y, y = ?$	S) 1

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2. Match the column of I and II

Column-I	Column-II
A) Angular momentum of electron	P) $-$ve
B) Potential energy of electron	Q) +ve
C) Total energy of electron	R) Proportional to n
D) Linear momentum of electron	S) Proportional to $1/\lambda$
	T) Proportional to $1/n$

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Level - II (Type-I) (Practice sheet - 2 (Section-A : More than one correct answer type questions))

1. In Bohr model of atom :

A. the radius of nth orbit is proportional to n^2

B. the total energy of the electron in the n^{th} orbit is inversely proportional to n

C. the angular momentum of the electron in an orbit is an integral multiple of $\frac{h}{2\pi}$

D. the magnitude of the potential energy of the electron in an orbit is greater than its kinetic energy

Answer: A::C::D

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2. Select the correct statements for hydrogen like atoms or ions.

A. Radius of an orbit is inversely proportional to Z

B. Radius of an orbit is inversely proportional to Z^2

C. Energy of the electron in an orbit is inversely proportional Z

D. Energy of the electron in an orbit is directly proportional Z^2

Answer: C::D

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3. Which of the following radius of orbits in hydrogen atom are possible ?

A. 52.9 pm

B. 182 pm

C. 211 pm

D. 364 pm

Answer: A::C

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4. For which of the following species, the expression for the energy of electron in n^{th} orbit $\left[E_n = -\frac{13.6}{n^2} \times Z^2 eV \text{ atom}^{-1}\right]$ has the validity ?

A. Tritium

B. Li^{2+}

C. Deuterium

D. He^{2+}

Answer: A::B::C

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5. If . R_H. is the Rydberg constant, then the energy of an electron in the ground state of hydrogen atom is

A. $\frac{R_H C}{h}$

B. $\frac{1}{R_H Ch}$

C. $\frac{-hcR_{\infty}}{n^2}$

D. $-R_H hc$

Answer: B::D

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Level - II (Type-I) (Practice sheet - 2 (Section - B : Linked comprehension Type questions))

1. Atoms more complicated than hydrogen have more than one proton in their nucleus. Let Z stands for the number of protons in a nucleus. Also imagine that an atom loses all but one of its electrons so that it changes into a positively charged ion with just one electron. Bohr.s formula for the energy levels of the hydrogen atom can easily be changed to apply to such ions. It becomes $E_m = \frac{-Z^2 e^4 m_e}{8\varepsilon_0^2 h^2 n^2}$, where m= mass of electron , e= change of electron, n = orbit number.

The ionization potential of Het in ground state is

A. $2427 kJmol^{-1}$

B. $5249 kJmol^{-1}$

C. $7116 kJmol^{-1}$

D. $9811 kJmol^{-1}$

Answer: A

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2. Atoms are complicated than hydrogen have more than one proton in their nucleus. Let z stands for the number of protons in a nucleus. Also imagine that an atom loses all but one of its electrons so that it changes into a positively charged ion with just one electron. Bohr.s formula for the energy levels of the hydrogen atom can easily be changed to apply to such ions

The potential energy of electron in the ground state of He^{+} ion is

A. 4.358×1^{-18} J/atom

B. -7.112×1^{-18} J/atom

C. -1.743×1^{-17} J/atom

D. -8.716×1^{-18} J/atom

Answer: C

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3. Atoms are complicated than hydrogen have more than one proton in their nucleus. Let z stands for the number of protons in a nucleus. Also imagine that an atom loses all but one of its electrons so that it changes into a positively charged ion with just one electron. Bohr.s formula for the energy levels of the hydrogen atom can easily be changed to apply to such ions

What minimum amount of energy is required to bring an electron from ground state of Be^{3+} to infinity

A. 4.358×10^{-18}

B. 2.179×10^{-18}

C. 3.4864×10^{-17}

D. 8.716×10^{-18}

Answer: C

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4. According to the Bohr theory for the atomic spectrum of hydrogen the energy levels of the proton -electron system depends, on the quantum number n. In an electron transition from a higher quantum level , n_2 to the lower level n_1, radiation is emitted. The frequency, v of the radiation is given by $hv = \left(E_{n_2} - E_{n_1}\right)$ where, h is Planck.s constant and E_{n_2}, E_{n_1} are the energy level values for the quantum number n_2 and n_1. A useful formula for the wavelength, $\lambda = c/v$ is given by $= \lambda(\text{Å}) = \frac{912}{Z^2} \times \left(\frac{n_2^2 n_1^2}{n_2^2 - n_1^2}\right)$ where, Z = atomic number of any one electron species viz H, He^+, Li^{2+}, Be^{3+},..... For hydrogen Z=1

In the above formula, when $n_2 \to \infty$, we have $\lambda = \frac{912}{1^2} \times n_1^2$. This values of

λ is known as the series limit for the given value of n_1. Calculate the value of n_1 for the series limit $\lambda = 8208Å$

A. 5

B. 2

C. 3

D. 4

Answer: C

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5. According to the Bohr theory for the atomic spectrum of hydrogen the energy levels of the proton -electron system depends, on the quantum number n. In an electron transition from a higher quantum level , n_2 to the lower level n_1, radiation is emitted. The frequency, v of the radiation is given by $hv = \left(E_{n_2} - E_{n_1}\right)$ where, h is Planck.s constant and E_{n_2}, E_{n_1} are the energy level values for the quantum number n_2 and n_1. A useful

formula for the wavelength, $\lambda = c/v$ is given by $= \lambda(\text{Å}) = \frac{912}{Z^2} \times \left(\frac{n_2^2 n_1^2}{n_2^2 - n_1^2} \right)$

where, Z = atomic number of any one electron species viz H, He^+, Li^{2+}, Be^{3+},..... For hydrogen Z=1

Calculating n_2 for the series limit = 22800 Å. Calculate λ for the transition $(n_2 + 1)$ to $(n_1 - 1)$

A. 26266 Å

B. 22665 Å

C. 25266 Å

D. 22566 Å

Answer: A

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Level - II (Type-I) (Practice sheet - 2 (Section -C : Matching/Straight objective type questions))

1. If in Bohr.s model, for uni electronic atom following symbols are used :

$r_{n,Z}$ → Radius of n^{th} orbit with atomic number z

$U_{n,Z}$ → Potential energy of e^-

$K_{n,Z}$ → Kinetic energy of e^-

$V_{n,Z}$ → Velocity of e^-

$T_{n,Z}$ → Time period of revolution

Column-I	Column-II
A) $U_{1,2} : K_{1,1}$	P) 1 : 8
B) $r_{2,1} : r_{1,2}$	Q) –8 : 1
C) $V_{1,3} : V_{3,1}$	R) 9 : 1
D) $T_{1,2} : T_{2,2}$	S) 8 : 1

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2. Match the following columns

Column-I	Column-II
A) Radius of 2nd orbit of H-atom	P) $2a_0$
B) Radius of 1st orbit of He^+ ion	Q) $4a_0$
C) Radius of 2nd orbit of Be^{3+} ion	R) $0.5a_0$
D) Radius of the nodal surface of 2s orbital	S) a_0

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Level - II (Type-I) (Lecture Sheet - 3 (Section-A : More than one correct answer type questions))

1. False statement about the de-Broglie.s wavelength of an electron in the Bohr.s orbit is

A. equal to the circumference of the first orbit

B. equal to twice the circumference of the first orbit

C. equal to half the circumference of the first orbit

D. equal to one fourth of the circumference of the first orbit

Answer: B::C::D

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2. Which of the following are wrong ?

A. de Broglie relation is applicable only to microscopic particles

B. The uncertainties in measurements are due to the imperfections of the techniques used to measure them

C. The wave function Ψ always has positive values.

D. There is some probability of finding electron even outside the boundary of the orbital.

Answer: A::B::C

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3. According to de Broglie

A. a moving electron possess wave character

B. light posses particle character

C. a moving proton posses wave character

D. all moving particles possess wave character

Answer: A::C::D

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4. In an electron transition of hydrogen atom orbital momentum may change by :

A. h

B. $\frac{h}{\pi}$

C. $\frac{h}{2\pi}$

D. $\frac{h}{4\pi}$

Answer: B::C::D

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Level - II (Type-I) (Lecture Sheet - 3 (Section - B : Linked comprehension Type questions))

1. Select the correct statements about the wave function Ψ.

A. Ψ must be real

B. Ψ must be single values, continuous

C. Ψ has no physical significance

D. Ψ^2 gives the probability of finding the electrons

Answer: A::B::C::D

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2. It is not possible to determine precisely both the position and the momentum or velocity) of a small moving particle (e.g. electron , proton, etc)

The above statements is known as :

A. de-Broglie principle

B. Pauli.s exclusion principle

C. Heisenberg.s uncertainty principle

D. Aufbau principle

Answer: C

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3. It is not possible to determine precisely both the position and the momentum or velocity) of a small moving particle (e.g. electron , proton, etc)

The uncertainity in position and velocity of a particle are $10^{-10}m$ and $5.27 \times 10^{-24}ms^{-1}$ respectively, Calculate the mass of the particle. $\left(h = 6.625 \times 10^{-34}J - s\right)$

A. 0.099 kg

B. 1 kg

C. 2 kg

D. 10 kg

Answer: A

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4. It is not possible to determine precisely both the position and the momentum or velocity) of a small moving particle (e.g. electron , proton, etc)

Calculate the uncertainity in velocity of a cricket ball of mass 150 g if the uncertainity in its position is of the order of 1 Å $\left(h = 6.6 \times 10^{-34} kgm^2 s^{-1}\right)$

A. $3.8 \times 10^{-25} ms^{-1}$

B. $3.499 \times 10^{-24} ms^{-1}$

C. $3.8 \times 10^{-30} ms^{-1}$

D. $3.499 \times 10^{-30} ms^{-1}$

Answer: B

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5. de-Broglie proposed dual nature for electron moving. The wavelength is given by the equations $\lambda = \frac{h}{mu}$. Later on Heisenburg proposed. The

total incertainly uncertainity principle as.

With what velocity an electron must travel so that its momentum is equal to that of photon of wavelength of $\lambda = 5200\text{Å}$

A. $800ms^{-1}$

B. $1400ms^{-1}$

C. $400ms^{-1}$

D. $200ms^{-1}$

Answer: B

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6. de-Broglie proposed dual nature for electron moving. The wavelength is given by the equations $\lambda = \frac{h}{mu}$. Later on Heisenburg proposed. The total incertainly uncertainity principle as.

If uncertainity in position an momentum of an electron are same, then uncertainty in its velocity can be given by

A. $\geq \sqrt{\frac{h}{4\pi m}}$

B. $\geq \sqrt{\frac{h}{2m}}$

C. $\geq \sqrt{\frac{\lambda}{4\pi m}}$

D. $\geq \frac{1}{m}\sqrt{\frac{h}{4\pi}}$

Answer: D

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Level - II (Type-I) (Lecture Sheet - 3 (Section -C : Matching/Straight objective type questions))

1. Match the following columns

Column-I	Column-II
A) Bohr's model	P) Two dimensions
B) Wave mechanical model	Q) Three dimensional
C) Summerfield model	R) Elliptical
D) Heisenberg principle	S) Dual nature of electron

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2.

Column-I	Column-II
A) Some α – particles were deflected back after striking thin foil of gold	P) There is a positively charged body within the atom
B) Some α – particles were deflected through small angles	Q) The positively charged body is quite heavy
C) Most of the α – particles passed through the foil without undergoing any deflection	R) The positively charged body occupies a very small volume
D) The number of α – particles deflected back was very small	S) There is sufficient empty space within the atom

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Level - II (Type-I) (Practice Sheet - 3 (Section-A : More than one correct answer type questions))

1. In which of the following conditions the de Broglie wavelentgh of particle A will be less than that of particle B $\left(m_A > m_B\right)$?

A. Linear momentum of these particles are same

B. Move with same speed

C. Move with same kinetic energy

D. Have fallen through same height

Answer: B::D

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2. In Which of the following situations the heavier of the two particles have smaller de Broglie wavelength ? The two particles

A. Move with same speed

B. Move with same linear momentum

C. Move with the same kinetic energy

D. Have fallen through same height

Answer: A::C::D

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3. If the radius of first Bohr.s orbit of H-atom is X, which of the following is the correct conclusion ?

A. The de-Broglie wavelength in the third Bohr orbit of H-atom $= 6\pi X$

B. The fourth Bohr.s radius of He^+ ion = 8X

C. The de-Broglie wavelength in third Bohr.s orbit of $Li^{2+} = 2X$

D. The second Bhor.s radius of Be^{2+} ion = X

Answer: A::B

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4. In Heisenberg.s uncertainty experiment

A. Use of high intensity light increases accuracy in the measurement of distance of e^- from the nucleus

B. Use of high frequency light increases accuracy in the measurement of distance of e^- from the nucleus

C. If an experiment is designed to measure the distance of e^- from nucleus, the speed measured in the same experiment would be

highly imprecise

D. Use of low wavelength light increases accuravy in the measurement at distance of e^- form the nucleus

Answer: D

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5. Which statement (s) is/are correct ?

A. Ratio of De-broglie wave lentghs of electrons and proton moving with same speed is 1:1836

B. Particles moving with same kinetic energy possess same De-Broglie wave length

C. Wave length of electrons in 2^{nd} orbit is more than in 1^{st} orbit of H-atom

D. Circumference of orbit in given by the product of principle quantum number of wave length of electron

Answer: C::D

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Level - II (Type-I) (Practice Sheet - 3 (Section - B : Linked comprehension Type questions))

1. De Broglie poroposed that moving micro particles exhibit wave behaviours. Electron in a Bohr.s orbit also shows dual nature whose wave length is given by $\lambda_e = \frac{h}{m_e V_e}$

m_e = mass of electron , V_e = velocity of electron , h = planck.s constant

Bohr.s atomic model is in good agreement with De-broglie concept and the electron has fixed energy in Bohr.s orbit : $2\pi r = n\lambda$ (constructive wave in phase).

The kinetic energy of an electron in α Bohr.s orbit of H-atom is 3.4 eV. What is the its De-broglie.s wave length ?

A. 3.3 Å

B. 6.6 Å

C. 2.2 Å

D. 4.4 Å

Answer: B

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2. De Broglie poroposed that moving micro particles exhibit wave behaviours. Electron in a Bohr.s orbit also shows dual nature whose wave length is given by $\lambda_e = \frac{h}{m_e V_e}$

m_e = mass of electron , V_e = velocity of electron , h = planck.s constant

Bohr.s atomic model is in good agreement with De-broglie concept and the electron has fixed energy in Bohr.s orbit : $2\pi r = n\lambda$ (constructive wave in phase).

Two moving micro particles possess their kinetic energies in 2:1 ratio with same De-Broglie.s wave length.s What is the ratio of their masses?

A. $1:1$

B. $1:2$

C. $4:9$

D. $1:4$

Answer: B

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3. De Broglie poroposed that moving micro particles exhibit wave behaviours. Electron in a Bohr.s orbit also shows dual nature whose wave length is given by $\lambda_e = \frac{h}{m_e V_e}$

m_e = mass of electron , V_e = velocity of electron , h = planck.s constant

Bohr.s atomic model is in good agreement with De-broglie concept and the electron has fixed energy in Bohr.s orbit : $2\pi r = n\lambda$ (constructive wave in phase).

A ground satte hydrogen atom is supplies with 17.6 ev of energy through α photon. What is the De-broglie wave length of the electron knocked out

A. 6.125 Å

B. 2.27 Å

C. 5.75 Å

D. 3.6 Å

Answer: A

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4. De-broglie proposet dual nature for matter $\lambda = \frac{h}{mv}$ and $\lambda = \frac{h}{\sqrt{2mK.E}}$ where m = mass, h = plancks constant. Dual nature is particle and wave nature.

If an electron is accelerated by applying 100 V. The wavelength of electron is

A. 12.3 A

B. 1.23 A

C. 2.6 A

D. 3.2 A

Answer: B

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5. De-broglie proposet dual nature for matter $\lambda = \frac{h}{mv}$ and $\lambda = \frac{h}{\sqrt{2mK.E}}$ where m = mass, h = plancks constant. Dual nature is particle and wave nature.

Which one is not related to de-Broglie.s concept

A. $\lambda = \frac{h}{mv}$

B. $\lambda = \frac{h}{\sqrt{2mK.E}}$

C. $\lambda = \left(\sqrt{m.e.V}\right)$

D. $\Delta x.\Delta p = \frac{h}{4\pi}$

Answer: D

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Level - II (Type-I) (Practice Sheet - 3 (Section -C : Matching/Straight objective type questions))

1. Match the following columns

Column-I	Column-II
A) H	P) Radius of 4^{th} orbit 0.53×4 Å
B) He^{+}	Q) Energy of 2^{nd} orbit = −13.6 eV
C) Be^{2+}	R) Radius of 2^{nd} orbit = 0.53×4 Å
D) Li^{3+}	S) Velocity of electron in the 3^{rd} orbit = 2.18×10^{8} cm/sec
	T) Energy of 4^{th} orbit = −13.6 eV

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2. Match the following columns

Column-I	Column-II
A) Thomson's model of atom	P) can explain thermonic emission but not the α – particle scattering
B) Rutherford's model of atom	Q) Can explain α – particle scattering but not the hydrogen spectrum
C) Bohr's model of atom	R) Can explain hydrogen spectrum
D) Dalton's model of atom	S) None of these

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Level - II (Type-I) (Lecture Sheet- 4 (Section-A : More than one correct answer type questions))

1. Which of the following statement (s) is (are) not correct ?

A. The shape of an atomic orbital depends on the azimuthal quantum number

B. The orientation of an atomic orbital depends on the magnetic quantum number

C. The energy of an electron in an atomic orbital of multi electron atom depends on principal quantum number

D. The number of degenerate atomic orbitals of one type depends on the values of principal, azimuthal and magnetic quantum numbers.

Answer: C::D

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2. Which of the following statements are correct ?

A. The number of orbitals for a given value of l is equal to 2l+1.

B. The number of orbitals for a given value of n is equal to n^2.

C. An atom having unpaired electrons is diamagnetic is nature.

D. The half-filled and fully-filled electronic configuration are less stable than the other configuration having the same number of electrons

Answer: A::B

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3. Which of the following are correct ?

A. All s-orbitals have the same orbital angular momentum

B. The angular momentum of the electron in 4^{th} orbit is $2h/\pi$

C. The magnetic moment of Cu^{2+} ion = 1.732 B.M.

D. All d-orbitals have two nodal planes.

Answer: A::B::C

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4. The chlorine atom has

A. 6 electrons with l = 0

B. 6 electrons with l = 0

C. 11 electron with l = 1

D. 5 orbitals with m=0

Answer: A::B::C::D

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5. Which of the following statements are correct ?

A. The angular momentum of an electron due to its spinning is given as s (where s can take the value of 1/2)

B. The angular momentum of an electron due to its spinning is given as s $m_s(h/2\pi)$ where m_s can take the value of +1/2.

C. According to Pauli.s exclusion principle, no two electrons in an atom can have the same values of quantum numbers n, l and m.

D. The azimuthal quantum number cannot have negative values.

Answer: A::D

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Level - II (Type-I) (Lecture Sheet- 4 (Section - B : Linked comprehension Type questions))

1. The letters n, l and m proposed by Bohr, Sommerfeld and Zeeman respectivelt for quantization of angular momentum in classical physics were later on obtained as the results of solution of Schrodinger wave

equation based on quantum mechanics. The term n, l, m are named as principal quantum number, azimuthal quantum number and magnetic number respectively. The fourth quantum number i.e., spin quantum number (s) was given by Uhlenback on the basis of two spins of electrons. The first two quantum number also decides the nodes of an orbital.

The numerical value $\Psi_{4,3,0}$ denotes

A. 3d-orbitals

B. 4f-orbitals

C. 2s-orbitals

D. 4d-orbitals

Answer: B

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The numerical value $\Psi_{4,3,0}$ denotes

A. $\sqrt{2}h$

B. 2h

C. $\frac{h}{\sqrt{2}}$

D. $\frac{h}{2\pi}$

Answer: A

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equation based on quantum mechanics. The term n, l, m are named as principal quantum number, azimuthal quantum number and magnetic number respectively. The fourth quantum number i.e., spin quantum number (s) was given by Uhlenback on the basis of two spins of electrons. The first two quantum number also decides the nodes of an orbital.

Which statement about energy level in H-atom is correct ?

A. Only n and l decide energy level

B. Only .l. decides energy level

C. Only n decides energy level

D. n, l and m decide energy level

Answer: C

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4. The hydrogen like species Li^{2+} is in a spherically symmetric state S_1 with one radial node. Upon absorbinf light the ion undergoes transition to a state S_2 The state S_2 has one radial node and its energy is equal to

the ground state energy of the hydrogen atom.

The state S_1 is

A. 1s

B. 2s

C. 2p

D. 3s

Answer: B

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Energy of the state S_1 units of the hydrogen atom ground state energy is

A. 0.75

B. 1.50

C. 2.25

D. 4.50

Answer: C

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Level - II (Type-I) (Lecture Sheet- 4 (Section -C : Matching/Straight objective type questions))

1. Match the following

Column-I	Column-II
A) Orbital angular momentum of the electron in a hydrogen- like atomic orbital.	P) Principal quantum number
B) A hydrogen-like one-electron wave function obeying Pauli's principle.	Q) Azimuthal quantum number
C) Shape, size and orientation of hydrogen-like atomic orbitals.	R) Magnetic quantum number
D) Probability density of electron at the nucleus in hydrogen-like atom	S) Electron spin quantum number

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2. Match the following columns

Column-I	Column-II
A) Hydrogen atom	P) Principal quantum number
B) Nitrogen atom	Q) Azimuthal quantum number
C) Li^{2+} ion	R) Exchange energy
D) Helium atom	S) Symmetry

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Level - II (Type-I) (Practice sheet-4 (Section-A : More than one correct answer type questions))

1. Let r, v and E are the radius of the orbit, speed of the electron and the total energy of the electron respectively. Which of the following quantities are proportional to the quantum number .n. ?

A. rE

B. v r

C. $\frac{v}{E}$

D. $\frac{r}{E}$

Answer: B::C

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2. Which of the following sets of quantum number is/are not possible ?

A. n=4, l=4, $m_1 = -2, m_s = +1/2$

B. n=3, l=0, $m_1 = 0, m_s = -1/2$

C. n=3, l=2, $m_1 = -3, m_s = -1/2$

D. n=5, l=3, $m_1 = 0, m_s = +1/2$

Answer: A::C

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3. Which of the following sets of quantum numbers represents the orbitals of same shape and orientation in external field.

A. n=3, l=2,, m = +1, s = +1/2

B. n=3, l=2,, m = -1, s = -1/2

C. $n = 4, l = 2, m = \pm 1, s = -1/2$

D. n=3, l=2,, m = 0, s = +1/2

Answer: A::C

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4. Which of the following sets of quantum numbers are followed ?

A. n=1, l=0 and m=0

B. n=2, l=1 and m=+1

C. n=1, l=0 and m = +1

D. n=2, l=2 and m=0

Answer: A::B

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5. Which of the following is/are correct about the radial probability curves ?

A. $3d_z^2$ has three angular nodes

B. The number of angular nodes are l

C. The number of radial nodes is equal to n-l-1

D. The number of maxima in 2s-orbitals are two

Answer: B::C::D

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Level - II (Type-I) (Practice sheet-4 (Section - B : Linked comprehension Type questions))

1. The sinle quantum number by Neil.s Bohr and the appearance of several spectral lines in a particular series of Hspectrum, suggest that there more

than one quantum to explain all the quantized properties of an electron in a particular energy level inside the atom.

If fact when the properties of the electron is transformed from Cartesian co-ordinate to polar co-ordinates then it becomes the function of r, θ and ϕ suggesting three independet quantum numbers. In addition to this a fourth quantum number is required to consider the spinning behaviour of an electron.

The principal quantum number n suggest the orbit number in which electron revolves, Azimuthal quantum number 1 suggest the shape of orbitals, magnetic quantum number m, gives orientation of orbital in presence of external magnetic field, while spin quantum number s, gives direction of an electron about its own axis $n \neq 0$ values of "1" ranges in between 0 to (n-1), while m depends upon 1. Total number values of m = 21+1, and "m" ranges in between -1 to +1 including 0. For each electron spin will be $\pm \frac{1}{2}$

Which of the following is not possible

A. 2s

B. 2d

C. 3f

D. Both b and c

Answer: D

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The two unpaired electron present in C-atom are different w.r.t their

A. n

B. l

C. m

D. s

Answer: C

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spin will be $\pm\frac{1}{2}$

d-orbital may contain maximum of 10 electron as for d-orbital

A. l=2

B. total value of m=5

C. Both a and b

D. None

Answer: C

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4. The total wave function Ψ may be symmetric (denoted by subscript S) or anti symmetric (denoted by the subscript A) depending on the symmtry of the function Ψ and S.

The function $\Psi = \Psi_S S_S$ and $\Psi_S = \Psi_A S_A$ are obviously symmetric whereas the function $\Psi_A = \Psi_A S_A$ and $\Psi_A = \Psi_A S_S$ are antisymmtric. All the functions Ψ_S and Ψ_A however do not corresponds to the state of an atom are governed by the Pauli principle. Pauli principle is regulated as one of the general principles underlying the modern quantum statistics. Now if two electron are supposed to have identical quantum numbers then transposition of these electrons will yield a state identical with the initial state and consequantly $\Psi_{12} = \Psi_{21}$ (for symmetric) and $\Psi_{12} = -\Psi_{21}$ (for antisymmetric). Hence the condition for satisfying only when the function is equal to zero.

Which of the following set of quantum number is incorrect ?

A. $n = 5, n = 0, l = 0, s = \pm \frac{1}{2}$

B. $n = 4, l = 3, m = 0, s = \pm \frac{1}{2}$

C. $n = 3, l = 2, m = \pm 2, s = \pm \frac{1}{2}$

D. $n = 4, l = -4, m = -3, s = \pm \frac{1}{2}$

Answer: D

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The number of radial nodes in 4d orbital is

A. 3

B. 1

C. 2

D. 0

Answer: C

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Level - II (Type-I) (Practice sheet-4 (Section -C : Matching/Straight objective type questions))

1. Match the following columns

Column-I	Column-II
A) 3s orbital	P) No spherical node
B) 2p orbital	Q) Two spherical nodes
C) 3d orbital	R) No planar node
D) 4f orbital	S) Two planar nodes

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2. Match the following columns

Column-I	Column-II
A) Orbital angular momentum of an electron	P) $\sqrt{s(s+1)}\,\frac{h}{2\pi}$
B) Angular momentum of an electron in an orbit	Q) $\sqrt{n(n+2)}$
C) Spin angular momentum of an electron	R) $\frac{nh}{2\pi}$
D) Magnetic moment of atom	S) $\sqrt{l(l+1)}\,\frac{h}{2\pi}$

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Level - II (Type-I) (Lacture sheet - 5 (Section-A : More than one correct answer type questions))

1. A neutral atom has 2K, 8L and 5M electrons, choose correct one

A. Atomic number is 15

B. Total number of p-electrons =9

C. Valency of element is 2

D. It is a representative element

Answer: A::B::D

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2. Choose the correct statement.

A. Splitting of spectral lines in magnetic field is due to presence of degenerate orbitals

B. In the presence of electrifield, energy value of P_x, P_y & P_z of same orbit are different

C. Degenrate orbitals differs only in their orientation

D. Degenerate orbitals have same shape, but different energy

Answer: A::B::C

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3. For the energy levels in an atom, which one of the following statement(s) is (are) correct ?

A. There are seven principal electron energy levels

B. The second principal energy level can have four sub-energy levels and contain a maximum of eight electrons

C. The M energy level can have a maximum of 32 electrons

D. The 4s sub-energy level is at a lower energy than the 3d sub-energy level.

Answer: A::D

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4. Select the correct configuration among the following

A. $Cr(Z = 24) : [Ar]3d^5, 4s^1$

B. $Cu(Z = 29) : [Ar]3d^{10}, 4s^1$

C. $Pd(Z = 46) : [Kr]4d^{10}, 5s^0$

D. $Pt(Z = 78) : [Xe]4d^{10}4s^2$

Answer: A::B::C

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5. The configuration $[Ar]3d^5 4s^1$ in the first excited states exists for

A. Fe^{2+}

B. Co^{3+}

C. Mn^{+}

D. Cr

Answer: A::B

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Level - II (Type-I) (Lacture sheet - 5 (Section - B : Linked comprehension Type questions))

1. The substances which contain species with unpaired electrons in their orbitals behave as paramagnetic substances. Such substances are weakly attracted by the magnetic field. The paramagnetism is expressed in terms of magneticmoment The magnetic moment is related to the number of unpaired electrons according to the following relation : Magnetic moment, $\mu = \sqrt{n(n+2)}$ B.M. Where 'n' = number of unpaired electrons. B.M stands for Bohr magneton, a unit of magnetic moment.

Which of the following has the highest magnetic moment ?

A. Fe^{+2}

B. Mn^{+2}

C. Cr^{+3}

D. V^{+3}

Answer: B

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Where .n. = number of unpaired electrons. B.M. stands for Bohr magneton, a unit of magnetic moment.

An ion of a d-block elements has magnetic moment 5.92 B.M. Select the ion among the following.

A. Zn^{+2}

B. Sc^{+2}

C. Mn^{+2}

D. Cr^{+3}

Answer: C

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Where .n. = number of unpaired electrons. B.M. stands for Bohr magneton, a unit of magnetic moment.

Which of the following is diamagnetic ?

A. He^{+2}

B. Sc^{+2}

C. Mg^{+2}

D. O^{-2}

Answer: B

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4. An orbital is designated by certain values of first three quantum numbers (n, l and m) and according to Pauli.s exclusion principle, no two electrons in a atom can have all the for quantum numbers equal. N, l and m denote size, shape and orientation of the orbital. The permissible values of n are 1,2,3.... $\propto$ while that of 1 are all possible integral values from 0 to n-n. Orbitals with same values of n and 1 but different values of m (where m can have any integral values from 1 to +1 including zero) are of equal energy and are called degenerate orbitals. However degeneracy is destroyed in homogeneous external magnetic field due to different extent of interaction between the applied field and internal electronic magnet of different orbitals differing in orientations. In octahedral magnetic field external magnetic field as oriented along axes while in tetrahedral field the applied field actas more in between the axes than that on the axes themselves. For 1=0, 1,2,3,...., the states (called sub-shells) are denoted by the symbol s,p,d,f.....respectively. After f, the subshells are denoted by letters alphabetically 1 determines orbital angular motion (L) of electron as $L = \sqrt{l(l+1)}\frac{h}{2\pi}$

ON the other hand, m determines Z-component of orbital angular momentum as $L_Z = m\left(\frac{h}{2\pi}\right)$

Hund.s rule states that in degenerate orbitals electrons do not pair up unless and until each each orbitals has got an electron with parallesl spins

Besides orbital motion,an electron also posses spin-motion. Spin may be clockwise and anticloskwise. Both these spin motions are called two spins states of electrons characterized by spin Q.N (s) : $s = +\frac{1}{2}$ and $= -\frac{1}{2}$ respectively

The sum of spin Q.N. of all the electrons is called total spin(s) and 2s+1 is called spin multiplicity of the configuration as a whole. The spin angular momentum of an electron is written as $L_s = \sqrt{s(s+1)}\frac{h}{2\pi}$

The orbital angular momentum of electron (l=1) makes an angles of 45° from Z-axis. The L_z of electron will be

A. $2\left(\frac{h}{2\pi}\right)$

B. $0\left(\frac{h}{2\pi}\right)$

C. $\frac{h}{2\pi}$

D. $3\left(\frac{h}{2\pi}\right)$

Answer: C

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According to Hund.s rule, the distribution of electron within the various orbitals of a given sub-shell is one which is associated with

A. Minimum spin multiplicity

B. Maximum spin multiplicity

C. maximum energy

D. Minimum total spin

Answer: B

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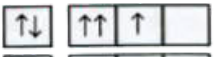
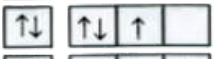
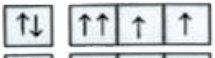
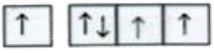
Level - II (Type-I) (Lacture sheet - 5 (Section -C : Matching/Straight objective type questions))

1. Match the following

Column-I	Column-II	
A) Violation of Aufbau's rule	P)	
B) Violation of Pauli's exclusion principle	Q)	
C)Violation of Hund's rule	R)	
D) Violation of both Pauli's and Hund's rule	S)	

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2. Match the following

Column-I	Column-II
A) Cr	P) $4s^1$ Configuration state
B) Cu	Q) Unpaired electron in 4s-orbit
C) K	R) Unpaired electron in 3d-orbital
D) Fe	S) Ferromagnetic

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Level - II (Type-I) (Practice sheet-5 (Section-A : More than one correct answer type questions))

1. Which of the following are correct ?

A. All s-orbitals have the same orbital angular momentum

B. The angular momentum of the electron in 4^{th} orbit is $2h/\pi$

C. The magnetic moment of Cu^{2+} ion = 1.732 B.M.

D. All d-orbitals have two nodal planes.

Answer: A::B::C

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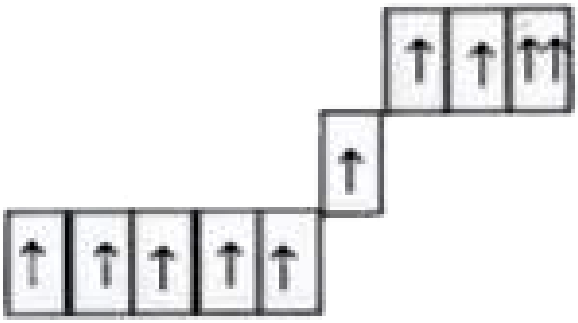
2. The following electronic configuration violates



A. Hund.s rule

B. Pauli.s principle

C. Aufbau principle

D. None of these

Answer: A::B::C

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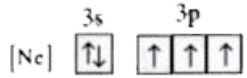
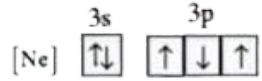
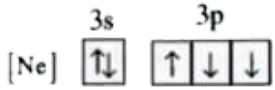
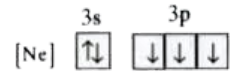
3. Ground state electronic configuration of p atom can be represented as

A. 

B. 

C. 

D. 

Answer: A::B::C::D

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4. Which is correct in case of p-orbitals ?

A. They are spherically symmetrical

B. They have strong directional character

C. They are three fold degenerate orbitals

D. Their charge density along x, y and z-axes are zero

Answer: B::C

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5. Which among the following is/are correct about chromium ?

A. Its electronic configuration is $3d^5 4s^1$

B. Total spin of chromium = 3

C. Spin multiplicity of 3d-subshell of chromium = 6

D. Magnetic moment of chromium $= \sqrt{48}$

Answer: A::B::C::D

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Level - II (Type-I) (Practice sheet-5 (Section - B : Linked comprehension Type questions))

1. The equation of Schroedinger for the hydrogen atom in the time-independet, non-relativistic form is a partial differential equation involving the position coordinates (x, y and z). The potential energy term for the proton-electron system is spherically symmetric of the form $-1/4\pi \in_0 \times \left(e^2/r\right)$. THus it is advantages to change over from the cartesian coordinates (x,y and z) to the spherical polar coordinates, (r, θ and ϕ). In this form the equation become separable in the radial part involving r and the angular part involving θ and ϕ. The probability of locating the electron within a volume element $d\tau = 4\pi r^2 dr$ is then given $|\Psi|^2\left(4\pi r^2 dr\right)$, where Ψ is a function of r, θ and ϕ. With proper conditions imposed on Ψ, the treatment yields certain functions, Ψ, known as atomic orbitals which are solutions of the equations. Each function Ψ correspods to quantum number n, l and m, the principal, the azimuthal and the magnetic quantum number respectively, n has values 1, 2, 3,....., l has values 0, 1, 2, ...(n-1) for each value of n and m (n-1) for each value of n and m $\left(m_l\right)$ has values =1, +(l+1),...1,0,-1,-2...-l i.e., (2l+1) values for each value of l. In addition a further quantum number called pin had to be introduced with values $\pm 1/2$. Any set of four values for n, l , m and s characterizes a spin

orbital. Pauli.s exclusion principle states that a given spin orbital can accomodate not more than electron. Further the values l = 0, l=1, l=2, l=3 are designated s,p,d and f orbitals respectively.

How many spin orbitals are there corresponding to n = 3?

A. 9

B. 18

C. 3

D. 6

Answer: B

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2. The equation of Schroedinger for the hydrogen atom in the time-independet, non-relativistic form is a partial differential equation involving the position coordinates (x, y and z). The potential energy term for the proton-electron system is spherically symmetric of the form $-1/4\pi \in_0 \times \left(e^2/r\right)$. THus it is advantages to change over from the

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It is a basic fact that any two electrons are indistinguishable. 3 electrons are to be accomodated in the spin orbitals included under the

designated 2p, conforming to the Pauli principle. Calculate the number of ways in which this may be done.

A. 20

B. 30

C. 60

D. 120

Answer: A

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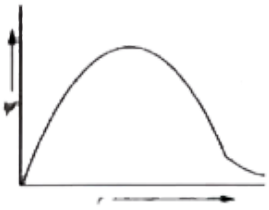
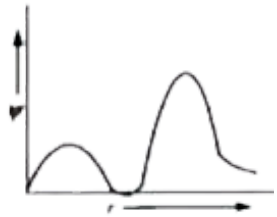
Which of the following diagrams corresponds to the 2s orbital ?

A.



B.



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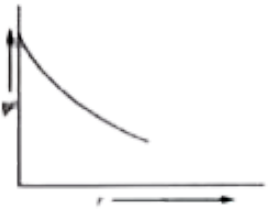
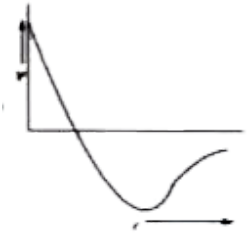


D.



Answer: D

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4. Electronic configuration of multielectron atoms can be written by the use of four quantum numbers and also by following certain principles. Pauli's exclusion principle suggests that maximum capacity of an atomic orbital is two. Auf bau principle suggests that the lower energy orbitals

are filled first and hence stability can be attained. Hunds rule of maximum multiplicity suggests that pairing occurs with one electron. The arrangement of electrons in the space around the nucleus can be understood only after writing the electronic configuration. Thus writing electronic configuration is more important in the structure of an atom.

Auf-bau principle is first violated for the element with atomic numbers

A. 21

B. 24

C. 26

D. 29

Answer: B

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5. Electronic configuration of multielectron atoms can be written by the use of four quantum numbers and also by following certain principles. Pauli's exclusio principle suggests that maximum capacity of an atomic

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Applying Hunds rule of maximum multiplicity, the maximum number of electrons that can posses spin quantum number +1/2 in 4p orbitals is

A. 1

B. 3

C. 4

D. 6

Answer: A

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Level - II (Type-I) (Practice sheet-5 (Section -C : Matching/Straight objective type questions))

1. Match the following

Column-I	Column-II
A) Number of electrons present in an orbit	P) 2
B) Number of orbitals in an orbit	Q) n
C) Number of electrons in an orbital	R) n^2
D) Number of subshells in an orbit	S) $2n^2$

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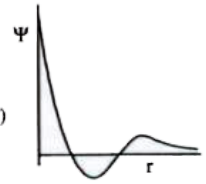
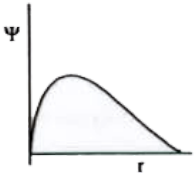
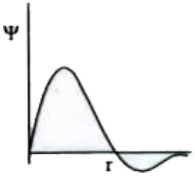
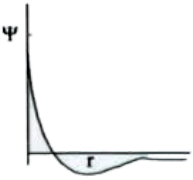
2. Match the following columns

Column-I	Column-II
A) R_{3s}	P) 
B) R_{2s}	Q) 
C) R_{2p}	R) 
D) R_{3p}	S) 

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Level - II (Type-I) (Lecture Sheet- 6 (Section-A : More than one correct answer type questions))

1. In a hydrogen like sample two different types of photons a and B are produced by electronic transition. Photon B has its wavelength in infrared region if photon A has more energy than B, then the prohon a may belong to the region

A. Ultraviolet

B. Visible

C. Infrared

D. None

Answer: A::B::C

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2. A hydrogen like atom in ground state absorbs .n. photons having the same energy nad it emits exactly .n. photons when electronic transition takes place. Then the energy of the absorbed photon may be

A. 91.8 eV

B. 4.8 eV

C. 48.4 eV

D. 54.4 eV

Answer: A::B

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3. Ionization potential of hydrogen atom is 13.6 eV hydrogen atoms in the ground state are excited by monochromatic radiation of photo energy 12.1 eV. According to Bohr's theorgy, the spectral lines emitted by hydrogen will be

A. N=3 to n=1

B. N=3 to n=2

C. N=2 to n=1

D. N=4 to n=1

Answer: A::B::C

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4. According to Bohr.s theory

A. When the atom gets the required energy from outside, electrons jumps from lower orbits to higher orbits and remain there

B. When the atom gets the required energy from outside, electrons jumps from lower orbits to higher orbits and remain there for very short intervals of time and return back to the lower orbit, radiating energy

C. Angular momentum of the electron is proportional to its quantum number

D. Angular momentum of the electron is independent to its quantum number

Answer: B::C

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5. If T is the time required by electron in taking one round in an orbit, n represents the number of waves in an orbit, r represents the radius of orbit, then which have the value of 1/2 for 2^{nd} orbit of H and 4^{th} orbit of He^+ ?

A. $\frac{r_{2(H)}}{r_4\left(He^+\right)}$

B. $\frac{T_{2(H)}}{r_4\left(He^+\right)}$

C. $\frac{n_{2(H)}}{n_4\left(He^+\right)}$

D. $\frac{E_{2(H)}}{E_4\left(He^+\right)}$

Answer: A::B::C

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Level - II (Type-I) (Lecture Sheet- 6 (Section - B : Linked comprehension Type questions))

1. Just as Bohr.s model of atom was developed on the basis of planck.s quantum theory, wave mechanical model of atom has been developed on the basis of quantum mechanics. The herat of quantum mechanism is Schrodinger wave equation which in turn is based on Heisenberg.s uncetainity principle and de broglie concept of dual nature of matter and radiation. Bohr model could explain the main lines of hydrogen or hydrogenic spectra but could not explain their fine structure. To explain this, it was suggested that each level consists of a number of sublevels, it was suggested that each level consists of a number of sublevels, the transitions between which gave rise to closely spaced lines. The numbers representing the main energy level are called Princiapl Quantum Number (n) while those representing sublevels are called Azimuthal Quantum numbers (l) and these determine the angular momentum of the electron. The orbital angular Number (m) which is just like a further split of a sublevel into finer sublevels. Lastly the electron may rotate or spin about its own axis given rise to Spin Quantum number (s) which determines the

angular momentum of the electron.

The quantum number not obtained from the solution of Schrodinger wave equation is

A. principal quantum no.

B. Azimuthal Quantum No

C. Magnetic Quantum No

D. Spin Quantum No

Answer: D

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2. Just as Bohr.s model of atom was developed on the basis of planck.s quantum theory, wave mechanical model of atom has been developed on the basis of quantum mechanics. The herat of quantum mechanism is Schrodinger wave equation which in turn is based on Heisenberg.s uncetainity principle and de broglie concept of dual nature of matter and radiation. Bohr model could explain the main lines of hydrogen or

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The de Broglie wavelength (λ) of the electron subjected to an accelerating potential of V volts is given by

A. $\frac{eh}{\sqrt{2mV}}$

B. $\frac{h}{\sqrt{2meV}}$

C. $\frac{h}{\sqrt{2me}} \times V$

D. $\frac{mh}{\sqrt{2eV}}$

Answer: B

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3. Just as Bohr.s model of atom was developed on the basis of planck.s quantum theory, wave mechanical model of atom has been developed on the basis of quantum mechanics. The herat of quantum mechanism is Schrodinger wave equation which in turn is based on Heisenberg.s uncetainity principle and de broglie concept of dual nature of matter and radiation. Bohr model could explain the main lines of hydrogen or hydrogenic spectra but could not explain their fine structure. To explain this, it was suggested that each level consists of a number of sublevels, it was suggested that each level consists of a number of sublevels, the transitions between which gave rise to closely spaced lines. The numbers representing the main energy level are called Princiapl Quantum Number (n) while those representing sublevels are called Azimuthal Quantum numbers (l) and these determine the angular momentum of the electron. The orbital angular Number (m) which is just like a further split of a sublevel into finer sublevels. Lastly the electron may rotate or spin about

its own axis given rise to Spin Quantum number (s) which determines the angular momentum of the electron.

The orbital angular momentum of 2p electron is

A. $\frac{h}{2\pi}$

B. $\sqrt{2}\frac{h}{\pi}$

C. $\frac{h}{\sqrt{2}\pi}$

D. $\frac{2h}{\pi}$

Answer: C

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Total number of ndoes $4d_{xy}$ orbital is

A. 1

B. 2

C. 3

D. 4

Answer: C

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The electron spin magnetic moment of Fe^{2+} ion in $FeSO_4$ in Bohr magnetons (B.M) is

A. 5.92

B. 4.90

C. 3.87

D. 2.84

Answer: B

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Level - II (Type-I) (Lecture Sheet- 6 (Section -C : Matching/Straight objective type questions))

1. Match the following columns

Column-I	Column-II
A) B.E. of He^+ atom in an excited state	P) Infrared region
B) 7 $\rightarrow$ 3 transition in H-atom	Q) 3.4 ev
C) 5 $\rightarrow$ 1 transition in H-atom	R) 13.6 ev
D) Series limit of Balmer series in H-atom	S) 10 spectral lines observed

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2. Match the following columns

Column-I	Column-II
A) Balmer series	P) Infrared region
B) Paschen series	Q) Visible region
C) Pfund series	R) Result of electronic transitions from outer shells to 2^{nd} shell
D) Bracket series	S) Result of electronic transitions from outer shells to 4^{th} shell

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Level - II (Type-I) (Practice sheet - 6 (Section-A : More than one correct answer type questions))

1. The nucleus of an atom is located at x = y = z = 0. If the probability of finding an s orbital electron in a tiny volume around x=a, y=z=0 is $1. \times 10^{-5}$, choose the correct statements(s) regarding the probability of electron

A. The probability of finding the electron in the same-sized volume around x = z=0, y=a is the same i.e., 1×10^{-5}

B. The probability of finding the electron in the same -sized vlume around x=y=0, z=a is zero

C. The probability at the second site if the electron were in a P_z obital is zero.

D. The probability at the second site if the electron were in a P_z orbital is the same i.e., 1.0×10^{-5}

Answer: A::C

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2. The radial distribution function [P(r)] is use to determine the most probable radius, which is used to find the electron in a given orbital $\frac{dP(r)}{dr}$ for 1s-orbital of hydrogen like atom having atomic number Z, is $\frac{dP}{dr} = \frac{4Z^3}{a_0^3}\left(2r - \frac{2Zr^2}{a_0}\right)e^{-2Ze/a_0}$. Then which of the following statements is/are correct

A. At the point of maximum value of radial distribution function $\frac{dP(r)}{dr} = 0$, one antinode is present

B. Most probable radius of Li^{2+} is $\frac{a_0}{3}$ pm

C. Most probable radius of He^{+} is $\frac{a_0}{2}$ pm

D. Most probable radius of hydrogen atom is a_0 pm

Answer: A::B::C::D

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3. Mark out the correct statement (s) :

A. Electrons within a sub shell for which $l > 0$ mean that the relatively greater electrostatic repulsion between two electrons in the same orbital within a sub shell as compared with occupancy of two orbitals having different m_l values.

B. Electrons in singly occupied orbitals tend to have their spins in the same direction so as to maximize the net magnetic moment

C. In the ground state, an atom adopts a configuration with the greatest number of unpaired electrons.

D. Electrons in different orbitals with parallel spins show mutual attraction, so electron-nucleus interaction is improved.

Answer: A::B::C

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4. The energy of an electron in the first energy level of H atom is -13.6 eV. The possible energy value (s) of the excited state (s) for the electron in He^+ is (are)

A. $-54.5eV$

B. $-13.6eV$

C. $-3.4eV$

D. $-6.04eV$

Answer: B::D

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5. If the electron of the hdyrogen atom is replaced by another particle of same charge but of the double mass, then :

A. radii of different shells will increases

B. energy gap between two levels will become double

C. ionization energy of the atom will be double

D. speed of new particle in a shell will be lesser than the speed of electron in the same shell

Answer: B::C

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Level - II (Type-I) (Practice sheet - 6 (Section - B : Linked comprehension Type questions))

1. The observed wavelengths in the line spectrum of hydrogen atom were first expressed in terms of a seriesby Johamn Balmer a swiss teacher.

Balmer.s empirical formula is : $\frac{1}{\lambda} = R_H\left[\frac{1}{2^2} - \frac{1}{n^2}\right] n = 3, 4, 5....$

$R_H = 109678 cm^{-1}$ is the Rydberg constant

How many lines in the spectrum will be observed when electrons return from 7^{th} shell to 2^{nd} shell ?

A. 13

B. 14

C. 15

D. 16

Answer: C

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$$\frac{1}{\lambda} = R_H\left[\frac{1}{2^2} - \frac{1}{n^2}\right] = n = 3, 4, 5\ldots$$

$R_H = 109678 cm^{-1}$ is the Rydberg constant.

Niels Bohr derived this expression theoretically in 1913. The formula is a generalised to any on electron atom/ion.

The wavelength of first line of Balmer spectrum of hydrogen will be :

A. 4340 Å

B. 4101 Å

C. 6564 Å

D. 4861 Å

Answer: C

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3. Bohr.s theory explains that when Hydrogen-like particles are excited, their electrons are shifted higher energy orbits. As such a state of atom is not stable, electrons return to lower energy orbits releasing quantum of energy. Thus different spectral lines are formed. The wave number of spectral line is given by $\bar{\nu} = \frac{2\pi^2 me^4 z^2}{ch^3}\left[\frac{1}{n_1^2 - \frac{1}{n_2^2}}\right]$

When electrons of excited H-atoms make transition from fifth excited state to second orbit, then maximum number of different types of photos observed is

A. 3

B. 6

C. 10

D. 4

Answer: C

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For a hydrogen -like particle, ionization energy is 122.4 eV. Then what is the wave number of series limit spectral line of the particle of paschen seres (R = rydberg.s constant)

A. $\frac{R}{9}$

B. $\frac{R}{3}$

C. R

D. 4R

Answer: C

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5. Bohr.s theory explains that when Hydrogen-like particles are excited, their electrons are shifted higher energy orbits. As such a state of atom is not stable, electrons return to lower energy orbits releasing quantum of energy. Thus different spectral lines are formed. The wave number of spectral line is given by $\bar{v} = \frac{2\pi^2 me^4 z^2}{ch^3}\left[\frac{1}{n_1^2 - \frac{1}{n_2^2}}\right]$

The angular momentum of an electron in a Bohr.s orbit of H-atom is $4.2178 \times 10^{-34} kgm^2 \sec^{-1}$. What is the wave number of the spectral line emitted when electron falls from this level to the next lower level

A. $\frac{7R}{144}$

B. $5.5 \times 10^{-4} cm^{-1}$

C. $\frac{8}{9}R$

D. $1.1 \times 10^{-5} cm^{-1}$

Answer: A

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Level - II (Type-I) (Practice sheet - 6 (Section -C : Matching/Straight objective type questions))

1. Match the following columns

Column-I	Column-II
A) 1s	P) ml = 0
B) $2P_z$	Q) Nodal planes = 2
C) $3d_{xy}$	R) Radial nodes = 0
D) $3d_{z^2}$	S) Number of maxima = 1

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2. Match the following Columns

Column-I	Column-II
A) Radius of n^{th} orbit	P) Inversely proportional to Z
B) Energy of n^{th} shell	Q) Integral multiple of $h/2\pi$
C) Angular momentum is lowest orbital	R) Proportional to $\left(-\frac{1}{n^2}\right)$
D) velocity of electron in n^{th} orbit	S) Inversely proportional to n

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Level-II (Type - II) (Lecture sheet - 1 (subjective/Analytical type Questions))

1. Mass numbers of Li, Be and B are 7, 9 and 10 respectively. Among B^+, Be^{2+}, Li^+, Be Which has two electrons, three protons and four neutrons

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2. Total number of fundamental particles present in N^{3-} ion (the nuclide of N is $^{14}_{7}N$

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3. If the wavelength of an electromagnetic radiation is 2000 A. what is its energy in ergs?

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4. The energy of a photon is $3 \times 10^{-12} erg$.What is its wavelength in nm? $\left(h = 6.62 \times 10^{-27} erg - s, 3 \times 10^{10} cms^{-1}\right)$

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5. The wave number of the radiation whose quantum is 1 erg is

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6. Energy of a photon with a wave length of 450 nm is

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7. The energy of an electromagnetic radiation is 19.875×10^{-13} ergs. What is the wave number in cm^{-1} ? ($h = 6.625 \times 10^{-27}$ erg.sec, $c = 3 \times 10^{10} cm. \sec^{-1}$)

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8. A 100 watt bulb emits monochromatic light of wavelength 400 nm . Calculate the number of photons emitted per second by the bulb.

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Level-II (Type - II) (Practice sheet-1 (subjective/Analytical type Questions))

1. A certain transition in H-spectrum from an axcited state to ground state in one (or) more steps gives rise to total 10 lines. How many of these belongs to UV-spectrum.

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2. The wavelength of the radiation emitted, when in hydrogen atom electron falls from 4 to stationary state 1, would be (Rydberg constant

$1.097 \times 10^7 m^{-1}$)

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3. The wavelength of the radiation emitted when in hydrogen atom electron falls from infinity to second state Would be (Rydberg constant $1.097 \times 10^7 m^{-1}$).

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4. If the shortest wavelengh of the wave length of the spectral line of H-atom

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5. In a certain electronic transition from the quantum level, 'n' to the ground state in atomic hydrogen in one or more steps, no line belonging

to the Bracket series is observed. What wave number may be observed in the Balmer series ? (R = Rydberg Constant)

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6. What is the lowest energy of the spectral line emitted by the hydrogen atom in the Lyman series? (h = Planck constant, c = Velocity of light, R = Rydberg constant)

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7. The wavelength of a spectral line emitted by hydrogen atom in the Lyman series is 16/15R cm. The value of n_2 if R is Rydberg constant

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8. The ratio of wavelength values of series limit lines $\left(n_2 = \infty\right)$ of Balmer series and Paschen series are

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Level-II (Type - II) (Lecture sheet-2 (subjective/Analytical type Questions))

1. Radius of tenth Bohr orbit of the hydrogen atoms is

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2. Radius of 3rd Bohr orbit is

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3. Velocity of the electron in the 1^{st} Bohr orbit

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4. The energy that is needed to remove an electron from the 1st Bohr orbit or Hydrogen atom is

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5. The energy of an electron present in Bohr's second orbit of hydrogen atom is

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6. The total energy of electron in an atom is a combination of potential energy and kinetic energy. If total energy is -E for an electron in an atom, then its K.E. and P.E. respectively are

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7. The radius of hydrogen atom in the ground state is 0.53 Å, the radius of Li^{2+} in the similar state is

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8. In hydrogen atom the kinetic energy of electron is 3.4 eV. The distance of the electron from the nucleus

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Level-II (Type - II) (Practice sheet-2 (subjective/Analytical type Questions))

1. The energy of second Bohr orbit of hydrogen atom is -328 kJ. mol^{-1}, hence energy of fourth Bohr orbit would be

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2. The angular momentum of an electron present in the excited state of hydrogen is $\frac{2h}{\pi}$. The electron present in _____

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3. The ratio of the difference between the first and second Bohr orbit energies to that between second and third Bohr orbit energies is

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4. The ratio of the radius of the first Bohr orbit for the electron orbiting the hydrogen nucleus to that of the electron orbiting the deuterium nucleus (mass nearly twice that of the hydrogen nucleus) is approximately

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5. The kinetic energy of an electron in the second Bohr orbit of a hydrogen atom is [a_0 is Bohr radius]

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6. In hydrogen atom the kinetic energy of electron is 3.4 eV. The distance of that electron from the nucleus

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7. Energy for 7.25×10^{15} photons of $5.37 \times 10^{14} S^{-1}$ frequently in Einstein unit is

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8. The energy of a photon is given as ΔE/atom $3.03 \times 10^{-19} J \text{atom}^{-1}$. Then the wave length ($\lambda$) of the photon is

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Level-II (Type - II) (Lecture sheet-3 (subjective/Analytical type Questions))

1. The momentum of a particle of wave length 1 Å is

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2. Uncertainity in position of a minute particle of mass 25 g in space is $10^{-5}m$. What is the uncertainity in its velocity (in ms^{-1}) ? $\left(h = 6.6 \times 10^{-34}Js\right)$

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3. The de Broglie wavelength of a particle with mass 1 g and velocity 100 m/s is

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4. The uncertainity in momentum of an electron is 1×10^{-5} kg m/s. The uncertainity in its position will be $\left(h = 6.62 \times 10^{-34} Kgm/s\right)$

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5. The de Broglie wave length of a riffle bullet of mass 2 grams moving with a velocity of 2m/sec of

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6. The uncertainty in the momentum of a particle is $3.31 \times 10^{-2} Kgms^{-1}$. The uncertainty in its position is (in meters)

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7. A cricket ball of mass 0.5 kg is moving with a velocity of $100 ms^{-1}$, the wavelength associated with its motion is

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8. The size of a microscopic particle is 1 micron and its mass is $6 \times 10^{-13} g$. If its position may be measured to within 0.1% of its size, the uncertainty in velocity (in cm^{-1}) is approximately

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Level-II (Type - II) (Practice sheet-3 (subjective/Analytical type Questions))

1. The de Broglie wavelength of a tennis ball of mass 60 g moving with a velocity of 10 metres per second is approximately

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2. The uncertanities in then velocities of two particle A and B are 0.05 and $0.02 ms^{-1}$ respectively.The mass of B is five times to that of A.What is the

ratio of uncertainities $\left[\frac{\Delta x_A}{\Delta x_B}\right]$ in their positions?

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3. The de Broglie wavelength associated with a ball of mass, 200g and moving at a speed of 5 metres/hour, is in the order of

$\left(h = 6.625 \times 10^{-34} Js\right)$

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4. The uncertainity in the position of an electron (mass $9.1 \times 10^{28} g$) moving with a velocity of $3.0 \times 10^{4} cm^{-1}$ accurate up to 0.011%, will be

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5. If the wavelength of the electron is numerically equal to the distance travelled by it in one second, then

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6. Uncertainity in the position of an electron (mass $= 9.1 \times 10^{-31} kg$) moving with a velocity $300 ms^{-1}$ accurate upto 0.001% will be $\left(h = 6.63 \times 10^{-34} Js\right)$

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7. For an electron to have the same de Broglie wave length as that of a Deuteron, its velocity should be --- times that of Deuteron

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8. The uncertainity in the position of an electron (mass $9.1 \times 10^{28} g$) moving with a velocity of $3.0 \times 10^{4} cm^{-1}$ accurate up to 0.011%, will be

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Level-II (Type - II) (Lecture sheet-4 (subjective/Analytical type Questions))

1. The azimuthal quantum number indicates_____of the orbital

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2. When the value of azimuthal quantum number, l=2, value of .n. will be _____

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3. The values of quantum numbers n, l and m for the fifth electron of boron is

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4. The total number of orbital.s in a shell with principal quantum number .n. is

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5. The possible set of quantum numbers for 4p electron are _____

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6. The maximum number of electrons in sub shell with l=1 and n=3 is

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7. An e^- has magnetic quantum number as -3, what is its principal quantum number ?

Watch Video Solution

8. An electron has principal quantum number 3. The number of its (i) sub-shells

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Level-II (Type - II) (Practice sheet- 4 (subjective/Analytical type Questions))

1. The four quantum numbers of the valence electron of potassium are _____

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2. What is the maximum number of electrons that can be accomodated in an atom in which the highest principal quantum number value is 4 ?

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3. The electrons identified by quantum numbers n and I

(i) n = 4,l = 1

(i) n = 4,l = 0

(iii) n = 3,l = 2

(iv) n = 3,l = 1

can be placed in order of increasing energy, from to highest as

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4. For a f-orbital, the values of m are _____

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5. Among Na, O, Cl, N elements outermost orbit.s last electron has magnetic quantum number m= 0 ?

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6. Sum of spin quantum number values of all the electrons in Gd(z=64) is

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7. For a particular value of azimuthal quantum number (1), the total number of magnetic quantum number values (m) is given by

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8. Given this set of quantum numbers for a multi electron atom $2, 0, 0, \text{ and } -1/2$. The next higher allowed set of n and 1 for this atom in its ground state

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Level-II (Type - II) (Lacture sheet- 5 (subjective/Analytical type Questions))

1. Correct energy order of $3p_x, 3d_{xy}, 2p_x$

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2. Hund.s rule deals with the distribution of electrons in____

Watch Video Solution

3. If the nitrogen atom had electronic configuration $1s^7$ is would have energy lower than that of the normal ground state configuration $1s^2 2s^2 2p^3$ because the electrons would be closer to the nucleus. Yet is not observed. It violates

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4. Give examples for Aufbau principle is violated.

Watch Video Solution

5. The number of spherical nodes in 3p orbitals are

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6. The maximum number of electrons in a subshell is given by the expression

Watch Video Solution

7. What is the maximum number of electrons that can be theoretically present in the sixth orbit

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8. For a given principal level n = 4, the energy of its sub-shells is of the order

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Level-II (Type - II) (Practice sheet- 5 (subjective/Analytical type Questions))

1. Give examples for Aufbau principle is violated.

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2. The electronic configuration of an atom/ion can be defined by _____

Watch Video Solution

3. Which atom has as many .s. electrons as p-electrons

Watch Video Solution

4. In a set of degenerate orbitals the electrons distribute themselves to retain similar spins as far as possible. This statement is attributed to

Watch Video Solution

5. No two electrons in an atom can have _____

Watch Video Solution

6. The value of the .spin only. magnetic moment for one of the following configuration is 2.84 BM. The correct one is

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7. The presence of 3 unpaired electrons in N atom can be explained by _____ ?

Watch Video Solution

8. Which principle/rule limit the maximum no. of electrons in an orbital to two ?

Watch Video Solution

Level-II (Type - II) (Lecture sheet- 6 (subjective/Analytical type Questions))

1. The velocity of an electron in a certain Bohr.s orbit of H-atom bears the ratio 1:275 to the velocity of light. Then find the quantum number (n) of orbit ?

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2. The wavelength of m^{th} line balmer series for an orbital is 4103Å. What is the value of m?

Watch Video Solution

3. Calculate the number of waves made by a Bohr.s electrons in one complete revolution in its 3^{rd} orbit of H-atom.

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4. Find the ratio of energy of a photon of 2000 Å wavelength radiation to that of 4000 Å radiation.

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5. When an electron is transisted from 2E to E energy level, the wavelength of resultant photon produce is λ. If electronic transition involves $\frac{4}{3}$ E to e level, the wavelength of resultant photon is λ_2. The correct relation between λ_1 & λ_2 is $\lambda_2 = x\lambda_1$. Then find the value of x ?

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6. The orbital angular momentum of 3p electrons is $\sqrt{x}\frac{h}{2\pi}$. Then the value of x is _____.

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7. If the lowest energy X-rays have $\lambda = 3.055 \times 10^{-8} m$, estimate the minimum difference in energy between two Bohr.s orbits such that an electronic transition would correspond to emission of an X-ray. Assuming that the electrons in other shells exert no influence, at what Z(minimum) would a transition from the second energy level to the first result in the emission of an X-ray ?

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8. At $200\ ^{\circ} C$ the velocity of hydrogen molecule is 2.0×10^{5} cm/sec. In this case, the de-Broglie wavelength is about _____Å.

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Level-II (Type - II) (Practice sheet- 6 (subjective/Analytical type Questions))

1. The amount of energy required to remove the electron from a Li^{+2} ion in its ground state is x times that of the amount of energy required to

remove the electron from an H-atom in its ground state find .x.

Watch Video Solution

2. If each hydrogen atom in the ground state, 1.0 inole of H atoms are excited by absrobing photons of energy 8.4 eV, 12.09 eV and 15.0 eV of energy, then the number of spectral lines emitted is equal to

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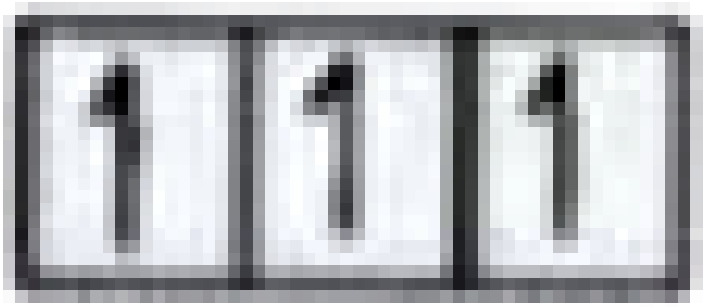
3. Spin multiplicity of p-subshell with configuration



is _____ .

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4. The wavelength of a certain line in Balmer Series is observed to be 4329 Å. To what value of .n. does this correspond ? $\left(R_H = 109678 cm^{-1}\right)$ (Z=1)

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5. When 4f level is completely filled with electrons, the next electron will enter into a subshell whose (n+1) is equal to -

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6. How many Balmer lines in the spectrum will be observed when electrons return from 7^{th} shell to 2^{nd} shell ?

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7. H-atoms in ground state (13.6 eV) are excited by monochromatic radiation of photon of energy 12.1 eV. Find the number of spectral lines

emitted in H-atom.

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8. The electrons in the ground state for a single H-atom absorbs a photon of wavelength 97.28 nm and it reaches to maximum level .n. then when it returns from this level to ground state. Maximum numbers of lines can be obtained in its spectrum ?

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LECTURE SHEET (Exercise-I) (level-I) (Main) (Straight Objective Type Questions)

1. Electron is a particle having a

A. negative charge of one unit and zero mass

B. positive charge of one unit and zero mass

C. negative charge of one unit and a mass of about 9.1×10^{-31} kg

D. negative charge of one unit and a mass of about 1.67×10^{-27} Kg

Answer: C

Watch Video Solution

2. The value of e/m for an electron is

A. 1.78×10^{8} c/g

B. $1.6724 \times 10^{-24} c/g$

C. $0.005486 c/g$

D. $1.00866 c/g$

Answer: A

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3. A and Z can be

A. negative

B. fractional

C. zero

D. whole number

Answer: D

Watch Video Solution

4. Calculate the number of protons , neutrons and electrons in $._{35}^{80}\mathrm{Br}$

A. 35,35,80

B. 35,35,45

C. 80,80,45

D. 45,45,35

Answer: B

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5. The nucleus of tritium consists of

A. 1 proton + 1 neutron

B. 1 proton + 3 neutrons

C. 1 proton + zero neutrons

D. 1 proton + 2 neutrons

Answer: D

Watch Video Solution

6. Sodium ion is isoelectronic with.....atom

A. Mg^{2+}

B. Al^{3+}

C. Ne

D. N^{3-}

Answer: C

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7. An atom differs from its ion in

A. Nuclear charge

B. Mass number

C. Number of electrons

D. Number of neutrons

Answer: C

Watch Video Solution

8. In C^{14} isotope the number of nuetrons would be

A. 6

B. 14

C. 8

D. 10

Answer: C

Watch Video Solution

9. The radius of the atom is of the order of

A. $10^{-10} cm$

B. $10^{-13} cm$

C. 10^{-15} cm

D. 10^{-8} cm

Answer: D

Watch Video Solution

10. An oxide of nitrogen has a molecular weight of 30. Total number of electrons in one molecule of the compound is

A. 15

B. 30

C. 45

D. 60

Answer: A

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11. When alpha particles are sent through a thin metal foil most of them go straight through the foil because

A. Alpha particles are much heavier than electrons

B. Alpha particles are positively charged

C. Most part of the atom is empty

D. Alpha particles move with high velocity

Answer: C

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12. Of the following properties of a wave, the one that is independent of the others is it

A. Wave number

B. Wave length

C. Frequency

D. Amplitude

Answer: D

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13. Which of the following radiation following has highest wave number?

A. Microwaves

B. X - rays

C. I.R. - rays

D. Radiowaves

Answer: B

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14. Which of the following relates a photon, both as a wave and as a stream of particles?

A. $E = mc^2$

B. Photoelectric effect

C. Diffraction

D. E = h v

Answer: D

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15. Kinetic energy of photoelectrons is independent of the of incident radiation.

A. Wavelength

B. Wave number

C. Frequency

D. Intensity

Answer: D

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16. The energy of a photon is $3 \times 10^{-12} erg$.What is its wavelength in nm? $\left(h = 6.62 \times 10^{-27} erg - s, 3 \times 10^{10} cms^{-1}\right)$

A. 662

B. 1324

C. 66.2

D. 6.62

Answer: A

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17. The frequency associated with photon of radiation having a wavelength of $6000A^0$ is

A. $5 \times 10^{14} Hz$

B. $5 \times 10^{10} Hz$

C. $2 \times 10^{14} Hz$

D. 5×10^{15} Hz

Answer: A

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18. Bohr.s theory is applicable to

A. Li^{+2}

B. Li^{+2}

C. He^{+}

D. Both 1 and 3

Answer: A

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19. Bohr.s theory is not applicable to

A. H

B. He^{+}

C. Be^{3+}

D. H^+

Answer: D

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20. (A) : Bohr.s orbits are called stationary orbits

(R) : Electrons remain stationary in these orbitss

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: C

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21. Energy of an electron in nth Bohr orbit is given as

A. $-\frac{n^2h^2}{4\pi^2mZe^2}$

B. $-\frac{2\pi^2Z^2me^4}{n^2h^2}$

C. $-\frac{2\pi Ze^2}{nh}$

D. $-\frac{n^2h^2}{2\pi^2Z^2me^4}$

Answer: B

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22. The energy of the electron when it is at an infinite distance from the nucleus is

A. Infinity

B. Zero

C. Minimum

D. Can not be predicted

Answer: B

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23. According to Bohr.s theory, when ever the electron drops from a higher energy level to a lower energy level, the frequency of radiation emitted is related to the energy change as

A. $\lambda = \frac{h}{mv}$

B. $mvr = \frac{nh}{2\pi}$

C. $v = \frac{\Delta E}{h}$

D. $v = \frac{h}{\Delta E}$

Answer: C

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24. Radius of 3^{rd} Bohr orbit of hydrogen atom

A. $6.529A^{\circ}$

B. $2.116A^{\circ}$

C. $4.761A^{\circ}$

D. $8.464A^{\circ}$

Answer: C

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25. Velocity of the electron in the 1^{st} Bohr orbit of H-atom is

A. 2.18×10^{8} cm/sec

B. 2.18×10^{8} m/sec

C. 2.18×10^{16} cm/sec

D. 36559×10^{8} cm/sec

Answer: A

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LECTURE SHEET (Exercise-I) (level-II) (Advanced) (Straight Objective Type Questions)

1. An α – particle having kinetic energy 5 MeV falls on a Cu-foil. The shortest distance from the nucleus of Cu to which α - particle reaches is (Atomic no. of Cu = 29, K= $9 \times 10^9 Nm^2/C^2$)

A. 2.35×10^{-13} m

B. $1.67 \times 10^{-14} m$

C. 5.98×10^{-15}

D. 1.67×10^{-16} m

Answer: B

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2. If the energy of H-atom in the ground state is -E, the velocity of photo-electron emitted when a photon having energy E_p strikes a stationary Li^{2+} ion in ground state, is given by:

A. $v = \sqrt{\frac{2\left(E_P - E\right)}{m}}$

B. $v = \sqrt{\frac{2\left(E_P + E\right)}{m}}$

C. $v = \sqrt{\frac{2\left(E_P - 9E\right)}{m}}$

D. $v = \sqrt{\frac{2\left(E_P - 3E\right)}{m}}$

Answer: C

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3. The energy of a I, II and III energy levels of a certain atom are E, $\frac{4E}{3}$ and 2E respectively A photon of wavelength λ is emitted during a transition from III to I. What will be the wavelength of emission for transition II to I?

A. $\frac{\lambda}{2}$

B. λ

C. 2λ

D. 3λ

Answer: D

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4. The increasing order of e/m values for electron, proton, neutron and alpha particle is

A. e, p, n, α

B. $n, p, e\alpha$

C. n, p, α, e

D. n, α, p, e

Answer: D

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5. The constancy of e/m ratio for electron shows that

A. Electron.s mass is $1/1837^{th}$th of the mass of proton

B. Electrons are universal particles of all matter

C. Electrons are produced in discharge tubes only

D. None of the above

Answer: B

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6. The e/m of proton is

A. 1.78×10^8 c/g

B. 9.57×10^4 c/g

C. 19.1410^4 c/g

D. 0.478×10^4 c/g

Answer: B

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7. Number of protons in the nucleus of carbon atom is

A. 7

B. 8

C. 4

D. 6

Answer: D

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8. The number of nucleons present in chlorine-37 is

A. 17

B. 20

C. 54

D. 37

Answer: D

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9. The number of neutrons in the dipositive zinc ion (Mass no. of Zn = 65)

A. 35

B. 33

C. 65

D. 67

Answer: A

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10. The charge of an electron is 1.6×10^{-19} coulombs. What will be the value of charge on Na^{+} ion

A. $1.6 \times 10^{-19} C$

B. $3.2 \times 10^{-19} C$

C. $2.4 \times 10^{-19} C$

D. $11 \times 1.6 \times 10^{-19} C$

Answer: A

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11. Maximum sum of the number of neutrons and protons in an isotope of hydrogen

A. 6

B. 5

C. 4

D. 3

Answer: D

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12. The incorrect statement regarding cathode rays is

A. They travel in straight line

B. They depend on the nature of the gas

C. They are deflected by magnetic as well as electric fields

D. They produce mechanical effects

Answer: B

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13. According to Planck's Quantun theory, the correct statements are

(a) The vibrating particle in the black body does not emit continuously

(b) Radiation is emitted in the form of small packets called Quanta

(c) Energy associated with emmitted radiations is inversely proportional to frequency.

(d) The emitted radiant energy is propagated in the form of waves.

A. I,II,III

B. II, III

C. I,II,IV

D. II,IV ,III

Answer: C

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14. Which of the following statements is incorrect ?

A. Particle nature of radiations can be experimentally demonstrated by Compton effect

B. Wave nature of electrons can be experimentally demonstrated by diffraction experiment

C. The value of Planck.s constant, h is 6.62×10^{-34} J.s

D. Intensity of light is directly proportional to its frequency.

Answer: D

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15. As an electron is brought from an infinite distance close to nucleus of atom, the energy of electron

A. Increases to a greater +ve value

B. Decreases to a smaller +ve value

C. Increases to a smaller -ve value

D. Decreases to a greater -ve value

Answer: D

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16. Rutherford's alpha ray scattering experiment showed for the first time that that atom has

A. Nucleus

B. Proton

C. Electron

D. Neutron

Answer: A

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17. In electromagnetic radiation, which of the following,..... rays has greater wavelength than visible light ?

A. U.V-rays

B. I.R-rays

C. Gamma rays

D. X-rays

Answer: B

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18. Which of the following is not an electromagnetic radiation ?

A. Gamma rays

B. Alpha rays

C. Radio waves

D. X-rays

Answer: B

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LECTURE SHEET (Exercise-I) (level-II) (Advanced) (More than one correct answer Type Question)

1. In Rutherford.s gold leaf experiment, the scattering of a -particles takes place. In this process:

A. coulombic force is involved

B. nuclear force is involved

C. path of α -particle is parabolic

D. path of α – particle is hyperbolic

Answer: A::D

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2. According to Bohr model of atom

A. The radius of n^{th} orbit $\alpha\, n^2$

B. The total energy of electron in n^{th} orbit $\alpha \frac{1}{n}$

C. The angular momentum electron is integral multiples of $h/2\pi$

D. The magnitude of potential energy of an electron is an orbit greater than kinetic energy

Answer: A::C::D

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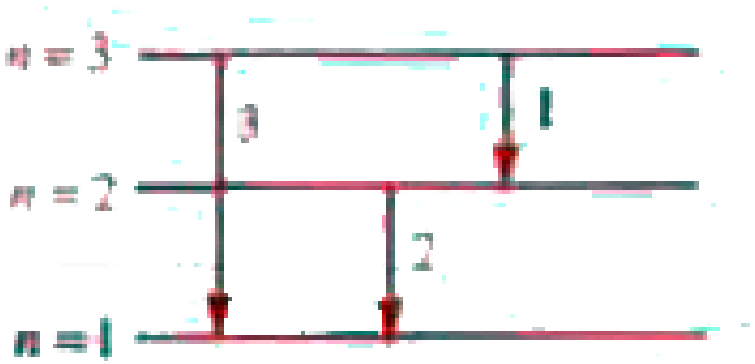

3.

For above transitions in hydrogen like atoms, select the incorrect

relation(s).

A. $v_3 = v_1 + v_2$

B. $v_3 = \frac{v_1 v_2}{v_1 + v_2}$

C. $\lambda_3 = \lambda_1 + \lambda_2$

D. $\lambda_3 = \frac{\lambda_1 \lambda_2}{\lambda + \lambda_2}$

Answer: B::C

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4. If the electron of the hdyrogen atom is replaced by another particle of same charge but of the double mass, then :

A. radii of different shells will increase

B. energy gap between two levels will become double

C. ionization energy of the atom will be double

D. speed of new particle in a shell will be lesser than the speed of electron in the same shell

Answer: C::D

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5. Let r, v and E are the radius of the orbit, speed of the electron and the total energy of the electron respectively. Which of the following quantities are proportional to the quantum number .n. ?

A. rE

B. ur

C. $\frac{\upsilon}{E}$

D. $\frac{r}{E}$

Answer: B::C

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6. Select the correct statement(s),

A. An electron near the nucleus is attracted by the nucleus and has a low potential energy

B. According to Bohr.s theory, an electron continuously radiate energy if it stayed in out orbit

C. Bohr.s model could not explain the spectra of multielectron atoms

D. Bohr.s model was the first atomic model based on quantisation of energy

Answer: A::C::D

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LECTURE SHEET (Exercise-I) (level-II) (Advanced) (Linked Comprehension Type Question)

1. A metal is irradiated with a radiation of wavelength 300 nm. Then photo electrons found to have velocity of 3.7×10^5m/s. When a graph is drawn between K.E of photo electrons and frequency of radiation a straight line is obtained cutting X-axis.

What is the K.E. of photo electrons

A. 6.23×10^{-20} J

B. 6.25×10^{-22} J

C. 6.625×10^{-18} J

D. 6.625×10^{-19} J

Answer: A

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2. A metal is irradiated with a radiation of wavelength 300 nm. Then photo electrons found to have velocity of 3.7×10^5m/s. When a graph is drawn between K.E of photo electrons and frequency of radiation a

straight line is obtained cutting X-axis.

The value of X-intercept

A. 9×10^4Hz

B. 10.2×10^5 Hz

C. 8.6×10^5 Hz

D. 9×10^{14} Hz

Answer: D

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3. A metal is irradiated with a radiation of wavelength 300 nm. Then photo electrons found to have velocity of 3.7×10^5m/s. When a graph is drawn between K.E of photo electrons and frequency of radiation a straight line is obtained cutting X-axis.

Difference between incident frequency and threshold frequency is

A. 9.4×10^{13} Hz

B. 8.5×10^{22} Hz

C. 9.4×10^{12} Hz

D. $8.4 \times 10^{10} Hz$

Answer: A

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4. To explain the nature of radiation, James Clark Maxwell in 1864 put forward .Electromagnetic wave theory.. This theory could explain the phenomena of interference and diffraction but could not explain phenomena of black body radiation and photoelectric effect. Also, after the advent of electromagnetic wave theory, Rutherford.s model of atom suffered a serious drawback. To explain the phenomena of black body radiation and photoelectric effect, Max planck in 1900 put forward Planck.s quantum theory. BAsed on this theory, Neils Bohr in 1913 put forward Bohr.s model of atom which could overcome the drawback of Rutherford.s model and also explain the line spectral elements, especially

the line spectra of hydrogen and hydrogen-like particles.

Which of the following statements is incorrect about electromagnetic wave theory ?

A. Energy is emitted continuously from the source

B. Radiations are associated with electric and magnetic fields

C. Radiations can travel even through vacuum

D. The velocity of any radiation depends upon the nature of the radiation.

Answer: D

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Kinetic energy of the electron ejected when yellow light of frequency $5.2 \times 10^{14} s^{-1}$ falls on the surface of potassium metal (threshold frequency $= 5 \times 10^{14} s^{-1}$) is

A. 1.325×10^{-13} J

B. 1.325×10^{-20} J

C. 1.325×10^{-20} J

D. $1.325 \times 10^{-34} J$

Answer: B

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LECTURE SHEET (Exercise-I) (level-II) (Advanced) (Matrix matching Type Questions)

1.

Column-I	Column-II
A) Isotopes	P) Same no. of atoms and same no. of electrons
B) Isobars	Q) Different no.of protons but same no.of neutrons
C) Isotones	R) Different no. of protons and different no.of neutrons
D) Isosters	S) Same no. of protons but different no.of neutrons

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2.

Column-I	Column-II
A) Angular momentum of electron	P) -ve
B) Potential energy of electron	Q) +ve
C) Total energy of electron	R) Proportional to n
D) Linear momentum of electron	S) Proportional to
	T) Proportional to 1/n

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Column-I	Column-II
A) Angular momentum of electron	P) -ve
B) Potential energy of electron	Q) +ve
C) Total energy of electron	R) Proportional to n
D) Linear momentum of electron	S) Proportional to
	T) Proportional to 1/n

3.

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4. According to Bohr.s theory, E_n = total energy, K_n = kinetic energy, V_n = potential energy, r_n = radius of n^{th} orbit. Match the following.

Column-I	Column-II
A) $V_n/K_n = ?$	P) 0
B) $r_n \propto E_n^x, x=?$	Q) -1
C) Angular momentum in lowest orbital	R) -2
D) $\frac{1}{r_n} \propto Z^y, y=?$	S) 1

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1. Find the ratio of energy of a photon of $2000A^\circ$ wavelength radiation to that of $4000A^\circ$ radiation.

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2. The work function for a metal is 4 eV. To eject the photo electrons with zero velocity the wavelength of the incident light should be

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3. Assume that 2×10^{-17} J of light energy is needed by the interior of the human eye to see an object. The number of photons of yellow light with $\lambda = 595.2$nm are needed to generate this minimum energy is 12x. Then the value of x is _____ .

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4. Number of photons of light with a wave length of 4000 pm necessary to provide one joule of energy approximately x $\times 10^{16}$. Then r is _____

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5. The velocity of an electron in a certain Bohr.s orbit of H-atom bears the ratio 1:275 to the velocity of light. Then find the quantum number (n) of orbit ?

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6. When an electron is transisted from 2E to E energy level, the wavelength of resultant photon produce is λ. If electronic transition involves $\frac{4}{3}$ E to e level, the wavelength of resultant photon is λ_2. The correct relation between λ_1 & λ_2 is $\lambda_2 = x\lambda_1$. Then find the value of x ?

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7. Given $r_{n+1} - r_{n-1} = 2r_n$ where r_n, r_{n-1}, r_{n+1} are Bohr radius for hydrogen atom in n^{th} , $(n+1)^{th}$ and $(n-1)^{th}$ shell respectively . Calculate the value of n.

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LECTURE SHEET (Exercise-II) (level-I) (Main) (Straight Objective Type Questions)

1. The equation corresponding to the wave number of spectral lines in Pfund series is

A. $R\left[\frac{1}{4^2} - \frac{1}{5^2}\right]$

B. $R\left[\frac{1}{3^2} - \frac{1}{4^2}\right]$

C. $R\left[\frac{1}{2^2} - \frac{1}{3^2}\right]$

D. $R\left[\frac{1}{5^2} - \frac{1}{6^2}\right]$

Answer: D

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2. The value of Rydberg constant is

A. $109677 cm^{-1}$

B. $109700 cm^{-1} s^{-1}$

C. $10968 cm^{-1}$

D. $10970 m$

Answer: A

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3. A spectral line of hydrogen with $\lambda = 4938 Å$ belongs to the series

A. Lyman

B. Balmer

C. Paschen

D. Pfund

Answer: B

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4. Among the.first lines of Lyman, Balmer, Paschen and Brackett series in hydrogen atomic spectra, which has higher energy?

A. Lyman

B. Balmer

C. Paschen

D. Bracket

Answer: A

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5. What are the values of n_1 and n_2 respectively for H_β line in the Lyman series of hydrogen atomic spectrum?

A. 3 and 5

B. 2and 3

C. 1 and 3

D. 2 and 4

Answer: C

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6. The fourth line of the Balmer series corres ponds to the electronic transition between two orbits of the H atom, Identify the orbits.

A. 3 and 1

B. 5 and 1

C. 5 and 2

D. 6 and 2

Answer: D

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7. Total number of spectral lines when electron jumps from 8^{th} orbit to 2^{nd} orbit

A. 6

B. 36

C. 21

D. 38

Answer: C

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8. Supposing the electron is present in the 4^{th} energy level of H- atom. When the electron returns to ground state the possible transitions would be :

A. $4 \rightarrow 1$

B. $4 \rightarrow 2, 2 \rightarrow 1$

C. $4 \rightarrow 3, 3 \rightarrow 2, 2 \rightarrow 1$

D. All the above

Answer: D

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9. The de-Broglie equation treats an electron to be

A. a particle

B. a wave

C. ray

D. both (1) and (2)

Answer: D

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10. Wavelength of the wave associated with a moving electron

A. Decreases with increase in speed of electron

B. Increases with increase in speed of electron

C. Remains same irrespective of speed of electron

D. is zero

Answer: A

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11. The uncertainity principle and the concept of wave nature of matter were proposed by----- and ---- respectively

A. Pauli, Hund

B. Heisenberg, Aufbau

C. Heisenberg, de Broglie

D. Heisenberg, Planck

Answer: C

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12. Bohr's postulate that $mvr = \frac{nh}{2\pi}$ is proved mathematically by

A. Pauli.s exclusion principle

B. de Broglie wave nature of the electron

C. Heisenberg.s uncertainity principle

D. Sommer feld theory

Answer: B

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13. The momentum of a particle of wave length 1 Å is

A. 6.625×10^{-27} g. $cm. s^{-1}$

B. $6.625 \times 10^{19} g. cm. s^{-1}$

C. $6.625 \times 10^{-16} g. cm. s^{-1}$

D. $6.625 \times 10^{-23} g. cms^{-1}$

Answer: B

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14. If uncertainty in position and velocity are equal then uncertainty in momentum will be:

A. $\frac{1}{2}\sqrt{\frac{mh}{\pi}}$

B. $\frac{1}{2}\sqrt{\frac{h}{\pi m}}$

C. $\frac{h}{4\pi m}$

D. $\frac{nh}{4\pi}$

Answer: A

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15. Be^{+3} and a proton are accelerated by the same potenatial, their de-Broglie wavelengths have the ratio (assume mass of proton = mass of neutron)

A. $1:2$

B. $1:4$

C. 1 : 1

D. 2 : 1

Answer: D

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LECTURE SHEET (Exercise-II) (level-II) (Advanced) (Straight Objective Type Questions)

1. Which of the following statements regarding spectral series is correct?

A. The lines in the Balmer series correspond to the electronic transition from higher energy level to n = 1 energy level.

B. Paschen series appears in the infra-red-region

C. The lines of Lyman series appear in the visible region

D. Transition from higher energy levels to 4^{th} energy level produces Pfund series which fall in the infrared region.

Answer: B

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2. In a series in the line spectrum of hydrogen the wavelength of radiation is 6,563Å. The name of the series and the orbits in which electron transition takes place are

A. Balmer series , 3^{rd} to 2^{nd} orbit

B. Lyman series , 2^{nd} to 1^{st} orbit

C. Pfund series ,6^{th} to 5^{th} orbit

D. Paschen series , 4^{th} to 3^{nd} orbit

Answer: A

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3. The frequency of the spectral line obtained when the electron in $n = 3$ of Hydrogen atom drops to the ground state is

A. 2.925×10^{15} Hertz

B. 2.925×10^{13} Hertz

C. 2.925×10^{13} Hertz

D. 36559×10^{10} Hertz

Answer: A

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4. Assertion (A) : The energy of ultraviolet radiation is greater than the energy of infrared radiation

Reason (R) : The velocity of ultraviolet radiation is greater than the velocity of infrared radiation

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true but R is not the correct explanation of A

C. A is true and R is false

D. R is true and A is false

Answer: C

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5. Which of the following transitions will have minimum wavelength ?

A. $n_4 \rightarrow n_1$

B. $n_2 \rightarrow n_1$

C. $n_4 \rightarrow n_2$

D. $n_3 \rightarrow n_1$

Answer: A

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6. Electrons are accelerated through a potential difference of 150V. Calculate the de Broglie wavelength.

A. $\lambda_3 = \lambda_p$

B. $\lambda_e < \lambda_p$

C. $\lambda_e > \lambda_p$

D. $n_3 \rightarrow n_1$

Answer: C

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7. Velocity of helium atom at 300K is2.40×10^2 meter per second. What is its wavelength? (He = 4)

A. 0.416 nm

B. 0.83 nm

C. 803 Å

D. 8000 Å

Answer: A

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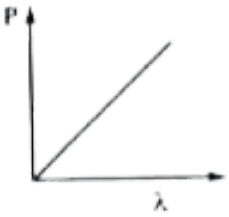
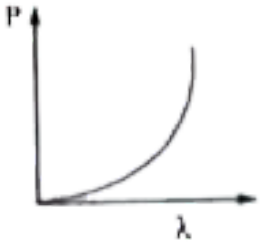
8. The graph between momentum p and de-Broglie wavelength λ of photon is

A.



B.



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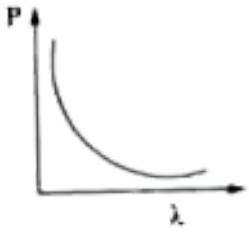
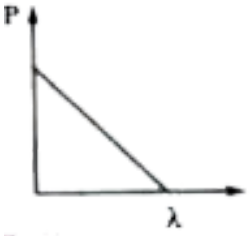


D. 

Answer: c

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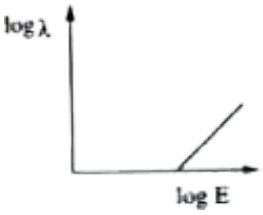
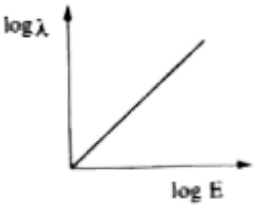
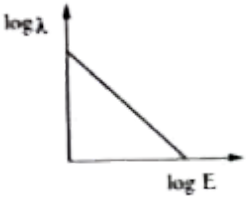
9. The graph between momentum p and de-Broglie wavelength λ of photon is

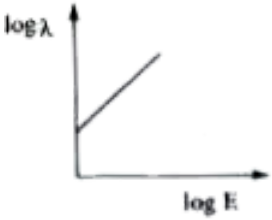
A. 

B. 

C.



D.



Answer: C

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10. A particle X moving with a certain velocity has a debroglie wave length of 1Å, If particle Y has a mass of 25% that of X and velocity 75% that of X, debroglies wave length of Y will be -

A. 3Å

B. 5.33Å

C. 6.88Å

D. 48Å

Answer: B

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11. Which of the following statement is incorrect ?

A. The third quantum shell can hold a maximum of 18 electrons

B. An electron falling to the same energy level from any higher level always emits the same quantum of energy

C. The Balmer series of lines is in the visible region of the emission spectrum of hydrogen atom

D. The electron of hydrogen atom in its ground state remains in the first quantum shell

Answer: B

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12. The schrodinger wave equation for hydrogen atom is $\Psi_2 = \frac{1}{4\sqrt{2\pi}}\left(\frac{1}{a_0}\right)^{3/2}\left(2 - \frac{r}{a_0}\right)e^{-r/a_0}$ where a_0 is Bohr.s radius. If the radial node in 2s be at r_0 would be equal to

A. $\frac{a_0}{2}$

B. $2a_0$

C. $\sqrt{2}a_0$

D. $\frac{a_0}{\sqrt{2}}$

Answer: B

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13. The Schrodinger wave equation for hydrogen atom is $Ps(\text{radial}) = \frac{1}{16\sqrt{4}}\left(\frac{Z}{a_0}\right)^{3/2}\left[(\sigma - 1)\left(\sigma^2 - 8\sigma + 12\right)\right]e^{-\sigma/2}$

where a_0 and z are the constant in which answer can be expressed and $\sigma = \frac{2\pi}{a_0}$ minimum and maximum position of radial nodes from nucleus are

A. $\frac{a_0}{Z}, \frac{3a_0}{Z}$

B. $\frac{a_0}{2Z}, \frac{a_0}{Z}$

C. $\frac{a_0}{2Z}, \frac{3a_0}{Z}$

D. $\frac{a_0}{2Z}, \frac{4a_0}{Z}$

Answer: C

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14. For a 3s- orbital $\Psi(3s) = \frac{1}{9\sqrt{3}}\left(\frac{1}{a_0}\right)^{3/2}\left(6 - 6\sigma + \sigma^2\right)e^{-\sigma/2}$, where $\sigma = \frac{2rZ}{3a_0}$. What is the maximum radial distance of node from nucleus ?

A. $\frac{\left(3+\sqrt{3}\right)a_0}{z}$

B. $\frac{a_0}{z}$

C. $\frac{3}{2}\frac{\left(3+\sqrt{3}\right)a_0}{z}$

D. $\frac{2a_0}{z}$

Answer: C

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LECTURE SHEET (Exercise-II) (level-II) (Advanced) (More than One correct answer Type Questions)

1. Which of the following statements is/are correct ?

A. The absorption spectrum is formed due to absorbing radiant energy by the matter in lower energy states

B. The emission spectrum is formed due to the emission of radiant energy by the excited matter

C. Hydrogen spectrum is an example of line spectrum

D. Li^+ ion spectrum is equivalent to H atom spectrum

Answer: A::B::C

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2. The electron in a hydrogen atom makes a transition $n_1 > n_2$ where n_1 and n_2 are the principal quantum numbers of the two states. Assume the Bohr model to be valid, if the time period of the electron in the initial state is eight times that in the final state, then the possible values of n_1 and n_2 are

A. $n_1 = 4, n_2 = 2$

B. $n_1 = 8, n_2 = 2$

C. $n_1 = 8, n_2 = 1$

D. $n_1 = 6, n_2 = 3$

Answer: A::D

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3. Whenever a hydrogen atom emits a quantum in the visible region of Balmer series :

A. it may emit another quantum in Balmer series again

B. it must emit another quantum in ultraviolet region of Lyman series

C. second quatum of wavelength 122nm will be emitted

D. second quantum will be emitted in Paschen series i.e., near infrared region

Answer: B::C

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4. Which of the following species are expected to give the line spectrum similar to that of hydrogen atom?

A. He(g)

B. $Li^{2+}(g)$

C. $He^{+}(g)$

D. D(g)

Answer: B::C::D

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5. Hydrogen atom has

A. half filled subshel

B. half filled shell

C. one electron in valence shell

D. half filled orbital

Answer: A::B::C::D

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6. Select the correct statement(s)

A. The phenomena of diffraction of light can only be explained by assuming that light behaves as waves

B. de-Broglie postulate the dual character existed with matter

C. In his atomic model Bohr considered electron as a particle

D. Wave nature of electrons was obtained when diffraction rings were observed protographically when a street of protons was passed through a metal foil

Answer: A::B::C

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7. False statement about the de-Broglie.s wavelength of an electron in the Bohr.s orbit is

A. equal to the circumference of the first orbit

B. equal to twice the circumference of the first orbit

C. equal to half the circumference of the first orbit

D. equal to one fourth of the circumference of the first orbit

Answer: B::C::D

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8. Which is correct in case of p-orbitals ?

A. They are spherically symmetrical

B. They have strong directional character

C. They are three fold degenerate orbitals

D. Their charge density along x, y and z-axes are zero.

Answer: B::C

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1. de-Broglie proposed the dual nature of electron and put forward his wave concept. The wave length of electron in an orbit was given by $\lambda = \frac{h}{mv}$

The de-Broglie.s wavelength (λ) of the electron subjected to an accelerating potential of V volts is given by

A. $\frac{ch}{\sqrt{2mv}}$

B. $\frac{h}{\sqrt{2mev}}$

C. $\frac{h}{\sqrt{2me}} \times v$

D. $\frac{mh}{\sqrt{2eV}}$

Answer: B

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2. de-Broglie proposed the dual nature of electron and put forward his wave concept. The wave length of electron in an orbit was given by $\lambda = \frac{h}{mv}$

The de-Broglie.s wavelength (λ) of the electron subjected to an accelerating potential of V volts is given by

A. $\frac{K.E}{h}$

B. $\frac{2K.E}{h}$

C. $\frac{K.E}{2h}$

D. $\frac{h}{2K.E}$

Answer: B

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3. de-Broglie proposed the dual nature of electron and put forward his wave concept. The wave length of electron in an orbit was given by

$\lambda = \frac{h}{mv}$

The circumference of 3^{rd} Bohr orbit in H-atom is

A. 3×10^{-7} cm

B. 3×10^{-8} cm

C. 3×10^{-6} cm

D. 4.3×10^{-9} cm

Answer: A

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4. de-Broglie proposed the dual nature of electron and put forward his wave concept. The wave length of electron in an orbit was given by $\lambda = \frac{h}{mv}$

The wavelength of moving electron in 3^{rd} Bohr orbit of H-atom is

A. 1×10^{-9} m

B. 2×10^{-7} m

C. 1×10^{-7} m

D. 1×10^{-8} cm

Answer: A

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5. In case of hydrogen spectrum wave number is given by

$\bar{v} = R_H\left[\frac{1}{n_2^2} - \frac{1}{n_2^2}\right]$ where $n_1 < n_2$

Column-I	Column-II
A) Lyman series	P) $n_2 = 2$
B) Balmer series	Q) $n_2 = 3$
C) Pfund series	R) $n_2 = 6$
D) Brackett series	S) $n_2 = 5$

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6. If the shortest wavelength of spectral line of H-atom in Lyman series is x. Then match the following for Li^{2+}

Column-I	Column-II
A) Shortest wavelength in Lyman series	P) $\frac{4x}{5}$
B) Longest wavelength in Lyman series	Q) $\frac{4x}{9}$
C) Shortest wavelength in Balmer series	R) $\frac{x}{9}$
D) Longest Wavelength in Balmer series	S) $\frac{4x}{27}$

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7. The wavelength of a certain line in Balmer Series is observed to be 4329 Å. To what value of .n. does this correspond ? $\left(R_H = 109678 cm^{-1}\right)$ (Z=1)

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8. The ratio of wave number of the limiting line of Lyman series to the limiting line of Balmar series in Hydrogen spectrums is _____ .

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9. Calculate the number of waves made by a Bohr.s electrons in one complete revolution in its 3^{rd} orbit of H-atom.

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LECTURE SHEET (Exercise-III) (level-I) (Straight Objective Type Questions)

1. The azimuthal quantum number indicates_____of the orbital

A. Size

B. Shape

C. Orientation

D. Spin

Answer: B

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2. Which of the following is indicated by the magnetic quantum number?

A. Size

B. Shape

C. Spatial orientation

D. Spin

Answer: C

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3. The spin quantum number has a value of

A. $1/2$

B. $+1/2$

C. $-1/2$

D. either $+1/2$ or $-1/2$

Answer: B

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4. Which one of the following expressions represent the electron probability function (D)

A. $4\pi r$ dr Ψ^2

B. $4\pi r^2$ dr Ψ

C. $4\pi r^3$ dr Ψ^2

D. $4\pi r$ dr Ψ

Answer: C

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5. Radial part of the wave function depends on quantum numbers

A. n and s

B. I and m

C. I and s

D. n and I

Answer: D

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6. Which of the following is correct with respect to .p. orbitals ?

A. Spherical

B. Strong directional character

C. Five fold degenerate

D. No directional character

Answer: B

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7. The maximum number of electrons accommodated in 5f orbitals

A. 5

B. 10

C. 14

D. 18

Answer: C

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8. The maximum probability of finding an electron of a particular energy in an orbital is about

A. 80 °

B. 85 °

C. 95 °

D. 99 °

Answer: C

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9. Number of nodes spaces in 4s orbital is

A. 0

B. 1

C. 3

D. 4

Answer: C

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10. (A) : The p-orbital has dumb-bell shaped

(R): Electron present in p-orbital can have any one of the three values of magnetic quantum numbers (0, +1, -1)

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: B

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11. No two electrons in an orbital can have parallel spin. This statement emerges from

A. Hund.s rule

B. Aufbau principle

C. Pauli.s exclusion principle

D. (n + l) rule

Answer: C

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12. Electrons never pair, if there are empty orbitals in a given sub-shell. This is

A. Aufbau principle

B. Pauli.s exclusion principle

C. Hund.s rule of maximum multiplicity

D. Heisenberg.s uncertainity principle

Answer: C

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13. Which of the following explains the sequence of filling electrons in different subshells?

A. Hund.s rule

B. Aufbau principle

C. Pauli.s principle

D. All of these

Answer: B

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14. Nitrogen atom has 3 unpaired electrons in its ground state. It can be explained by

A. Auf bau principle

B. Pauli.s principle

C. Hund.s rule

D. All of these

Answer: B

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15. The electronic configuration of sodium is

A. $[Ne]3s^2$

B. $[Ne]3s^1$

C. $[Ar]4s^1$

D. $[Ar]4s^2$

Answer: B

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16. Which of the following configuration may represent the ground state of nitrogen atom?

A.

B.

C.

D.

Answer: B

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17. Electronic configuration of the element with atomic number 56 and mass number 138 is

A. $[Xe]6s^2$

B. $[kr]5s^2$

C. $[Xe]6s^2 6p^2$

D. $[Xe]3d^2 5d^2$

Answer: A

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18. In potassium the order of energy levels is

A. $4s > 3d$

B. $4s < 3d$

C. $4s < 3p$

D. $4s = 3d$

Answer: B

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19. The number of d-electrons retained in Fe^{2+} (At. no. of Fe = 26) ion is

A. 3

B. 4

C. 5

D. 6

Answer: D

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20. Which of the following is the correct electronic configuration of Fe^{3+} ion ? (Z for Fe= 26)

A. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^4 4s^1$

B. $1s^2, 2s^2, 2p^6, 3s^2, 3d^3, 4s^2$

C. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^5$

D. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^5, 4s^2, 4p^3$

Answer: C

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21. Number of unpaired electrons in the electrmonic configuration $1s^2 2s^2 2p^4$ is

A. 2

B. 3

C. 4

D. 6

Answer: A

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LECTURE SHEET (Exercise-III) (level-II)(Advanced) (Straight Objective Type Questions)

1. n a multi - electron atom, which of the following orbitals described by the three quantum numbers will have the same energy in the absence of magnetic and electric field

$i) n = 1, l = 0, m = 0$

ii) n=2 , l=0, m=0

iii) n=2 , l=1 , m=1

iv) n=3 , l=2 , m=0`

A. I and ii

B. ii and iii

C. iii and iv

D. iv and v

Answer: D

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2. An electron has magnetic quantum number as $'-3'$. Its principal quantum number is

A. 3

B. 2

C. 1

D. 4

Answer: D

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3. Identify the incorrect match

LIST-1	LIST-2
1) $n = 3, l = 3, m = 0, s = +1/2$	I) when $n = 3$, l can not be 3
2) $n = 5, l = 2, m = 3, s = +1/2$	II) when $l = 2$, m can not be 3
3) $n = 4, l = 2, m = 1, s = 0$	III) when $l = 2$, s can not be 0
4) $n = 0, l = 1, m = 1, s = -1/2$	IV) n can not be zero

A. 1-I

B. 2-II

C. 3-III

D. 4-IV

Answer: C

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4. The quantium number of four electrons $\left(e_1 \text{ to } e_4\right)$ are given below

	n	l	m	s
e_1	3	0	0	+1/2
e_2	3	2	2	−1/2

	n	l	m	s
e_2	4	0	1	1/2
e_3	3	1	−1	1/2

The correct order of decreasing energy of these electrons is

A. $e_4 > e_3 > e_2 > e_1$

B. $e_2 > e_3 > e_4 > e_1$

C. $e_3 > e_2 > e_4 > e_1$

D. $e_1 > e_3 > e_4 > e_2$

Answer: C

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5. Which orbital gives an electron the greatest probability of closer to the nucleus ?

A. 3p

B. 3d

C. 3s

D. equal

Answer: C

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6. Which one of the following statements is correct ?

A. 2S orbital is spherical with two nodal planes

B. The de-Borglie wavelength of a particle of mass .m. and velocity .v. is equal to mv/h

C. The principal quantum number (n) indicates the shape of the orbital

D. The electronic configuration of phosphorus is given by [Ne] $3s^2 3p_x^1, 3p_y^1 p_x^1$

Answer: D

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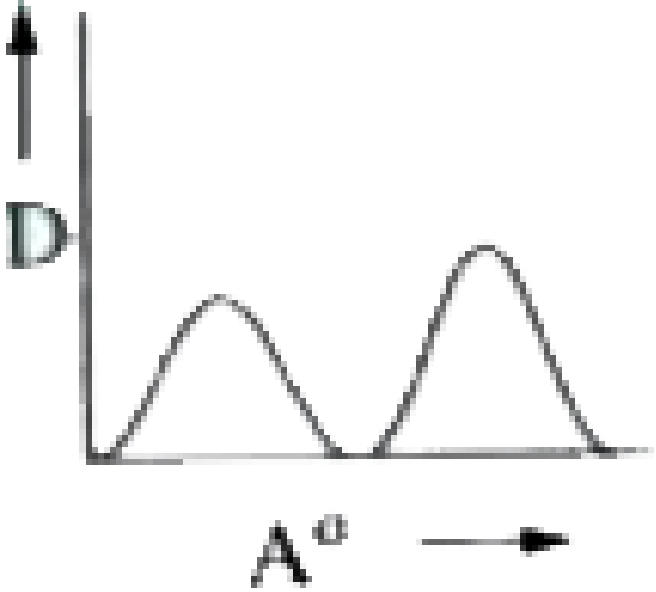
7. The set of quantum numbers .n. and .l. possible for the orbital shown in the radial probability curve are



A. n = 3, l = 2

B. n = 4, l= 1

C. n = 2, l = 0

D. n = 3, l = 3

Answer: C

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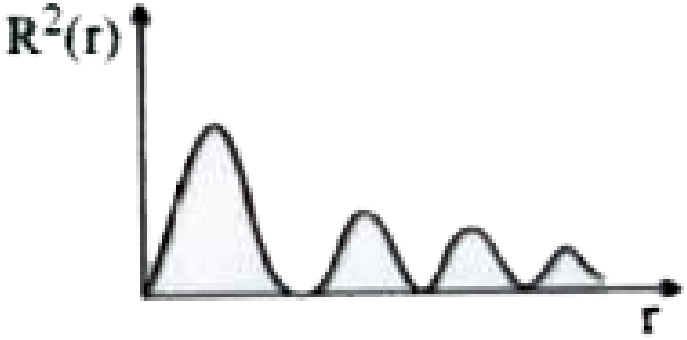
8. From the following observations predict the type of orbital :

Observation 1: x y plane acts as a nodal plane

Observation 2: The angular function of the orbital intersect the three axis at origin only.

Observation 3: R^2(r) vs r curve is obtained for the orbital is



A. $5P_z$

B. $6d_{xy}$

C. $6dx^2 - y^2$

D. $6d_{yz}$

Answer: A

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LECTURE SHEET (Exercise-III) (level-II)(Advanced) (More than one correct answer Type Questions)

1. Choose the correct statement

A. Splitting of spectral lines in magnetic field is due to presence of degenerate orbitals

B. In the presence of electricfield, energy value of P_x, P_y, $\&P_z$ of same orbit are different

C. Degenerate orbitals differs only in their orientation

D. degenerate orbitals have same shape, but different energy

Answer: A::B::C

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2. Which of the following statements are not correct?

A. The ionization energy of a hydrogen-like species in its ground state is equal to the magnitude of energy of the orbit having n = 1

B. The ionization energy of a hydrogen-like species in its ground state increases in proportion to the positive charge in its nucleus

C. According to the uncertainty principle, $\Delta_P \Delta_x \leq h/4\pi$

D. The energy of an electron in an orbital of a multielectron atom depends only on the principal quantum number n

Answer: B::C::D

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3. For the energy levels in an atom, which one of the following statement(s) is (are) correct ?

A. There are seven principal electron energy levels

B. The second principal energy level can have four sub-energy levels and contain a maximum of eight electrons

C. The M energy level can have a maximum of 32 electrons

D. The 4s sub-energy level is at a lower energy than the 3d sub-energy level.

Answer: A::D

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4. Which of the following statements are correct

A. The angular momentum of an electron due to its spinning is given as $\sqrt{s(s+1)}\frac{h}{2\pi}$ (where s can take the value of 1/2)

B. The angular momentum of an electron due to its spinning is given asm_s (h/2π)where m_s can take the value of +1/2.

C. According to Pauli.s exclusion principle, no two electrons in an atom can have the same values of quantum numbers n, I and m

D. The azimuthal quantum number cannot have negative values.

Answer: A::D

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5. The chlorine atom has

A. 6 electrons with l = 0

B. 11 electrons with l=1

C. 5 orbitals with m = 0

D. 2 orbitals with m + 1

Answer: A::B::C::D

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6. Which of the following sets of quantum numbers represents the orbitals of same shape and orientation in external field.

A. $n = 3, l = 2, m = +1, s = +1/2$

B. $n = 3, l = 2, m = -1, s = -1/2$

C. $n = 4, l = 2, m = +1, s = -1/2$

D. $n = 3, l = 2, m = 0, s = +1/2$

Answer: A::C

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7. Choose the correct statement(s)

A. The shape of an atomic orbital depends upon azimuthal quantum number

B. The orientation of an atomic orbital depends upon the magnetic quantum number

C. The energy of an electron in an atomic orbital of multi-elelctron atom depends on principal quantum number only

D. The number of degenerate atomic orbitals of one type depends upon the value of azimuthal quantum number

Answer: A::B::D

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8. Select the correct configurations among the following

A. $Cr(Z = 24) : [Ar]3d^5, 4s^1$

B. $Cu(Z = 29) : [Ar]3d^{10}, 4s^1$

C. The energy of an electron in an atomic orbital of multi-elelctron atom depends on principal quantum number only

D. $Pt(Z = 78) : [Xe]4d^{10}4s^2$

Answer: A::B::C

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LECTURE SHEET (Exercise-III) (level-II)(Advanced) (Linked Comprehension Type Questions)

1. The substances which contain species with unpaired electrons in their orbitals behave as paramagnetic substances. Such substances are weakly attracted by the magnetic field. The paramagnetism is expressed in terms of magneticmoment The magnetic moment is related to the number of unpaired electrons according to the following relation : Magnetic moment, $\mu = \sqrt{n(n+2)}$ B.M. Where 'n' = number of unpaired electrons. B.M stands for Bohr magneton, a unit of magnetic moment.

Which of the following has the highest magnetic moment ?

A. Fe^{+2}

B. Mn^{+2}

C. Cr^{+3}

D. V^{+3}

Answer: B

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2. The substances which contain species with unpaired electrons in their orbitals behave as paramagnetic substances. Such substances are weakly attracted by the magnetic field. The paramagnetism is expressed in terms of magnetic moment. The magnetic moment is related to the number of unpaired electrons according to the following relation : Magnetic moment, $\mu = \sqrt{n(n+2)}$ B.M.

Where .n. = number of unpaired electrons. B.M. stands for Bohr magneton, a unit of magnetic moment.

An ion of a d-block elements has magnetic moment 5.92 B.M. Select the ion among the following.

A. Zn^{+2}

B. Sc^{+2}

C. Mn^{+2}

D. Cr^{3+}

Answer: C

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3. The substances which contain species with unpaired electrons in their orbitals behave as paramagnetic substances. Such substances are weakly attracted by the magnetic field. The paramagnetism is expressed in terms of magnetic moment. The magnetic moment is related to the number of unpaired electrons according to the following relation : Magnetic moment, $\mu = \sqrt{n(n+2)}$ B.M.

Where .n. = number of unpaired electrons. B.M. stands for Bohr magneton, a unit of magnetic moment.

Which of the following is diamagnetic ?

A. He^{2+}

B. Sc^{+2}

C. Mg^{+2}

D. O^{-2}

Answer: B

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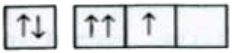
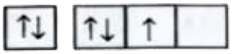
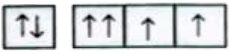
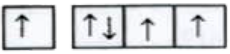
4. Match the following columns

Column-I	Column-II
A) Violation of Aufbau's rule	P) 
B) Violation of Pauli's exclusion principle	Q) 
C) Violation of Hund's rule	R) 
D) Violation of both Pauli's and Hund's rule	S) 

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5. The number of electrons in M-shell of an element with atomic number 24 is

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6. Find out the number of angular nodes in the orbital to which the last electron of Cr enter

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7. The orbital angular momentum of 3p electrons is $\sqrt{x}\frac{h}{2\pi}$. Then the value of x is _____.

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8. An ion Mn^{3+} at has the magnetic moment equal to 4.9 BM. What is the value of a ?

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9. The compound of vanadium has magnetic moment of 1.73 BM. The vanadium chloride has the formula:

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PRACTICE SHEET (EXERCISE-I) (LEVEL-I) (MAIN) (Straight Objective Type Questions)

1. Energy of a photon with a wave length of 450 nm is

A. 4.36×10^{-12} ergs

B. 4.36×10^{-13} ergs

C. 4.36×10^{-20} ergs

D. 4.36×10^{-11} ergs

Answer: A

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2. A wave has a frequency of $3 \times 10^{15} \text{sec}^{-1}$. The energy of that photon is

A. 1.6×10^{-12} erg

B. 3.2×10^{-11} erg

C. 2.0×10^{-11} erg

D. 3×10^{15} erg

Answer: C

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3. The wave length having wave number $4000 cm^{-1}$ is

A. $2.5 \mu m$

B. $250 \mu m$

C. $25 \mu m$

D. $25 nm$

Answer: A

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4. The energy of an electromagnetic radiation is 19.875×10^{-13} ergs. What is the wave number in cm^{-1} ? ($h = 6.625 \times 10^{-27}$ erg.sec, $c = 3 \times 10^{10} cm.\ \sec^{-1}$)

A. 1000

B. 10^6

C. 100

D. 10, 000

Answer: D

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5. The ratio of energies of photons with wavelengths $2000A^0$ and $4000A^0$ is

A. 1 : 4

B. 4 : 1

C. $1:2$

D. $2:1$

Answer: D

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6. The energy of an electromagnetic radiation is 3×10^{-12} ergs. What is its wavelength in nanometers ? ($h = 6.625 \times 10^{-27}$ erg.sec, $C = 3 \times 10^{10} cm.\ \sec^{-1}$

A. 400

B. 228.3

C. 3000

D. 662.5

Answer: D

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7. Energy equal to the mass of one electron is

A. 8.2×10^{-7} erg

B. 9.2×10^{-8} erg

C. 8.2×10^{-10} erg

D. 4.1×10^{-8} erg

Answer: A

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8. A light source of wavelength λ illuminates a metal and ejects photo-electrons with $(K.E.)_{\max} = 4eV$. Find the value of work function ?

A. 1eV

B. 2eV

C. 0.5 eV

D. None of these

Answer: D

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9. The ratio of slopes of $K_{\max}$ vs. v and V_0 vs. v curves in the photoelectric effect gives (v= frequency , $K_{\max}$ = maximum kinetic energy , V_0 = stopping potential)

A. charge of electron

B. planck.s constant

C. work function

D. the ratio of plant.s constant of electronic charge

Answer: A

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10. If the electron of a hydrogen atom is present in the first orbit. The total energy of the electrons is

A. $\frac{-e^2}{r}$

B. $\frac{-e^2}{r^2}$

C. $\frac{-e^2}{er}$

D. $\frac{-e^2}{2r^2}$

Answer: C

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11. The angular momentum of an electron present in the excited state of hydrogen is $1.5h/\pi$. The electron is present in

A. Third orbit

B. Second orbit

C. Fourth orbit

D. Fifth orbit

Answer: A

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12. According to Bohr.s theory, the angular momentum of electron in 5th orbit is

A. $2.5\frac{h}{\pi}$

B. $25\frac{h}{\pi}$

C. $1.0\frac{h}{\pi}$

D. $10\frac{h}{\pi}$

Answer: A

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13. When an electron with charge .e. and mass .m. moves with velocity .v. around the nucleus having nuclear charge .Z. in a circular orbit of radius .r., the potential energy of electron is

A. $\frac{Ze^2}{r}$

B. $\frac{Ze^2}{r^2}$

C. $\frac{-Ze^2}{r}$

D. $\frac{mv^2}{r}$

Answer: C

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14. The change in velocity when electron jumps from the first orbit to the second orbit is

A. Half its original velocity

B. Twice its original velocity

C. One fourth its original velocity

D. Equal to its original velocity

Answer: A

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15. The ratio of the radii of the first three orbits in an atom of hydrogen is

A. $1:4:9$

B. $9:4:1$

C. $1:2:3$

D. $3:2:1$

Answer: A

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16. The radius of hydrogen atom in the ground state is 0.53Å, the radius of Li^{2+} in the similar state is

A. $1.06A^{\circ}$

B. $0.265A^{\circ}$

C. $0.175A^{\circ}$

D. $0.53A^{\circ}$

Answer: C

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17. No of revolutions made by the electron in one sec in 2^{nd} orbit of Be^{3+}

A. 1.31×10^{16}

B. 2.13×10^{16}

C. 1.23×10^{15}

D. 2.68×10^{14}

Answer: A

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18. An electron is revolving in the 2^{nd} orbit of He^{+} ion. To this if 12.1 eV of energy supplied. Then to which orbit it will be excited.

A. 6

B. 8

C. 4

D. 2

Answer: A

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PRACTICE SHEET (EXERCISE-I) (LEVEL-II) (ADVANCED) (Straight Objective Type Questions)

1. A beam of specific kind of particles of velocity 2.1×10^7 m/s is scattered by a gold (z = 79) nucleli, Find out specific charge (charge/mass) of this particle if the distance of closet approach is 2.5×10^{-14} m.

A. 4.84×10^7 C/kg

B. 4.84×10^{-7} C/kg

C. 2.42×10^7 C/kg

D. 3×10^{-12} C/kg

Answer: A

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2. Particle nature of electron is proved by

A. Radioactivity

B. Cathode ray experiment

C. Rutherford.s α -scattering experiment

D. Interference of electron beams

Answer: B

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3. The photoelectric work function for a metal surface is 4.125eV. The cut - off wavelength for this surface is

A. energy of incident photons is 4eV

B. energy of incident photons is 1eV

C. photoelectric current increases when we use photons of high frequency

D. energy of incident photons is 3eV

Answer: A

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4. Select the incorrect statement :

A. K.E. of photo-electron does not depend upon the wavelength of incident radiation

B. Photoelectric current depends on intensity of incident ratiation and on frequency

C. Stopping Potential depends on frequency of radiation and not on intensity

D. photoelectric current increases when we use photons of high frequency

Answer: A

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5. The total energy of an electron in the first excited state of hydrogen atom is -3.4eV. What is the kinetic energy of the electron in this state ?

A. 2.55 eV

B. 4.25 eV

C. 11.25 eV

D. 19.55 eV

Answer: D

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6. Uncertainity in position of a minute particle of mass 25 g in space is $10^{-5}m$. What is the uncertainity in its velocity (in ms^{-1}) ? $\left(h = 6.6 \times 10^{-34}Js\right)$

A. 23.5

B. 26.9

C. 66.37

D. 73.1

Answer: B

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7. The number of solutions of $\sin x = \frac{x}{10}$ is

A. 10 hcx

B. $\frac{hc}{10x}$

C. $\frac{10}{hcx}$

D. $\frac{hcx}{10}$

Answer: C

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8. The radius or second stationary orbit in Bohr's atom is R. The radius of the third orbit in the same atom will be

A. R/3

B. 9R

C. R/9

D. 2.25 R

Answer: D

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9. The radius of which of the following orbit is same as that of the first Bohr.s orbit of hydrogen atom?

A. $H^+(n = 2)$

B. $Li^{2+}(n = 2)$

C. $Li^{2+}(n = 3)$

D. $Be^{3+}(n = 2)$

Answer: D

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10. The energy of an electron in the first energy level of H atom is -13.6 eV. The possible energy value (s) of the excited state (s) for the electron in He^+ is (are)

A. $-3.4eV$

B. $-4.2eV$

C. $-6.8eV$

D. $+6.8eV$

Answer: A

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11. What is the ninth ionization potential of fluorine atom ?

A. 13.6 eV

B. $9 \times 13.6eV$

C. $81 \times 13.6eV$

D. $100 \times 13.6Ev$

Answer: C

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12. Kinetic energy of electron in a mono electronic species is +1313 lJ/mole.

Then which of the following statements are correct

(I) The electron is present in the 2^{nd} orbit of He^{+} ions

(II) The electron is present in the 2^{nd} orbit of H atom

(III) The electron is present in the 3^{rd} orbit of Li^{+2} ion

(IV) The electron is present in the 4^{th} orbit of He^{+} ion

A. I and II

B. II and III

C. I and III

D. III and IV

Answer: C

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13. Ionisation energy of He^{+} is 19.6×10^{-18}J atom^{-1} The energy of the first stationary state of Li^{2+} is

A. $-4.41 \times 10^{-18} J.\ \text{atom}^{-1}$

B. $-4.41 \times 10^{-17} J.\ \text{atom}^{-1}$

C. $-4.41 \times 10^{-16} J.\ \text{atom}^{-1}$

D. $8.72 \times 10^{-18} J.\ \text{atom}^{-1}$

Answer: B

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LIST-I	LIST-II
A) Work	1) Extensive property
B) Enthalpy	2) Intensive property
C) Temperature	3) State variable
D) P, V, T and n	4) Path function

14. The correct match is

The correct match is

A.
A	B	C	D
4	3	2	1

B.
A	B	C	D
3	4	1	2

C.
A	B	C	D
2	1	4	3

D.
A	B	C	D
3	4	2	1

Answer: B

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15. The ionisation potential of Hydrogen is 2.17×10^{-11} erg/atom. The energy of the electron in the second orbit of the hydrogen atom is

A. $-\frac{2.17 \times 10^{-11}}{2}$ erg/atom

B. $-\frac{2.17 \times 10^{-11}}{2^2}$ erg/atom

C. $-\frac{2.17 \times 10^{-17}}{2^2}$ erg/atom

D. $-\frac{2.17 \times 10^{11}}{2^2}$ erg/atom

Answer: B

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16. (A) : In an atom the velocity of electron as it moves into higher orbits keeps on decreasing

(R) : Velocity of electron is inversely proportional to the radius of orbit

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: C

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17. If the first excitation potential of a hypothetical hydrogen like atom is 15 V, then the third excitation potential of the atom is

A. 10.2 V

B. 12 V

C. 14 V

D. 16 V

Answer: B

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18. In an atom two electrons move around the nucleus in circular orbits of radii R and 4R. The ratio of the time taken by them to complete one

revolution is

A. $1:4$

B. $2:1$

C. $1:4$

D. $1:8$

Answer: C

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19. In Bohr.s model of hydrogen atom, the ratio between the period of revolution of an electron in orbit n=1 to the period of the electron in the orbit n=2 is

A. $1:2$

B. $2:1$

C. $1:4$

D. $1:8$

Answer: D

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20. What is the ratio of the time periods $\left(T_1/T_2\right)$ on second orbit of H atom to 3rd orbit of He^+

A. $8/27$

B. $32/27$

C. $27/32$

D. $27/8$

Answer: B

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21. For a hypothetical hydrogen like atom, the potential energy of the system is given by U(r) = $\frac{-Ke^2}{r^3}$,where r is the distance between the two particles, If Bohr.s model of quantization of angular momentum is applicable then velocity of particle is given by:

A. $v = \frac{n^2h^3}{Ke^2 8\pi^3 m^2}$

B. $v = \frac{n^3h^3}{8Ke^2 8\pi^3 m^2}$

C. $v = \frac{n^3h^3}{Ke^2 8\pi^3 m^2}$

D. $v = \frac{n^2h^3}{24Ke^2 8\pi^3 m^2}$

Answer: C

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22. A small particle of mass m moves in such a way that the potential energy U = ar^2 where a is a constant and r is the distance of the particle from the origin. Assuming Bohr's model of quantization of angular momentum and circular orbits, find the radius of n^{th} allowed orbit.

A. n^2

B. n

C. $\sqrt{n}$

D. $\frac{1}{\sqrt{n}}$

Answer: C

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23. The velocity of an electron in excited state of H-atom is 1.093×10^6 m/s, what is the circumference of this orbit?

A. 3.32×10^{-10} m

B. 6.64×10^{-10}m

C. 13.30×10^{-10}

D. $13.28 \times 10^{-8}m$

Answer: C

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24. A hydrogen-like atom (atomic number Z) is in a higher excited state of quantum number n. This excited atom can make a transition to the first excited state by successively emitting two photons of energies 10.20 eV and 17.00 eV respectively. Alternatively the atom from the same excited state can make a transition to the second excited state by snccessively emitting two photons of energies 4.25 eV and 5.95 eV respectively. Determine the values of n and Z (ionization energy of hydrogen atom = 13.6 eV)

A. 1

B. 2

C. 3

D. 4

Answer: C

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25. If the lowest energy X-rays have $\lambda = 3.055 \times 10^{-8} m$, estimate the minimum difference in energy between two Bohr.s orbits such that an electronic transition would correspond to emission of an X-ray. Assuming that the electrons in other shells exert no influence, at what Z(minimum) would a transition from the second energy level to the first result in the emission of an X-ray ?

A. 1

B. 2

C. 3

D. 4

Answer: B

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26. Choose the correct statement (s)

(i) The energy of an electron in an atom is always negative, because it is negatively charged.

(ii) The charge of an electron in an atom is positive

(iii) When an electron is at an infinite distance from the nucleus so that there is no electrical interaction , then orbitarily the energy of electron is taken to be zero

(iv) As the electron moves closer to the nucleus, energy is released and so its energy becomes less than zero i.e., negative.

A. all are correct

B. iii and iv are correct

C. ii is correct

D. No statement is correct

Answer: B

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27. When an electron makes a transition from (n + 1) state to n^{th} state, the frequency of emitted radiations is related to 'n' according to $(n > > 1)$

A. $v = \frac{2cRz^2}{n^3}$

B. $v = \frac{cRZ^2}{n^4}$

C. $v = \frac{cRZ^2}{n^4}$

D. $v = \frac{2cRZ^2}{n^2}$

Answer: A

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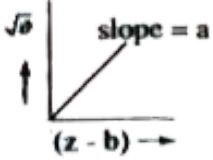
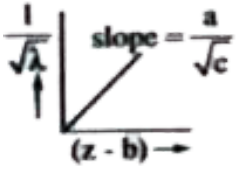
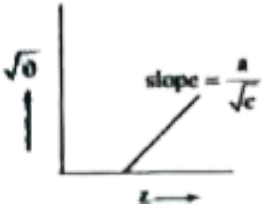
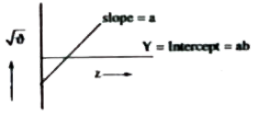
PRACTICE SHEET (EXERCISE-I) (LEVEL-II) (ADVANCED) (More than One correct answer Type Questions)

1. Which of the following graphs represents Moseley.s Law ?

A. 

B. 

C. 

D. 

Answer: A::B::D

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2. Describe the Rutherford's alpha particle scattering experiment. What are the conclusions of this experiment.

A. Distance of closest approach is of the order of 10^{14}m

B. At the distance of closest approach, the kinetic energy of the α-particle is transformed into electrostatic potential

C. The α - praticles moving towards the nucleus will stop and start retracing its path

D. Maximum number of a, particles went straight through metal foil

Answer: A::B::C::D

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3. The kinetic energy (KR) of photoelectron emitted on irradiating a metal surface with frequency . ϑ. is related by $KE = h\vartheta - IE$. The plots of K.E vs incident frequency is a straight line which shows

A. slope equal to planck.s constant

B. intercept on x-axis equal to the product of threshold frequency & planck.s constant

C. with extrapolated on y-axis equal to IE

D. with intercept on x-axis equal to threshold frequency

Answer: A::C::D

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PRACTICE SHEET (EXERCISE-I) (LEVEL-II) (ADVANCED) (Linked Comprehension Type Questions)

1. An electron in an excited state of hydrogen atom absorbs 2.5 times the energy needed to unbound the electron and moves with a wavelength of 5.416 Å $\left(h = 6.6 \times 10^{-34} \text{Js}\right)$

The kinetic energy of the electron is

A. 3.4 eV

B. 5.1 eV

C. 13.6 eV

D. 10.2 eV

Answer: B

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2. An electron in an excited state of hydrogen atom absorbs 2.5 times the energy needed to unbound the electron and moves with a wavelength of 5.416 Å $\left(h = 6.6 \times 10^{-34} \text{Js}\right)$

The energy absorbed by the electron is

A. 8.5 eV

B. 3.4 eV

C. 68 eV

D. 3.78 eV

Answer: A

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3. An electron in an excited state of hydrogen atom absorbs 2.5 times the energy needed to unbound the electron and moves with a wavelength of 5.416 Å $\left(h = 6.6 \times 10^{-34} \text{Js}\right)$

The electron was originally in

A. n = 3

B. a=4

C. n=5

D. n=2

Answer: D

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4. Atoms more complicated than hydrogen have more than one proton in their nucleus. Let Z stands for the number of protons in a nucleus. Also imagine that an atom loses all but one of its electrons so that it changes into a positively charged ion with just one electron. Bohr.s formula for the

energy levels of the hydrogen atom can easily be changed to apply to such ions. It becomes $E_m = \frac{-Z^2e^4m_e}{8\varepsilon_0^2h^2n^2}$, where m= mass of electron , e= change of electron, n = orbit number.

The ionization potential of Het in ground state is

A. $2427KJmol^{-1}$

B. $5249KJmol^{-1}$

C. $7116KJmol^{-1}$

D. $9811KJmol^{-1}$

Answer: A

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5. Atoms more complicated than hydrogen have more than one proton in their nucleus. Let Z stands for the number of protons in a nucleus. Also imagine that an atom loses all but one of its electrons so that it changes into a positively charged ion with just one electron. Bohr.s formula for the

energy levels of the hydrogen atom can easily be changed to apply to such ions. It becomes $E_m = \frac{-Z^2 e^4 m_e}{8\varepsilon_0^2 h^2 n^2}$, where m= mass of electron , e= change of electron, n = orbit number.

The ionization potential of Het in ground state is

A. 4.358×10^{-18} J/atom

B. -7.112×10^{-18} J/atom

C. -1.743×10^{-17} J/atom

D. -8.279×10^{-18} J/atom

Answer: C

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6. Atoms more complicated than hydrogen have more than one proton in their nucleus. Let Z stands for the number of protons in a nucleus. Also imagine that an atom loses all but one of its electrons so that it changes into a positively charged ion with just one electron. Bohr.s formula for the

energy levels of the hydrogen atom can easily be changed to apply to such ions. It becomes $E_m = \frac{-Z^2 e^4 m_e}{8\varepsilon_0^2 h^2 n^2}$, where m= mass of electron , e= change of electron, n = orbit number.

The ionization potential of Het in ground state is

A. 4.358×10^{-18} J/atom

B. 2.179×10^{-18} J/atom

C. 3.4864×10^{-17} J/atom

D. 8.716×10^{-18} J/atom

Answer: C

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PRACTICE SHEET (EXERCISE-I) (LEVEL-II) (ADVANCED) (Matrix Matching Type Questions)

1. If in Bohr.s model, for uni electronic atom following symbols are used :

$r_{n,z}$ → Radius of n^{th} orbit with atomic number z. $U_{n.z}$ → Potential energy of e^-

$K_{n.Z}$ → Kinetic energy of e^-

$T_{n.Z}$ → Time period of revolution

Column-I	Column-II
A) $U_{1,2} : K_{1,1}$	P) 1 : 8
B) $r_{2,1} : r_{1,2}$	Q) –8 : 1
C) $V_{1,3} : V_{3,1}$	R) 9 : 1
D) $T_{1,2} : T_{2,2}$	S) 8 : 1

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2. Match the following

Column-I	Column-II
A) Orbital angular momentum of an Electron	P) $\sqrt{s(s+1)}\frac{h}{2\pi}$
B) Angular momentum of an electron in an orbit	Q) $\sqrt{n(n+2)}$
C) Spin angular momentum of an electron	R) $\frac{nh}{2\pi}$
D) Magnetic moment of atom	S) $\sqrt{l(l+1)}\frac{h}{2\pi}$

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3. Match the following

Column-I	Column-II
A) $\frac{K.E.}{P.E.}$	P) 2
B) P.E. + 2K.E.	Q) $-\frac{1}{2}$
C) $\frac{P.E}{T.E.}$	R) -1
D) $\frac{K.E.}{T.E.}$	S) 0

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PRACTICE SHEET (EXERCISE-I) (LEVEL-II) (ADVANCED) (Integer Type Questions)

1. The frequency of a radiation having a wave number of $2 \times 10^{14} cm^{-1}$ will be $x \times 10^{24} s^{-1}$ .Then the value of x is ____

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2. Energy required to stop the ejection of electrons from Cu-plate 0.27 eV. Calculate the work function (in eV) When radiation of λ= 235nm strikes the plate.

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3. Suppose 10^{-18}J of light energy is needed by the interior of the human eye to see an object. How many photon of green light (λ = 550nm) are needed to generate this amount of energy ?

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4. If the lowest energy X-rays have $\lambda = 3.055 \times 10^{-8} m$, estimate the minimum difference in energy between two Bohr.s orbits such that an electronic transition would correspond to emission of an X-ray. Assuming that the electrons in other shells exert no influence, at what Z(minimum) would a transition from the second energy level to the first result in the emission of an X-ray ?

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5. The work function (ϕ) of some metals is listed below. The number of metals which will show photoelectric effect when light of 300nm wavelength falls on the metal. The Metal is

Metal	Li	Na	K	Mg	Cu	Ag	Fe	Pt	W
ϕ(eV)	2.4	2.3	2.2	3.7	4.8	4.3	4.7	6.3	4.75

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6. The radius of the first orbit of hydrogen atom is 0.52×10^{-8} cm. The radius of the first orbit of He^{+} ion is 0.26×10^{-x} cm. Then the value of x is _____

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7. Ratio of the number of waves made by a Bohr electron in one complete revolution in n^{th} orbit and 2^{nd} orbit is 1.5. The value of n is_____

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8. 1 mole of photons, each of frequency $250s^{-1}$ would have approximately a total energy of _____ erg.

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9. If an electron in H-atom has an energy of -78.4 kcal/mole, the electron is present in__ orbit.

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PRACTICE SHEET (EXERCISE-II) (LEVEL-I) (MAIN) (Straight ObjectiveType Questions)

1. Which of the following expressions represents the spectrum of Balmer series (If n is the principal quantum number of higher energy level) in Hydrogen atom?

A. $\bar{\upsilon} = \frac{R(n-1)(n+1)}{n^2}$

B. $\bar{\upsilon} = \frac{R(n-2)(n+2)}{4n^2}$

C. $\bar{\upsilon} = \frac{R(n-1)(n+2)}{n^2}$

D. $\bar{\upsilon} = \frac{R(n-1)(n+1)}{4n^2}$

Answer: B

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2. (A) : Hydrogen has only one electron in its orbit but produces several spectral lines

(R) : There are many excited energy levels available in a sample of Hydrogen gas

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

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3. When electron jumps from 5^{th} energy level to 1^{st} energy level, to which series the spectral line belongs?

A. Balmer

B. Lyman

C. Paschen

D. Pfund

Answer: B

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4. When the electron in the .H. atom jumps from the fifth orbit to the second orbit, the spectral line emitted is found in

A. Visible region

B. Ultraviolet region

C. Near IR region

D. Far IR region

Answer: A

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5. A hydrogen atom in the ground state is excited by monochromatic ratiation of wavelength $\lambda\text{Å}$. The resulting spectrum consists of maximum 15 different lines. What is the wavelength λ ? $\left(R_H = 109677.8cm^{-1}\right)$

A. 937.3Å

B. 1025Å

C. 1236Å

D. 1120Å

Answer: A

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6. Let ϑ_1 be the frequency of the series limit of the Lyman series and ϑ_2 be the frequency of the first line of the Lyman series and ϑ_3 be the frequency of the series limit of Balmar series, then

A. $v_1 - v_2 = v_3$

B. $v_2 - v_1 = v_3$

C. $v_3 - \frac{1}{2}\left(v_1 + v_2\right)$

D. $v_1 + v_2 = v_3$

Answer: A

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7. An excited hydrogen atom emits a photon of wavelength t while returning to the ground state. If R is the Rydberg.s constant, then the quantum number n of the excited state is

A. $\sqrt{\lambda R}$

B. $\sqrt{\lambda R - 1}$

C. $\sqrt{\frac{\lambda R}{\lambda R - 1}}$

D. $\sqrt{\lambda R(\lambda R - 1)}$

Answer: C

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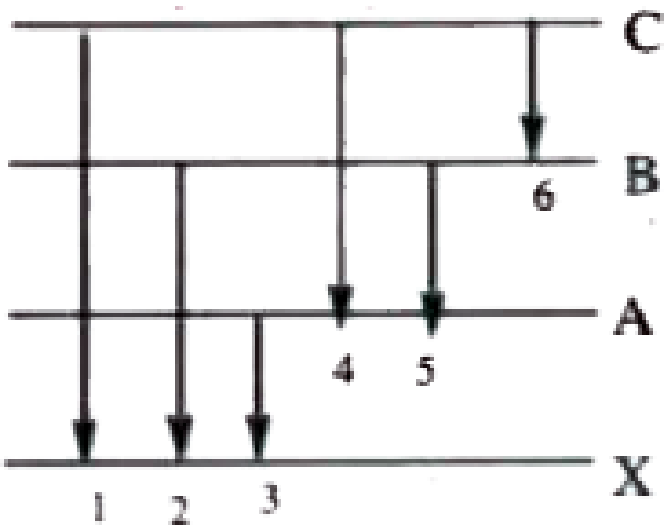
8. he figure indicates the energy level diagram of an atom and the origin of six spectral lines in emission (e.g. line no. 5 arises from the transition from level B to A). Which of the following spectral lines will also occur in

the absorption spectrum ?



A. 4,5,6

B. 1,2,3,4,5,6

C. 1,4,6

D. 1,2,3

Answer: B

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9. In hydrogen spectrum L_α line arises due to transition of electron from the orbit n=3 to the orbit n=2. In the spectrum of singly ionized helium there is a line having the same wavelength as that of the L_α line. This is due to the transition of electron from the orbit:

A. $n = 3 \rightarrow n = 2$

B. $n = 2 \rightarrow n = 1$

C. $n = 5 \rightarrow n = 3$

D. $n = 6 \rightarrow n = 4$

Answer: D

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10. A hydrogen atom in an excited state emits a photon which has the longest wavelength of the Paschen series. Further emissions from the atom cannot include the

A. longest wavelength of the Lyman series

B. second longest wavelength of the Lyman series

C. longest wavelength of the Balmer series

D. second longest wavelength of the Balmer series

Answer: D

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11. If λ_L, λ_M and λ_N an are the wave lengths of electron in L, M, N energy levels of H-atom respectively.

What is their decreasing order:

A. $\lambda_L > \lambda_M > \lambda_N$

B. $\lambda_L < \lambda_M < \lambda_N$

C. $\lambda_L > \lambda_M < \lambda_N$

D. $\lambda_L < \lambda_M > \lambda_N$

Answer: B

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12. The de Broglie wavelength associated with a moving particle of fixed mass is inversely proportional to

A. Its kinetic energy

B. Square root of its kinetic energy

C. Square of its kinetic energy

D. Cube of its kinetic energy

Answer: B

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13. The de Broglie wavelength of a particle with mass 1 g and velocity 100 m/s is

A. 6.63×10^{-33}

B. 6.63×10^{-34}

C. 6.63×10^{-35} m

D. $6.63 \times 10^{-36} m$

Answer: A

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14. The de Broglie wave length of a riffle bullet of mass 2 grams moving with a velocity of 2m/sec of

A. $\frac{6.6 \times 10^{-34}}{2 \times 2} m$

B. $\frac{6.6 \times 10^{-27}}{2 \times 10^{-3} \times 2} cm$

C. $\frac{6.6 \times 10^{-34}}{2 \times 10^{-3} \times 2} m$

D. $\frac{6.6 \times 10^{-27}}{2 \times 2} m$

Answer: C

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15. A cricket ball of mass 0.5 kg is moving with a velocity of $100 ms^{-1}$, the wavelength associated with its motion is

A. $13.25 \times 10^{-26} m$

B. 13.25×10^{-34} m

C. $13.25 \times 10^{-36} m$

D. $6.6 \times 10^{-34} m$

Answer: C

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16. If the Planck's constant $h = 6.6 \times 10^{-34} Js$, the de-Broglie wave length of a particle having momentum of $3.3 \times 10^{-24} kg.\, ms^{-1}$ will be

A. $2 \times 10^{-10} m$

B. 1×10^{-15} m

C. 10^{5} m

D. $4 \times 10^{-10} m$

Answer: A

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17. If the wavelength of the electron is numerically equal to the distance travelled by it in one second, then

A. $\lambda = \sqrt{\frac{h}{m}}$

B. $\lambda = \frac{h}{p^2}$

C. $\lambda = \frac{h}{m}$

D. $\lambda = \sqrt{\frac{h}{p}}$

Answer: A

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18. For an electron to have the same de Broglie wave length as that of a Deuteron, its velocity should be --- times that of Deuteron

A. 1836

B. $1/1836$

C. 3672

D. $1/3672$

Answer: C

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19. A hydrogen molecule and helium atom are moving with the same velocity. Then the ratio of their de Broglie wavelength is

A. $1:1$

B. $1:27$

C. $2:1$

D. $2:3$

Answer: C

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20. Wavelength of an electron is 5Å Velocity of the electron is

A. 1.45×10^{8} cm/s

B. 1.6×10^{-8} cm/s

C. 3.2×10^{-27} cm/s

D. 3.2×10^{27}cm/s

Answer: A

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21. The wavelength of radiation required to remove the electron of hydrogen atom $\left(\text{Ionisation energy } 21.7 \times 10^{-12}\text{erg}\right)$ from n=2 orbit to $n = \infty$is

A. 3.664×10^{-4} cm

B. 3.66×10^{-5} cm

C. 3.66×10^{-6} cm

D. 3.664×10^{-7} cm

Answer: B

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22. An electron of velocity 'x' is found to associate with a wave. The velocity to be possessed by the neutron to have half the de-Broglie wavelength possessed by electron is

A. $\frac{x}{1840}$

B. $\frac{x}{1480}$

C. $\frac{x}{920}$

D. $1840x$

Answer: C

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23. Calculate the wave length of an electron moving with a velocity of $2.05 \times 10^7 ms^{-1}$.

A. Increases with the increase of the velocity of the electron

B. Does not depend upon the velocity of the electron

C. Decreases with the increase of velocity of the electron

D. Is equal to zero

Answer: C

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24. Choose the correct statement(s)

A. de-Broglie waves are not radiated into space

B. The wavelength of material particles decreases if value of .m. increases

C. The circumference of Bohr.s orbit is equal to whole number multiple of the wavelength of the electron wave

D. All are true

Answer: B

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25. Choose the incorrect statement

A. Light exhibit wave particle duality, but electron does not

B. Light - travels with speed of 3×10^8 m/s and photons have zero rest mass

C. Electrons always travel at speeds less than speed of light and have a non zero rest mass

D. Light and electron both exhibit wave-particle duality

Answer: A

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26. A particle of mass one microgram is confined to move along one direction (x-axis) within a region 1 mm is extension. What is the uncertainity in its velocity ?

A. $3.313 \times 10^{-20} cm^{-1}$

B. $5.012 \times 10^{-20} cm^{-1}$

C. $8.325 \times 10^{-20} cm^{-1}$

D. $5.27 \times 10^{-21} cm^{-1}$

Answer: D

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27. Which of the following statement is wrong

A. The product of uncertainty in postion and uncertainty in moments is greater than or equal to $\frac{h}{2\pi}$

B. If the position of a particle is measured accurately, there will be more error in measurement of momentum

C. If the momentum of a particle is measured accurately, there will be more error in measurement of position

D. The position and velocity of a particle can be simultaneously known with accuracy

Answer: D

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28. According to Schrodinger model, nature of electron in an atom is as

A. Particles only

B. Wave only

C. Both simultaneously

D. Sometimes waves and sometimes particles

Answer: C

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29. Choose the correct statement

A. Electronic energy is positive

B. Ψ^2 represents the probability of finding an electron per unit volume

C. Ψ represents the probability of finding an electron

D. none of the above is correct

Answer: B

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30. The probability of occurrence of an event is $\frac{2}{5}$ and the probability of non occurrence of another event is $\frac{3}{10}$ if these events are independent then the probability that only one of the two events occurs is

A. also independent of anlges

B. spherically symmetric

C. both (1) and (2) are correct

D. both (1) and (2) are incorrect

Answer: C

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31. The density of electron cloud of the orbital d_{xy} in yz plane is

A. Zero

B. Maximum

C. Not determined

D. Infinite

Answer: A

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32. The probability of finding an electron in p_y orbital along the x-axis is

A. Maximum

B. Zero

C. Not determined

D. Infinite

Answer: B

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33. The number of nodes and nodal planes in 4p orbital are respectively

A. 2, 1

B. 1, 2

C. 2, 3

D. 3, 2

Answer: A

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34. The number of nodal planes .d. orbital has

A. Zero

B. one

C. two

D. three

Answer: C

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PRACTICE SHEET (EXERCISE-II) (LEVEL-II) (ADVANCED) (Straight ObjectiveType Questions)

1. What electronic transition in Li^{2+} produces the radiation of the same wave length as the first line in the Lyman series of hydrogen?

A. n = 4 to n = 2

B. n = 9 to n = 6

C. n = 9 to n = 3

D. n = 6 to n = 3

Answer: D

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2. The wavelength of the spectral line, for the transition n = 2 to n=1 in the hydrogen emission spectrum is .X.. Which of the following spectral line also has a wavelength of X

A. . H_{α}. line in the Balmer series of spectrum of .H.

B. . H_{β}. line in the Balmer series of spectrum of .H.

C. . H_{α}. line in the Balmer series of spectrum of .He^(+).

D. . H_{β}. line in the Balmer series of spectrum of .He^(+).

Answer: D

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3. The ratio of the wave lengths of the first line in the Lyman series of the spectrum of Hydorgen atom and the first line in the Balmer series of the spectrum of He^{+} is

A. $20/27$

B. $27/20$

C. $27/5$

D. $5/27$

Answer: A

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4. In Bohr series of lines of hydrogen spectrum, the third line from the red end corresponds to which one of the following inter - orbit jumps of the electron for Bohr orbits in an atom of hydrogen ?

A. $3 \rightarrow 2$

B. $5 \rightarrow 2$

C. $4 \rightarrow 1$

D. $2 \rightarrow 5$

Answer: B

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5. In a certain electronic transition from the quantum level, 'n' to the ground state in atomic hydrogen in one or more steps, no line belonging to the Bracket series is observed. What wave number may be observed in the Balmer series ? (R = Rydberg Constant)

A. $\frac{8R}{9}, \frac{5R}{36}$

B. $\frac{3R}{16}, \frac{8R}{9}$

C. $\frac{5R}{36}, \frac{3R}{16}$

D. $\frac{3R}{4}, \frac{3R}{16}$

Answer: C

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6. The minimum and maximum values of wavelength in the Lyman series of a H atom are, respectively

A. 364.3 nm and 653.4 nm

B. 91.2 nm and 121.5 nm

C. 41.2 nm and 102.6 nm

D. 9.12 nm and 121.5 nm

Answer: B

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7. The ratio of wavelength values of series limit lines $\left(n_2 = \infty\right)$ of Balmer series and Paschen serie are

A. $4:9$

B. $9:4$

C. $2:3$

D. $3:2$

Answer: A

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8. The wavelength of the first member of the Balmer series in hydrogen spectrum is $x\text{Å}$. Then the wave length $(\text{in } \text{Å})$ of the first member of Lyman series in the same spectrum

A. $\frac{5}{27}x$

B. $\frac{4}{3}x$

C. $\frac{27}{5}x$

D. $\frac{5}{36}$ x

Answer: A

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9. The number of unpaired electrons present in the first excited state of chlorine atom is

A. 15

B. 10

C. 6

D. 3

Answer: C

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10. If $\lambda = C_2\left[\frac{n^2}{n^2 - n^2}\right]$ for Balmer series , what is the value of C_2 ?

A. $\frac{2}{R_H}$

B. $2R_H$

C. $4R_H$

D. $\frac{4}{R_H}$

Answer: D

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11. The ratio of the wavelength of the last line of Balmer series and the last line of Lyman series is :

A. $2.5:1$

B. $3.5:1$

C. $4.5:1$

D. $5.5:1$

Answer: A

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12. the energy of photon is equal to the kinetic energy of a porton,If λ_1 is the De-Broglie wavelength of a proton,λ_2 the wavelength associated with the proton and if the energt of the protonis E, then $\left(\lambda_1/\lambda_2\right)$ is proportional to

A. $\lambda_1 + \lambda_2 = \lambda_3$

B. $\frac{1}{\lambda_3} = \frac{1}{\lambda_1} + \frac{1}{\lambda_2}$

C. $\lambda_3 = \sqrt{\lambda_1\lambda_2}$

D. $\frac{2}{\lambda_3} = \frac{1}{\lambda_1} + \frac{1}{\lambda_2}$

Answer: B

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13. The value of $\left(n_2 + n_1\right)$ and $\left(n_2^2 - n_1^2\right)$ for He^+ ion in atomic spectrum are 4 and 8 respectively . The wavelength of emitted photon when electron jump from n_2 to n_1 is

A. $\frac{32}{9}R_H$

B. $\frac{9}{32}R_H$

C. $\frac{9}{32}R_H\Big)$

D. $\frac{32}{9}R_H\Big)$

Answer: C

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14. Number of possible spectral lines which may be emitted in Brackett series in H atom, if electrons present in 9^{th} excited level returns to ground level, are

A. 21

B. 6

C. 45

D. 5

Answer: B

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15. If radiation correcsponding to second line of "Balmer series" of Li^{2+} ion, knocked out electron from first excited state of H-atom, then kinetic energy of ejected electron would be:

A. 2.55 eV

B. 4.25 eV

C. 11.25 eV

D. 19.55 eV

Answer: D

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16. In a collection of H-atoms, all the elctrons jump from n = 5 to ground level finally (directly or indirectly), without emitting any line in Balmer series. The number of possible different photons are

A. 10

B. 8

C. 7

D. 6

Answer: D

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17. Balmer gave an equation for wavelength of visible region of H-spectrum as $\bar{\nu} = \frac{n^2 - 4}{Kn^2}$ where n = principal quantum number of energy level, K = constant terms.of R (Rydberg constant). The value of K in terms of R is:

A. R

B. $\frac{R}{2}$

C. $\frac{4}{R}$

D. $\frac{5}{R}$

Answer: C

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18. If the velocity of the electron is $1.6 \times 10^{6} \mathrm{ms}^{-1}$, calculate the de-Broglie wavelength associated with this electron .

A. 3.2×10^{-7} m

B. 2×10^{-7} m

C. $4 \times 10^{-7} m$

D. 0.5×10^{-8} m

Answer: A

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19. An α-particle and a proton are accelerated from rest by the same potential, thenthe ratio of their de-Broglie wavelength is

A. $\sqrt{2}$

B. $\frac{1}{\sqrt{2}}$

C. $2\sqrt{2}$

D. 2

Answer: C

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20. If λ_1 and λ_2 denote the de-Broglie wavelength of two particles with same masses but charges in the ratio of 1 : 2 after they are accelerated from rest through the same potential difference, then

A. $\lambda_1 = \lambda_2$

B. $\lambda_1 < \lambda_2$

C. $\lambda_1 > \lambda_2$

D. none of these

Answer: C

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21. An electron, a proton and an alpha particle have kinetic energies of 16E, 4E and E respectively. What is the qualitative order of their de Broglie wavelengths?

A. $\lambda_e > \lambda_p = \lambda_a$

B. $\lambda_p = \lambda_a > \lambda_e$

C. $\lambda_p > \lambda_e > \lambda_a$

D. $\lambda_a > \lambda_e > \ > \lambda_p$

Answer: A

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22. In the light of Heisenburg uncertainty principle, which radiation photon can locate the position of electron in an atom most precisely?

A. γ -ray

B. Visible light

C. X-ray

D. Microwave

Answer: A

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23. Angular momentum of an orbit of a H like species in which the electron revolving is 4.2197×10^{-34} JS. The number of waves made by the

electron in that orbit.

A. 6

B. 4

C. 8

D. 2

Answer: B

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24. The speed of a Helium atom is equal to its root mean square speed at 27° C. The approximate wavelength of this atom will be equal to :

A. 1.37×10^{5} cm/sec

B. 1.20×10^{-39}cm/sec

C. 2.0×10^{-39} cm/sec

D. 3.5×10^{-39} cm/sec

Answer: A

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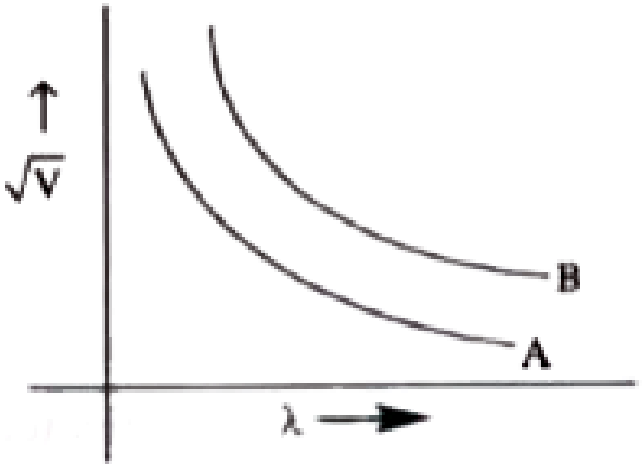
25. $\sqrt{V}$ of two particles A and B are plotted against de-Broglie wavelengths. where V is the potential on the particles. Which of the following relation is correct about the mass of particles?



A. $m_A = m_B$

B. $m_A > m_B$

C. $m_A < m_B$

D. $m_A < m_B$

Answer: B

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26. The de-Brogilc wavelength of an electron in the first Bohr orbit is

A. $\lambda = \frac{1.23}{\sqrt{m}}$

B. $\lambda = \frac{1.23}{\sqrt{h}} m$

C. $\lambda = \frac{1.23}{\sqrt{V}}$ nm

D. $\lambda = \frac{1.23}{V}$

Answer: C

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27. The engergy of separation of an electron in a Hydrogen like atom in excited state is 3.4 eV. The de-Broglie wave length (in A°) associated with the electron is:

A. 3.33

B. 6.66

C. 13.31

D. 16.65

Answer: B

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28. The size of a microscopic particle is 1 micron and its mass is $6 \times 10^{-13} g$. If its position may be measured to within 0.1% of its size, the uncertainity in velocity (in cm^{-1}) is approximately

A. $\frac{10^{-7}}{4\pi}$

B. $\frac{10^{-5}}{4\pi}$

C. 10^{-5}

D. 10^{-8}

Answer: A

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29. The uncertanities in then velocities of two particle A and B are 0.05 and $0.02 ms^{-1}$ respectively.The mass of B is five times to that of A.What is the ratio of uncertainities $\left[\frac{\Delta x_A}{\Delta x_B}\right]$ in their positions?

A. 2

B. 0.25

C. 4

D. 1

Answer: A

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30. The uncertainty in the position of an electron $\left(\text{mass } 9.1 \times 10^{-28} g\right)$ moving with a velocity of $3.0 \times 10^{4} cm^{-1}$ accurate up to $0.011\ \%$, will be

A. 0.192 cm

B. 7.68 cm

C. 0.175 cn

D. 3.84 cm

Answer: C

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31. Alveoli are tiny sacs in the lungs whole average diameter is 5×10^{-10}m, an oxygen molecule (mass 5.6×10^{-25}kg) is trapped in a sac the

uncertainty in the velocity of oxygen molecule within a sac is:

A. 2.0 m/sec

B. 3.0 m/sec

C. 1.0 m/sec

D. 4.0 m/sec

Answer: A

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32. The mass of a particle is $10^{10}g$ and its radius is $2 \times 10^{-4}cm$. If its velocity is $10^{-6}cm\sec^{-1}$ with 0.0001% uncertainty in measurement, the uncertainty in its position is :

A. $5.2 \times 10^{-8}m$

B. $5.2 \times 10^{-7}m$

C. $5.2 \times 10^{-6}m$

D. 5.2×10^{-9} m

Answer: A

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33. An electron is allowed to move freely in a closed cubic box of length of side 10 cm. The uncertainty in its velocity will be :

A. a. $3.35 \times 10^{-4} m\sec^{-1}$

B. b. $5.8 \times 10^{-4} m\sec^{-1}$

C. c. $4 \times 10^{-5} m\sec^{-1}$

D. d. $4 \times 10^{-6} m\sec^{-1}$

Answer: A

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34. For an e in a hydrogen atom, the wave function Ψ is proportional to e^{-r/a_0} where a_0 as Bohr.s radius, what is the ratio of probability of finding the e^- at the nucleus to the probability of finding it at a_0, the wave function is $\Psi = \frac{1}{\sqrt{\pi}}\left(\frac{1}{a_0}\right)^{\frac{3}{2}} e^{-r/a_0}$

A. e

B. e^2

C. $1/e^2$

D. Zero

Answer: B

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PRACTICE SHEET (EXERCISE-II) (LEVEL-II) (ADVANCED) (More than One correct answer Type Questions)

1. Which of the following transitions are allowed in the normal electronic emission spectrum of an atom?

A. $2s \rightarrow 1s$

B. $2p \rightarrow 1s$

C. $3d \rightarrow 2p$

D. $5d \rightarrow 2s$

Answer: A::B::C::D

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2. Which of the following are wrong statements ?

A. de Broglie relation is applicable only to microscopic particles

B. The uncertainities in measurements are due to the imperfections of the techniques used to measure them.

C. The wave function Ψ always has positive values.

D. There is some probability of finding the electron even outside the boundary of the orbital.

Answer: A::B::C::D

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3. According to de Broglie

A. a moving electron possess wave character

B. light posses particle character

C. a moving proton posess wave character

D. all moving particles possess wave character

Answer: A::C::D

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4. In which of the following conditions the de Broglie wavelentgh of particle A will be less than that of particle B $\left(m_A > m_B\right)$?

A. Linear momentum of these particles are same

B. Move with same speed

C. Move with same kinetic energy

D. Have fallen through same height

Answer: B::D

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5. Select the correct statements about the wave function Ψ.

A. Ψ must be real

B. Ψ must be single values, continuous

C. Ψ has no physical significance

D. Ψ gives the probability of finding the electrons

Answer: A::B::C::D

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6. The probability of finding an electron in the P_x orbital is

A. zero at nucleus

B. the same on all the sides around nucleus

C. zero on the z-axis

D. maximum on the two opposite sides of the nucleus along the x-axis

Answer: A::C::D

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7. Excited atoms emit radiations consisting of only certain discrete frequencies or wavelengths. In spectroscopy it is often more convenient to use frequencies or wave numbers than wavelength because frequencies and wave numbers are proportional to energy and spectroscopy involves transitions between different energy levels. The line spectrum shown by a mono electronic excited atom (a finger print of an atom) is called atomic spectrum. $\frac{1}{\lambda} = Z^2R\left[\frac{1}{n_1^2 - \frac{1}{n_2^2}}\right.$

The ratio of wavelength for II line of Balmer series and I line of Lyman series is

A. 1

B. 2

C. 3

D. 4

Answer: D

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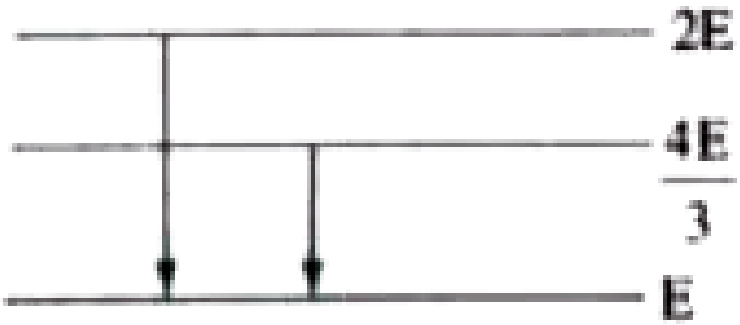
8. Excited atoms emit radiations consisting of only certain discrete frequencies or wavelengths. In spectroscopy it is often more convenient to use frequencies or wave numbers than wavelength because frequencies and wave numbers are proportional to energy and spectroscopy involves transitions between different energy levels. The line spectrum shown by a mono electronic excited atom (a finger print of an atom) is called atomic spectrum. $\frac{1}{\lambda} = Z^2R\left[\frac{1}{n_1^2 - \frac{1}{n_2^2}}\right.$

The given diagram indicates the energy levels of certain atom. When an electron moves from 2E level to E level, a photon of wavelength λ is emitted. The wavelength of photon emitted during its transition from $\frac{4E}{3}$

level to E level is



A. $\frac{\lambda}{3}$

B. $\frac{3\lambda}{4}$

C. $\frac{4\lambda}{3}$

D. 3λ

Answer: D

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9. The only e^- in the H-atom resides under ordinary conditions on the first orbit when energy is supplied, the e^- moves to higher energy shells depending upon the amount of energy absorbed. When an e emits

energy i.e., the e^- returns to the lowest energy state, from this Lyman, Balmer, Paschen, Bracket, Pfund series are there, so different spectral lines in the spectra of atoms correspond to different transitions of e^- s from higher to lower energy levels:

If the shortest wavelength of H atom in Lyinan series x, then longest wavelength in Balmer series of He^+ is

A. $\frac{36x}{5}$

B. $\frac{x}{4}$

C. $\frac{9x}{5}$

D. $\frac{5x}{9}$

Answer: C

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10. The only e^- in the H-atom resides under ordinary conditions on the first orbit when energy is supplied, the e^- moves to higher energy shells depending upon the amount of energy absorbed. When an e emits

energy i.e., the e^- returns to the lowest energy state, from this Lyman, Balmer, Paschen, Bracket, Pfund series are there, so different spectral lines in the spectra of atoms correspond to different transitions of e^- s from higher to lower energy levels:

The ratio of number of spectral lines obtained when an e^- s jumps from 7^{th} to ground to 6^{th} to 3^{rd}

A. 7

B. 3.5

C. 10

D. 2.5

Answer: B

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11. The only e^- in the H-atom resides under ordinary conditions on the first orbit when energy is supplied, the e^- moves to higher energy shells depending upon the amount of energy absorbed. When an e emits

energy i.e., the e^- returns to the lowest energy state, from this Lyman, Balmer, Paschen, Bracket, Pfund series are there, so different spectral lines in the spectra of atoms correspond to different transitions of e^- s from higher to lower energy levels:

In an hydrogen atom which of the following transition should be associated with highest absorption of energy

A. n = 1 to n = 4

B. n = 2 to n = 3

C. n = 4 to n = 1

D. n = 3 to n = 2

Answer: A

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12. It is not possible to determine precisely both the position and the momentum or velocity) of a small moving particle (e.g. electron , proton,

etc)

The above statements is known as :

A. de-Broglie.s principle

B. Pauli.s exclusion principle

C. Heisenberg.s Uncertainity principle

D. Aufbau principle

Answer: C

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13. It is not possible to determine precisely both the position and the momentum or velocity) of a small moving particle (e.g. electron , proton, etc)

The uncertainity in position and velocity of a particle are $10^{-10}m$ and $5.27 \times 10^{-24}ms^{-1}$ respectively, Calculate the mass of the particle. $\left(h = 6.625 \times 10^{-34}J - s\right)$

A. 0.099 kg

B. 1 kg

C. 2 kg

D. 10 kg

Answer: A

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14. It is not possible to determine precisely both the position and the momentum or velocity) of a small moving particle (e.g. electron , proton, etc)

Calculate the uncertainity in velocity of a cricket ball of mass 150 g if the uncertainity in its position is of the order of 1 Å $\left(h = 6.6 \times 10^{-34} kgm^2 s^{-1}\right)$

A. $3.8 \times 10^{-25} ms^{-1}$

B. $3.499 \times 10^{-24} ms^{-1}$

C. $3.8 \times 10^{-30} ms^{-1}$

D. $3.449 \times 10^{-30} ms^{-1}$

Answer: B

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15. If uncertainity in position is zero, the uncertainity in momentum of an electron will be

A. $\frac{1}{m}\sqrt{\frac{h}{4\lambda}}$

B. $m\frac{\sqrt{h}}{\sqrt{4\lambda}}$

C. $\sqrt{\frac{h}{4\lambda m}}$

D. $\sqrt{\frac{hm}{4\lambda}}$

Answer: D

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16. Hiesenberg.s uricertainty principle states that it is impossible to determine simultaneously the position and momentum of a particle. He considered the limits of how precisely we can measure properties of an e^- (or)other microscopic particles like electron. The more accurately we measure the momentum of a particle, less accurately we can determine its position.

The police are monitoring an automobile of mass 2.0 tons speeding along a high way. They are certain about location of the vehicle only to with in Im, what is the minimum uncertainty in the speed of the vehicle ?

A. $3.9 \times 10^{-38} ms^{-1}$

B. $12.4 \times 10^{-38} ms^{-1}$

C. $2.63 \times 10^{-38} ms^{-1}$

D. $0.62 \times 10^{-38} ms^{-1}$

Answer: C

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17. Hiesenberg.s uricertainty principle states that it is impossible to determine simultaneously the position and momentum of a particle. He considered the limits of how precisely we can measure properties of an e^- (or)other microscopic particles like electron. The more accurately we measure the momentum of a particle, less accurately we can determine its position.

If uncertainty in measurement of position and momentuin are equal calculate the uncertainty in velocity

A. $\frac{\Delta p}{m}$

B. $\frac{m}{\Delta p}$

C. $m\Delta p$

D. $\frac{1}{m\Delta p}$

Answer: A

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PRACTICE SHEET (EXERCISE-II) (LEVEL-II) (ADVANCED) (Matrx Matching Type Questions)

1. Match the following

Column-I	Column-II
A) Orbital angular momentum of an Electron	P) $\sqrt{s(s+1)}\,\frac{h}{2\pi}$
B) Angular momentum of an electron in an orbit	Q) $\sqrt{n(n+2)}$
C) Spin angular momentum of an electron	R) $\frac{nh}{2\pi}$
D) Magnetic moment of atom	S) $\sqrt{l(l+1)}\,\frac{h}{2\pi}$

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2. Match the following

Column-I	Column-II
A) Cathode rays	P) Helium nuclei
B) Dumb-bell	Q) Uncertainty principle
C) Alpha particles	R) Electromagnetic radiation
D) Moseley	S) p-orbital
E) Heisenberg	T) Atomic number
F) X-rays	U) Electrons

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3. Match the following

Column-I	Column-II
A) Total number of lines in H-Spectrum	P) decreases for a transition $5 \rightarrow 1$
B) Intensity of spectral line in linespectrum,	Q) H-spectrum as n value increases
C) Band spectrum is due to	R) 10
D) The proof for the presence of energy levels in an atom molecules to electronic transition	S) Rotations and vibrations of atom in addition
	T) Increases

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4. Match the following

Column-I	Column-II
A) Number of electrons present in an orbit	P) 2
B) Number of orbitals in an orbit	Q) n
C) Number of electrons in an orbital	R) n^2
D) Number of subshells in an orbit	S) $2n^2$

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PRACTICE SHEET (EXERCISE-II) (LEVEL-II) (ADVANCED) (Integer Type Questions)

1. The electrons in the ground state for a single H-atom absorbs a photon of wavelength 97.28 nm and it reaches to maximum level .n. then when it returns from this level to ground state. Maximum numbers of lines can be obtained in its spectrum ?

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2. A transition for H-atom from II to I orbit has same wavelength as from n^{th} orbit to 2^{nd} orbit for He^{+} ion. The value of 'n' is _____ .

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3. The wavelength of m^{th} line balmer series for an orbital is 4103Å. What is the value of m?

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4. The electron in Li^{2+} ions are excited from ground state by absorbing 8.4375 R_H energy/electron. How many emission lines are expected during de-excitation of electrons to ground state ?

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5. How many Balmer lines in the spectrum will be observed when electrons return from 7^{th} shell to 2^{nd} shell ?

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6. H-atoms in ground state (13.6 eV) are excited by monochromatic radiation of photon of energy 12.1 eV. Find the number of spectral lines emitted in H-atom.

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7. At $200\ ^{\circ}C$ the velocity of hydrogen molecule is 2.0×10^5 cm/sec. In this case, the de-Broglie wavelength is about _____Å.

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8. The threshold wavelength for certain metal is λ_0. When a light of wavelength $\left(\lambda_0\right)/(2)$ is incident on it , the mximum velocity of photelectrons is $10^6 m/s$. If the wavelength of the incident radiation is reduced to $\left(\lambda_0/(5)\right.$, then the maximum velocity of the photoelectrons in m/s will be ,

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9. The product of uncertainty in the position and uncertainty in velocity of a particle is $5.79 \times 10^{-5} m^2 s^{-1}$.

If uncertainty in the position is 1 nm , what is the uncertainty in the measurement of its velocity in ms^{-1} ?

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10. From quantization of angular momentum, one gets for hydrogen atom. the radius of the n^{th} orbit as $r_n = \frac{n^2}{m_e}\left(\frac{h}{2\pi}\right)^2\left(\frac{4\pi^2\varepsilon_0}{e^2}\right)$ for a hydrogen like atom of atomic number 'Z'.

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PRACTICE SHEET (EXERCISE-III) (LEVEL-I) (MAIN) (Straight Objective Type Questions)

1. When there are two electrons in the same orbital they have the spins

A. $+\frac{1}{2}, +\frac{1}{2}$

B. $-\frac{1}{2}, -\frac{1}{2}$

C. $+\frac{1}{2}, -\frac{1}{2}$

D. 0,0

Answer: C

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2. The values of quantum numbers n, l and m for the fifth electron of boron is

A. n = 2,l = 1, m = -1

B. n= 2, l=0 , m=-1

C. n=2 , l=2 , m=-1

D. n=1 , l = 2 , m=-1

Answer: A

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3. l = 3, then the values of magnetic quantum numbers are

A. $\pm 1, \pm 2, \pm 3$

B. $0, \pm 1, \pm 2, \pm 3$

C. $-1, -2, -3$

D. $0, +1, +2, +3$

Answer: B

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4. The impossible set of quantum numbers is

A. n = 2 , l= 0 , m =0 , s =+1/2

B. n=2 , l=1 , m=0 , s =+1/2

C. n=2 , l=0 , m=1 , s=-1/2

D. n=3 , l=1 , m=-1 , s=-1/2

Answer: C

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5. Which of the following quantum numbers are not possible ?

A. n = 2,l = 1, m = -1, s = -1/2

B. n = 3,l = 2, m = -3, s = + 1/2

C. n = 2,l = 0, m = 0, s = +1/2

D. n = 3,l = 2, m = -2, s = +1/2

Answer: B

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6. The correct set of quantum numbers for the unpaired electron of chlorine atom is

A.

n	l	m
2	1	0

B.

n	l	m
2	1	1

C.

n	l	m
3	1	0

D.

n	l	m
3	0	0

Answer: C

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7. The two electrons occupying an orbital are distinguished by

A. Principal quantum number

B. Azimuthal quantum number

C. Magnetic quantum number

D. Spin quantum number

Answer: D

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8. Which of the following sets of quantum number is correct for an electrons in 4f orbital ?

A. n = 4,l = 3, m= + 4, s = +1/2

B. n = 3,l = 2, m = -2, s = +1/2

C. n = 4,l = 3, m = +1, s = +1/2

D. n = 4, l = 4, m = - 4, s = -1/2

Answer: C

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9. The number of nodes possible in radial probability distribution curve of 3d orbital is

A. 1

B. 2

C. 3

D. 0

Answer: D

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10. In the radial probability distribution curve for the 2s orbital of the hydrogen atom, the minor maximum, the node and the major maximum occur at the following distances from the nucleus respectively

A. $1.1A^{\circ}, 0.53A^{\circ}, 2.6A^{\circ}$

B. $0.53A^{\circ}, 1.1A^{\circ}, 2.6A^{\circ}$

C. $2.6A^{\circ}, 1.1A^{\circ}, 0.53A^{\circ}$

D. $0.53A^{\circ}, 2.116A^{\circ}, 2.6A^{\circ}$

Answer: B

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11. When n=3 and l=1, the designation given to the orbital is

A. 4s

B. 4p

C. 3s

D. 3p

Answer: D

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12. Which of the following designation is impossible ?

A. 4f

B. 5g

C. 2d

D. 6p

Answer: C

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13. The correct valence electronic configuration for Cu(z = 29) is

A. $3d^9 4s^2$

B. $3d^{10} 4s^1$

C. $3d^{10} 4s^2$

D. $3d^8 4s^2$

Answer: B

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14. Which one of the following pairs of ions have the same electronic configuration

A. Cr^{3+}, Fe^{3+}

B. Fe^{3+}, Mn^{2+}

C. Fe^{3+}, Co^{3+}

D. Sc^{3+}, Cr^{3+}

Answer: B

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15. The (n+1) value for 4f sub shell is

A. 4

B. 5

C. 6

D. 7

Answer: D

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16. The energy of the electron in the hydrogen atom depends on

A. The principal quantum number only

B. All the quantum numbers

C. The Azimuthal quantum number

D. The principal and azimuthal quantum numbers

Answer: D

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17. After 3d-su level is completely filled the differentiating electron enters into ..... sub level.

A. 4s

B. 4p

C. 4f

D. 5s

Answer: A

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18. The correct ground state electronic configuration of chromium atom is

A. $[Ar]3d^5 4s^1$

B. $[Ar]3d^4 4s^2$

C. $[Ar]3d^6$

D. $[Ar]3d^5 4s^2$

Answer: A

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19. Consider the following pairs of ions

A) Sc^{+3} and Ti^{+4}

B) Mn^{+4} and Fe^{+2}

C) Fe^{+2} and Co^{+3}

D) Cu^{+} and Zn^{+2}

Among these pairs of ions, isoelectronic pairs would include

A. ii, iii and iv

B. I, iii and iv

C. I, ii and iv

D. I , ii and iii

Answer: B

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PRACTICE SHEET (EXERCISE-III) (LEVEL-II) (ADVANCED) (Straight Objective Type Questions)

1. The number of sub levles in the quantum level n = 3 is

A. 1

B. 2

C. 3

D. 4

Answer: C

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2. The number of different spatial arrangements for the orbital with 1 = 2 is

A. 1

B. 3

C. 5

D. 7

Answer: C

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3. An electron in an atom has m = -2 value. Then

(I) its 'n' value should be greater thn 2

(II) its 's' value should +1/2

(III) its 'l' value should be 2

(IV) its 'l' value shoul be greater than 1

A. I and II are correct

B. II and III are correct

C. III and IV are correct

D. I and IV are correct

Answer: B

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4. The maximum number of electrons that can be present in an orbit with s = +1/2 and l=2

A. 1

B. 3

C. 5

D. 7

Answer: C

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5. The maximum number of electrons with s = +1/2 in an orbital for which 1=2 is

A. 1

B. 3

C. 5

D. 7

Answer: A

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6. (A) : The energy of electrons is largely determined by its principal quantum number.

(R) : The principal quantum number is a measure of most probable distance of finding the electron around the nucleus

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

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7. If the value of principal quantum number is 3, the total possible values for magnetic quantum number will be

A. 5

B. 9

C. 8

D. 10

Answer: B

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8. For a particular value of azimuthal quantum number (l), the total number of magnetic quantum number values (m) is given by

A. $l = \frac{m+1}{2}$

B. $l = \frac{m - 1}{2}$

C. $l = \frac{2m + 1}{2}$

D. $n = \frac{2l + 1}{2}$

Answer: B

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9. The electrons identified by quantum numbers n and I

(i) n = 4,l = 1

(i) n = 4,l = 0

(iii) n = 3,l = 2

(iv) n = 3,l = 1

can be placed in order of increasing energy, from to highest as

A. $(iv) < (ii) < (iii) < (i)$

B. $(ii) < (iv) < (i) < (iii)$

C. $(i) < (iii) < (ii) < (iv)$

D. $(iii) < (i) < (iv) < (ii)$

Answer: A

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10. The values of quantum numbers n, 1 and m for the fifth electron of boron is

A. rotation of the electron in clockwise and anticlockwise direction respectively.

B. rotation of the electron in anticlockwise and clockwise direction respectively.

C. magnetic moment of the electron pointing up and down respectively.

D. two quantum mechanical spin states which have no classical analogue.

Answer: D

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11. Orbitals having equal energies are

A. the most probable distance increases with increase in 'n'

B. the most probable distance decreases with increase in 'n'

C. the most probable distance remains constant with increase in .n.

D. the most probable distance increases with increse in . n^2.

Answer: A

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12. The quantum numbers n, l, m, m_s respectively of the electron 3d^1 are

A. $\sum_{l=0}^{l=n} 2(2l+1)$

$l=n$

B. $\sum_{l=1}^{l=n} 2(2l+1)$

C. $\sum_{l=0}^{l=n-1} (2l+1)$

D. $\sum_{l=0}^{} 2(2l+1)$

Answer: D

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13. Which of the following sets of quantum numbers are followed ?

A. $n=3, l=1, m_1=1, m_s=-\frac{1}{2}$

B. $n=2, l=1, m_1=0, m_s=-\frac{1}{2}$

C. $n=4, l=0, m_1=1, m_s=+\frac{1}{2}$

D. $n=4, l=0, m_1=0, m_s=+\frac{1}{2}$

Answer: D

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14. There is no difference between a 2p and a 3p orbital regarding

A. Value of n

B. Size

C. Energy

D. Shape

Answer: D

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15. The probability of finding electron in XY plane for P_Z - orbital is

A. 100 %

B. 50 %

C. 99.9 %

D. 0 %

Answer: D

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16. How many electrons maximum can have n + l = 4 in an atom.

A. 8

B. 2

C. 6

D. 18

Answer: A

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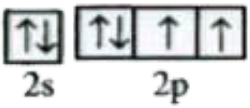
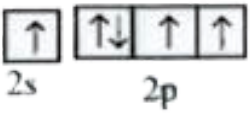
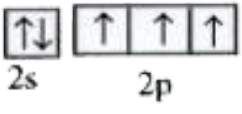
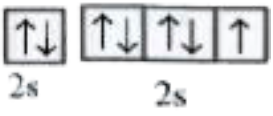
17. In which of the following Aufbau principle is violated ?

A. 

B. 

C. 

D. 

Answer: B

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18. Which of the following electronic configuration is not possible?

A. $1s^2 2s^2 2p^6$

B. $1s^2 2s^2 2p^7$

C. $1s^2 2s^2$

D. $1s^2 2s^2 2p^5$

Answer: B

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19. The configuration $1s^2 2s^2 2p^5 3s^1$ shows

A. Ground state of fluorine

B. Excited state of fluorine

C. Exited state of neon atom

D. Excited state of argon

Answer: C

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20. Which of the following has maximum unpaired d-electrons?

A. Zn^+

B. Fe^{2+}

C. Ni^{3+}

D. Cu^+

Answer: B

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21. Consider the ground state of Cr atom (Z = 24). The numbers of electrons with the azimuthal quantum numbers, $l = 1$ and 2 are, respectively

A. 12,4

B. 12,5

C. 16,4

D. 16,5

Answer: B

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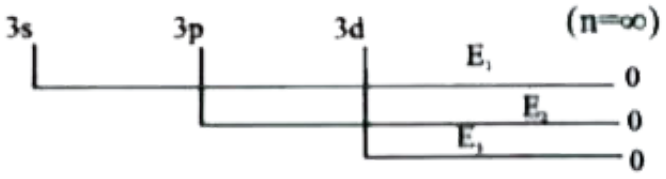
22. For H-atom, the energy required for the removal of electron from various sub-shells is given as under:



The order of the energies would be :

A. a. $E_1 > E_2 > E_3$

B. b. $E_3 > E_2 > E_1$

C. c. $E_1 < E_2 < E_3$

D. d. $E_1 < E_3 < E_2$

Answer: C

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23. Among the following representations of excited states of atoms which is impossible ?

A. $1s^2 2s^1$

B. $3s^2 3p^3 4s^1$

C. $1s^2 2s^2 2p^4 3s^2$

D. $[Ne]3s^2 3p^6 3d^2 4s^3$

Answer: D

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24. Consider the following six electronic configurations (remaining inner orbitals are completely filled) and mark the incorrect option

A. Stability order : $IV > II > III$

B. Order of spin mutiplicity :$IV > III = I > II$

C. V does not violate all the three rules of electronic configuration

D. If IV represents A^+ when kept near a magnet , acts as diamagnetic substance

Answer: D

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25. How many electrons in atom can have n =4, =2, m=-2 and $s = +\frac{1}{2}$?

A. 1

B. 2

C. 5

D. 10

Answer: A

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26. Write the electronic configurations of Ca and Sr

A. Due to extra stability of exactly half filled and exactly filled sub shells

B. Because they belong to d-block

C. Both of the above

D. due to the presence of unpaired d-electrons

Answer: A

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27. Which one of the following pairs of ions have the same electronic configuration

A. $Ti^{2+}, V^{3+}, Cr^{4+}, Mn^{5+}$

B. $TI^{3+}, V^{2+}, Cr^{3+}, Mn^{4+}$

C. $Ti^{4+}, V^{4+}, Cr^{6+}, Mn^{7+}$

D. $Ti^{4+}, V^{3+}, Cr^{2+}, Mn^{3+}$

Answer: A

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PRACTICE SHEET (EXERCISE-III) (LEVEL-II) (ADVANCED) (More than One correct Answer Type Questions)

1. Which of the following statement (s) is (are) not correct ?

A. The shape of an atomic orbital depends on the azimuthal quantum number

B. The orientation of an atomic orbital depends on the magnetic quantum number

C. The energy of an electron in an atomic orbtial of multi electron atom depends on principal quantum number

D. The number of degenerate atomic orbitals of one type depends on the values of principal, azimuthal and magnetic quantum numbers.

Answer: C::D

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2. Which one of the following sets of quantum numbers is not possible for an electron in the ground state of an atom with atomic number 19 ?

A. Quantum number were proposed out of necessity in Bohr model of the atom.

B. Knowing n and l it is possible to designate a subshell.

C. The principal quantum number alone can give the complete energy of an electron in any atom.

D. Azimutal quantum number refers to the subshell to which an electron belongs and describes the motion of the electron.

Answer: A::C::D

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3. The spin of the electron

A. increases the angular momentum

B. decreases the angular momentum

C. can be forward (clockwise) relative to the direction of the path of the electron

D. can be backward (anti-clockwise) relative to the direction of the path of the electron

Answer: C::D

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4. When an atom is placed in the magnetic field, then due to the presence of electrons in it

A. the orbitals do not orient themselves relative to the magnetic field

B. the orbitals orient themselves relative to the magnetic field

C. there are (2l + 1) different values of m for each value of l

D. there are (2) different values of m for each value of l

Answer: B::C

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5. Which of the following is/are correct about the radial probability curves ?

A. The number of maxima in 2s orbital are two

B. The number of spherical or radial nodes is equal to n -l-1

C. The number of angular nodes are .l..

D. $3d_x^2$ has 3 angular nodes

Answer: A::B::C

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6. Choose the correct statement(s)

A. for a particular orbital in hydrogen atom, the wave function may have negative value

B. Radial probability distribution function may have zero value but can never have negative value

C. $3d_{x^2-y^2}$ Orbital has two angular nodes and one radial node

D. yz and xz planes are nodal planes for d_{xy} orbital

Answer: A::B::D

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7. Which of the following statements are correct

A. The electron may be in a d-orbital

B. The electron is in the fourth principal electronic shell

C. The electron may be in a p-orbital

D. The electron must have the spin quantum number = +1/2.

Answer: A::B

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8. Which of the following statements are correct

A. The number of orbitals for a given value of l is equal to 2 l+ 1

B. The number of orbitals for a given value of n is equal to n^2

C. An atom having unpaired electrons: is diamagnetic is nature

D. The half-filled and fully-filled electronic configurations are less stable than the other configuration having the same number of electrons.

Answer: A::B

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9. Select the correct statement(s)

A. Radial distribution function indicates that there is a higher probability of finding the 3s electron close to the nucleus than in case of 3p and 3d orbitals

B. Energy of 3s orbital is less than for the 3p and 3d orbitals

C. At the node, the value of the radial function changes from positive to negative

D. The radial function depends upon the quantum numbers n and I

Answer: A::B::C::D

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10. A neutral atom has 2K, 8L and 5M electrons, choose correct one

A. Atomic number is 15

B. Total number of p-electrons = 9

C. Valency of element is 2

D. It is a representative element.

Answer: A::B::D

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11. Which of the following are correct ?

A. All s-orbitals have the same orbital angular momentum.

B. The angular momentum of the electron in 4^{th} orbit is $2h/\pi$

C. The magnetic moment of Cu^{2+} ion = 1.732 B.M.

D. All d-orbitals have two nodal planes.

Answer: A::B::C

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12. The configuration $[Ar]3d^5 4s^1$ in the first excited states exists for

A. Fe^{2+}

B. Co^{3+}

C. Mn^{+}

D. Cr

Answer: A::B

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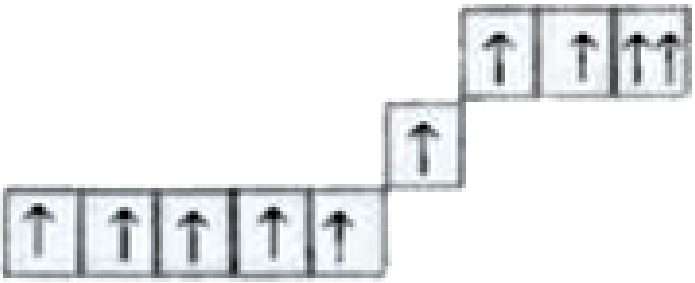
13. The following electronic configuration violates



A. Hund.s rule

B. Pauli.s principle

C. Aufbau principle

D. All of these

Answer: A::B::C

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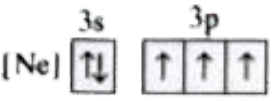
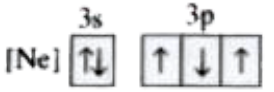
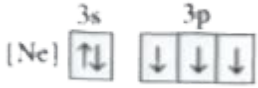
14. Ground state electronic configuration of p atom can be represented as

A. 

B. 

C.

D. 

Answer: A::D

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15. Which of the following statement is/are wrong about pericyclic reaction?

A. If the value of l = 0, the electron distribution is spherical

B. The shape of the orbital is given by magnetic quantum no

C. Angular moment of 1s, 2s, 3s electrons are equal

D. In an atom, all electrons travel with the same velocity

Answer: B::D

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16. Ground state electronic configuration of p atom can be represented as

A. ↑ ↓ ↑ ↓ ↑ ↑ ↑

B. ↑ ↓ ↑ ↓ ↑ ↓ ↑

C. ↑ ↓ ↑ ↓ ↑ ↓ ↓

D. ↑ ↓ ↑ ↓ ↓ ↓ ↓

Answer: A::D

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17. Electronic configuration of an element is $1s^2\ 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$. It belongs to

A. excited state

B. ground state

C. cationic form

D. anionic form

Answer: B::C

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PRACTICE SHEET (EXERCISE-III) (LEVEL-II) (ADVANCED) (Linked Comprehension Type Questions)

1. It is tempting to think that all possible transitions are permissible, and that an atomic spectrum arises from the transition of the electron from any initial orbital to any other orbital. However, this is not so, because a

photon has an intrinsic spin angular momentum of $\sqrt{2}\frac{h}{2\pi}$ corresponding to S = 1 although it has no charge and no rest mass. On the other hand, an electron has got two types of angular momentum :

Orbital angular momentum, $L = \sqrt{l(l+1)}\frac{h}{2\pi}$ and spin angular momentum, arising from orbital motion and spin motion of electron respectively. The change in angular momentum of the electron during any electronic transition must compensate for the angular momentum carries away by the photon. to satisfy this condition the difference between the azimuthal quantum numbers of the orbital within which transition takes place must differ by one. Thus, an electron in a d-orbital (1 = 2) cannot make a transition into an s = orbital (I = 0) because the photon cannot carry away enough angular momentum. An electron as is well known, possess four quantum numbers n, I, m and s. Out of these four I determines the magnitude of orbital angular momentum (mentioned above) while (2n m determines its z-components as $m\left(\frac{h}{2\pi}\right)$ he permissible values of only integers right from -1 to + l. While those for I are also integers starting from 0 to (n − 1). The values of I denotes the sub shell. For I = 0, 1, 2, 3, 4,..... the sub-shells are denoted by the symbols s,

p, d, f, g, ... respectively

The maximum orbital angular momentum of an electron with n= 5 is

A. $\sqrt{16}\frac{h}{2\pi}$

B. $\sqrt{12}\frac{h}{2\pi}$

C. $\sqrt{42}\frac{\sqrt{h}}{2\pi}$

D. $\sqrt{20}\frac{h}{2\pi}$

Answer: D

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2. It is tempting to think that all possible transitions are permissible, and that an atomic spectrum arises from the transition of the electron from any initial orbital to any other orbital. However, this is not so, because a photon has an intrinsic spin angular momentum of $\sqrt{2}\frac{h}{2\pi}$ corresponding to S = 1 although it has no charge and no rest mass. On the other hand, an electron has got two types of angular momentum :

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The orbital angular momentum of an electron in p-orbital makes an angle of 45° from Z-axis. Hence Z-component of orbital angular momentum of election is :

A. $\frac{h}{\pi}$

B. $\left(\frac{h}{2\pi}\right)$

C. $-\frac{h}{\pi}$

D. $-\left(\frac{h}{2\pi}\right)$

Answer: B

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3. It is tempting to think that all possible transitions are permissible, and that an atomic spectrum arises from the transition of the electron from any initial orbital to any other orbital. However, this is not so, because a photon has an intrinsic spin angular momentum of $\sqrt{2}\frac{h}{2\pi}$ corresponding to S = 1 although it has no charge and no rest mass. On the other hand, an electron has got two types of angular momentum :

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The spin-only magnetic moment of free ion is $\sqrt{8}$ B.M. The spin angular momentum of electron will be

A. $\sqrt{2}\frac{h}{2\pi}$

B. $\sqrt{8}\frac{h}{2\pi}$

C. $\sqrt{6}\frac{h}{2\pi}$

D. $\sqrt{\frac{3}{4}}\frac{h}{2\pi}$

Answer: A

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4. When Schrodinger wave equation in polar coordinates is solved the solution for Φ is of the form $\Psi(r, \theta, \phi) = R(r), Y(\theta, \phi)$. Here R(r) is radial part of wave function and $Y(\theta, \phi)$ is angular part of the wave function. The region or space where probability of finding electron is zero is called nodal surface. If the probability of finding electron is zero then $\Psi^2(r, \theta, \phi) = 0 \Rightarrow \Psi(r, \theta, \phi) = 0$

If the radial wave function is equal to zero we get radial node and if angular part is equal to zero we get angular nodes. Total no. of nodes for any orbital = n - 1. Where 'n' is principal quantum number.

The d-orbital with two nodal surfaces formed cones

A. $3d_{x^2-y^2}$

B. $3d_{z^2}$

C. $3d_{xy}$

D. $4d_{xy}$

Answer: B

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5. When Schrodinger wave equation in polar coordinates is solved the solution for Φ is of the form $\Psi(r, \theta, \phi) = R(r), Y(\theta, \phi)$. Here R(r) is radial part of wave function and $Y(\theta, \phi)$ is angular part of the wave function. The region or space where probability of finding electron is zero is called nodal surface. If the probability of finding electron is zero then $\Psi^2(r, \theta, \phi) = 0 \Rightarrow \Psi(r, \theta, \phi) = 0$

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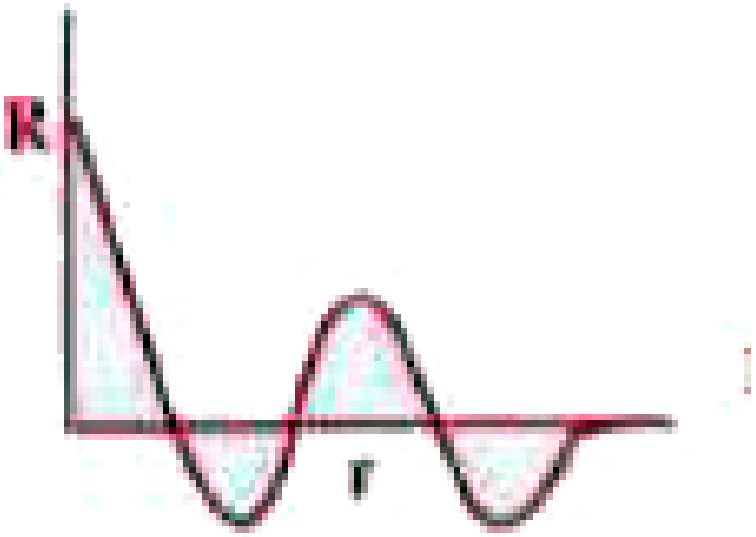

represents

A. 4s

B. 5p

C. 3s

D. $6d_{xy}$

Answer: A

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6. When Schrodinger wave equation in polar coordinates is solved the solution for Φ is of the form $\Psi(r, \theta, \phi) = R(r), Y(\theta, \phi)$. Here R(r) is radial part of wave function and $Y(\theta, \phi)$ is angular part of the wave function. The region or space where probability of finding electron is zero is called nodal surface. If the probability of finding electron is zero then $\Psi^2(r, \theta, \phi) = 0 \Rightarrow \Psi(r, \theta, \phi) = 0$

If the radial wave function is equal to zero we get radial node and if angular part is equal to zero we get angular nodes. Total no. of nodes for any orbital = n - 1. Where 'n' is principal quantum number.

Number of radial nodes for 4f orbital

A. 3

B. 2

C. 1

D. zero

Answer: D

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7. In an universe other than earth all the quantum numbers have same value as on earth except .l. and .s.. Azimuthal quantum number can have values from 0 to (n + 1) in integral step and s (spin quantum no.) has values of $\left(-\frac{1}{2}, 0 \& + \frac{1}{2} \right)$. If all rules like Aaufbau rule, Hund.s rule and Paulis exclusion rule follow in other universe also.

No. of element in third period of another universe will be

A. 27

B. 32

C. 36

D. 42

Answer: A

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8. In an universe other than earth all the quantum numbers have same value as on earth except .l. and .s.. Azimuthal quantum number can have values from 0 to (n + 1) in integral step and s (spin quantum no.) has values of $\left(-\frac{1}{2}, 0 \& +\frac{1}{2}\right)$. If all rules like Aaufbau rule, Hund.s rule and Paulis exclusion rule follow in other universe also.

Configuration of element with atomic number 29 will

A. $1s^3, 2s^3, 1d^{14}$

B. $1s^3, 2s^3, 2p^9, 3s^3, 3p^9, 4s^2$

C. $1s^2, 1p^6, 2s^2, 1d^{10}, 2p^9$

D. $1s^3, 1p^6, 2p^9, 2s^2, 1d^{10}$

Answer: A

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9. In an universe other than earth all the quantum numbers have same value as on earth except .l. and .s.. Azimuthal quantum number can have

values from 0 to (n + 1) in integral step and s (spin quantum no.) has values of $\left(-\frac{1}{2}, 0 \& +\frac{1}{2}\right)$. If all rules like Aaufbau rule, Hund.s rule and Paulis exclusion rule follow in other universe also.

Atomic number of element in 4^{th} period and 5^{th} column will be

A. 89

B. 71

C. 73

D. 75

Answer: B

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PRACTICE SHEET (EXERCISE-III) (LEVEL-II) (ADVANCED) (Matrix Matching Type Questions)

1. Match the following

Column-I	Column-II
A) Cathode rays	P) Helium nuclei
B) Dumb-bell	Q) Uncertainty principle
C) Alpha particles	R) Electromagnetic radiation
D) Moseley	S) p-orbital
E) Heisenberg	T) Atomic number
F) X-rays	U) Electrons

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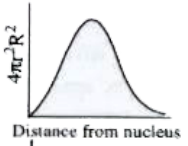
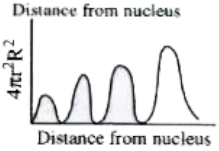
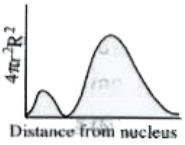
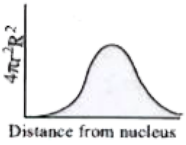
2. Match the following

Column-I	Column-II
A) 4s	P) 
B) 3p	Q) 
C) 3d	R) 
D) 2p	S) 

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3. Match the following

Column-I	Column-II
A) Cathode rays	P) Helium nuclei
B) Dumb-bell	Q) Uncertainty principle
C) Alpha particles	R) Electromagnetic radiation
D) Moseley	S) p-orbital
E) Heisenberg	T) Atomic number
F) X-rays	U) Electrons

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PRACTICE SHEET (EXERCISE-III) (LEVEL-II) (ADVANCED) (Integer Type Questions)

1. For how many orbitals, the quantum numbers n = 3, l = 2, m = +2 are possible ?

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2. Find out the number of angular nodes in the orbital to which the last electron of Cr enter

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3. What is the total number of radial and angular nodes present in 5f orbital?

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4. The atomic mass of an element is 19. The second shell of its atom contains 7 electrons. The number of neutrons in its nucleus is 2x. The value of x is _____.

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ADDITIONAL PRACTICE EXERCISE (Level-I (MAIN)) (Straight Objective Type Questions)

1. Ratio of masses of proton and electron is

A. 1.8

B. 1.8×10^3

C. Infinite

D. 1.8×10^2

Answer: B

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2. The ratio between the neutrons present in carbon atom and silicon atoms with mass numbers 12 and 28 is

A. $7:3$

B. $3:7$

C. $1:2$

D. $2:1$

Answer: B

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3. The number of nucleons in the isotope of an atom ${}_zX^m$ are

A. m

B. Z

C. m+Z

D. m-Z

Answer: A

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4. The total energy of electron in an atom is a combination of potential energy and kinetic energy. If total energy is $-E$ for an electron in an atom, then its K.E. and P.E. respectively are

A. 2E,-E

B. 2E,E

C. E,-2E

D. E,-E

Answer: C

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5. The radius of which of the following orbit is same

A. $He^{2+}(n = 2)$

B. $Li^{2+}(n = 2)$

C. $Li^{2+}(n = 3)$

D. $Be^{3+}(n = 2)$

Answer: D

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6. In hydrogen atom the kinetic energy of electron is 3.4 eV. The distance of that electron from the nucleus

A. $2.11A^{\circ}$

B. $0.529A^{\circ}$

C. $1.587A^{\circ}$

D. $21.16A^{\circ}$

Answer: A

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7. The radius of first Bohr.s orbit for hydrogen is 0.53 Å. The radius of third Bohr.s orbit would be

A. $0.79A^{\circ}$

B. $1.59A^{\circ}$

C. $3.18A^{\circ}$

D. $4.77A^{\circ}$

Answer: D

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8. The energy of second Bohr orbit of hydrogen atom is -328 kJ. mol^{-1}, hence energy of fourth Bohr orbit would be

A. $-41KJmol^{-1}$

B. $-82KJmol^{-1}$

C. $-164KJmol^{-1}$

D. $-1312KJmol^{-1}$

Answer: B

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9. Which of the following transistions in hydrogen atom will require the highest amount of energy

A. n=1 to n=2

B. n=1 to n=3

C. n=2 to n=1

D. n=3 to n=4

Answer: B

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10. The energy of an electron in the first Bohr's orbit of a hydrogen atom is $-2.18 \times 10^{-18} J$. Its energy in the second orbit would be

A. $-1.09 \times 10^{-18} J$

B. $-4.36 \times 10^{-18} J$

C. $-5.45 \times 10^{-19} J$

D. $-8.72 \times 10^{-18} J$

Answer: C

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11. (A) : For n = 3, 1 may be 0,1,2 and .m. may be 0, (± 2, ± 1 and 0)

(R) : For each value of n there are 0 to (n-1) possible values of 1 and for each value of l values of .m. are -1....0....+1

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

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12. If magnetic quantum number of a given electron is represented -3, then what will be its principal quantum number ?

A. 2

B. 3

C. 4

D. 1

Answer: C

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13. The configuration of $1s^2 2s^2 2p^5 3s^1$ shows

A. Ground state of fluorine atom

B. Excited state of fluorine atom

C. Excited state of neon atom

D. Excited state of oxygen atom

Answer: C

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14. The incorrect electronic arrangment is

A. 2, 8, 13, 1

B. 2, 8, 12, 2

C. 2, 8, 8, 1

D. 2, 8, 8, 2

Answer: B

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15. Given this set of quantum numbers for a multi electron atom $2, 0, 0, \text{ and } -1/2$. The next higher allowed set of n and 1 for this atom in its ground state

A. n = 2,l = 0

B. n = 2,l = 1

C. n = 3,l = 0

D. n = 3,l = 1

Answer: B

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16. Which one of the following pairs of atoms/ions have identical ground state configurations ?

A. Li^+ and He^+

B. Cl^- and Ar

C. Na and K

D. F^+ and Ne

Answer: B

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17. The atomic number of an element 'M' is 26. How many electrons are present in the M-shell of the element in its M^{3+} state ?

A. 11

B. 15

C. 14

D. 13

Answer: C

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18. Consider the ground state of Cr atom (Z = 24). The numbers of electrons with the azimuthal quantum numbers, $l = 1$ and 2 are, respectively

A. 12 and 4

B. 16 and 5

C. 16 and 4

D. 12 and 5

Answer: C

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19. Which is the first element to have 4d-electron in its electronic configurations

A. Ca

B. Sc

C. Y

D. La

Answer: C

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20. In the ground state, an element has 13 electrons in its "M - shell". The element is

A. Copper

B. Chromium

C. Nickel

D. Iron

Answer: B

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21. (A) : The electronic configuration of Cr is $[Ar]3d^5 4s^1$ but not $[Ar]3d^4 4s^2$

(R) : Lowering energy with configuration $[Ar]3d^5 4s^1$ is more than that with configuration $[Ar]3d^4 4s^2$

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

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22. The electrons identified by quantum numbers n and I

(i) n = 4,l = 1

(i) n = 4,l = 0

(iii) n = 3,l = 2

(iv) n = 3,l = 1

can be placed in order of increasing energy, from to highest as

A. $IV < II < III < I$

B. $II < IV < I < III$

C. $I < III < II < IV$

D. $III < I < IV < II$

Answer: A

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23. Which of the following statement(s) is/are consistent with the Bohr's theory of the atom (and no others)?

A) An electron can remain in a praticular orbit as long as it continuously absorbs radiation of a definite frequency.

B) The lowest energy orbits are those closest to the nucleus.

C) All electrons can jump from the K shell to the M shell by emitting ratiation of a definite frequency.

A. A,B,C

B. B only

C. C only

D. A,B

Answer: D

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24. Give the correct order of initials T (True) or F (False) for following statements.

(I) If electron has zero magnetic quantum number, then it must be present in s-orbital.

(II) In orbital diagram, pauli's exclusion principle is violated.

(III) Bohr.s model can explain spectrum of the hydrogen atom.

(IV) A d-orbital can accommodate maximum 10 electrons only.

A. TTFF

B. FFTF

C. TFTT

D. FFTT

Answer: B

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25. The orbital diagram in which both the Pauli.s exclusion principle and Hund.s rule are violated, is:

A.

B.

C.

D.

Answer: A

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26. The number of angular nodal planes are same in the orbitals:

A. 3p and 4p

B. 3s and 4d

C. 4s and 3p

D. 4s and 3d

Answer: A

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27. The wave lengths of first member of Balmer series of a hydrogen atom is nearly (The value Rydberg constant is $1.08 \times 10^7 m^{-1}$)

A. $4400A^\circ$

B. $5500A^\circ$

C. $6600A^\circ$

D. $7700A^\circ$

Answer: C

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28. The wave length of H_δ line of Balmer series of a hydrogen atom is nearly $\left(R = 1.08 \times 10^7 m^{-1}\right)$

A. $4090A^\circ$

B. $5400A^\circ$

C. $6800A^\circ$

D. $7200A^{\circ}$

Answer: A

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29. The first emision line of hydrogen atomic spectrum in the Balmer series appear at(R=Rydberg constant)

A. $\frac{5R}{36}cm^{-1}$

B. $\frac{3R}{4}cm^{-1}$

C. $\frac{7R}{144}cm^{-1}$

D. $\frac{9R}{400}cm^{-1}$

Answer: A

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30. What is the wave length of H_b line Balmer series of hydrogen spectrum ? (R = Rydberg constant)

A. 36/5R

B. 5R/36

C. 3R/16

D. 16/3R

Answer: D

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31. Uncertainity in position of a minute particle of mass 25 g in space is $10^{-5}m$. What is the uncertainity in its velocity (in ms^{-1}) ? $\left(h = 6.6 \times 10^{-34}Js\right)$

A. 2.1×10^{-34}

B. 0.5×19^{-34}

C. 2.1×10^{-25}

D. 0.5×10^{-23}

Answer: C

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32. The uncertainity in momentum of an electron is $1 \times 10^{-5} kg.\, m/s$. The uncertainity in its position will be $\left(h = 6.62 \times 10^{-34} kg.\, m/s\right)$

A. $1.05 \times 10^{-28} m$

B. 1.05×10^{-26} m

C. 5.27×10^{-30} m

D. 5.27×10^{-28} m

Answer: C

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33. The uncertainity in the momentum of a particle is $3.31 \times 10^{-2} kgms^{-1}$.

The uncertainity in its position is (in metres)

A. 1.59×10^{-33}

B. 0.33×10^{-30}

C. 0.4×10^{-20}

D. 3.3×10^{-24}

Answer: A

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34. The shape of orbital for which l = 1 is

A. Spherical

B. Dumb-bell

C. Double dumb-bell

D. Circular

Answer: B

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35. The maximum number of electrons in a sub-shell is given by the expression.

A. $(l + 2)$

B. $(2l + 2)$

C. $(4 l + 2)$

D. $(l + 1)$

Answer: C

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36. The magentic quantum number, m for the outermost electron in the sodium atom is

A. 1

B. 0

C. 2

D. -1

Answer: B

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37. For the configuration $1s^2 2s^1$, the quantum numbers for the outermost electron are

A. $2, 1, 0, -1/2$

B. $2, 0, 0, +1/2$

C. $2, 1, 0, +1/2$

D. $2, 0, 1, +1/2$

Answer: B

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38. The maximum number of electrons that a p-orbital can accommodate is

A. 6

B. 2

C. 10

D. 14

Answer: B

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39. The number of orbitals in the quantum level n = 4 is

A. 4

B. 9

C. 16

D. 18

Answer: C

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40. The quantum number which is equal for all the d-electrons in an atom is

A. 1

B. m

C. s

D. n

Answer: A

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41. Correct set of four quantum numbers for the valence electron of Rubidium (Z=37) is

A. 5, 0, 0, +1/2

B. 5, 1, 0, +1/2

C. 5, 1, 1, +1/2

D. 6, 0, 0, +1/2

Answer: A

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42. n, l and m values of the $2p_z$ orbital are

A. 3,2,1

B. 2,1,0

C. 1,2,0

D. 2,0,1

Answer: B

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43. The azimuthal quantum number for the last electron in sodium atom is

A. 1

B. 2

C. 0

D. 3

Answer: C

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44. Which of the following electronic configuration corresponds to an inert gas ?

A. $1s^2 2s^2 2p^5$

B. $1s^2 2s^2 2p^6$

C. $1s^2 2s^2 2p^6 3s^1$

D. $1s^2 2s^2$

Answer: B

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45. The rule that explain the reason for chromium to have $[Ar]3d^5 4s^1$ configuration instead of $[Ar]3d^4, 4s^2$ is

A. Pauli.s exclusion principle

B. Aufbau principle

C. more exchange energy

D. Heisenberg.s principle

Answer: C

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46. Which of the following configuration is not possible ?

A. $2p^2$

B. $3f^7$

C. $3d^5$

D. $4p^6$

Answer: B

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47. Which of the following ions is not isoelectronic with O^{2-}

A. N^{3-}

B. F^-

C. Ti^+

D. Na^+

Answer: C

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48. Number of valence electrons in carbon is

A. 3

B. 1

C. 4

D. 0

Answer: C

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49. The orbital diagram in which both the Pauli.s exclusion principle and Hund.s rule are violated, is:

A.

B.

C.

D.

Answer: D

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50. The ratio of magnetic moments of Fe(III) & Co(II) is

A. $\sqrt{5}:\sqrt{7}$

B. $\sqrt{35}:\sqrt{15}$

C. $7:3$

D. $\sqrt{24}:\sqrt{15}$

Answer: B

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51. If the electronic structure of oxygen atom is written as $1s^2, 2s^2$

it would violate

A. Hund.s rule

B. Paulis exclusion principle

C. Both Hund.s and Pauli.s principles

D. Aufbau.s principle

Answer: A

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ADDITIONAL PRACTICE EXERCISE (Level-II (ADVANCED)) (More than One correct answer Type Questions)

1. According to Bohr.s atomic theory, which of the following relation (s) is (are) correct ?

A. Kinetic energy of electron $\propto \frac{Z^2}{n^2}$

B. The product of velocity of electron and the principal quantum number $\propto Z^2$

C. Frequency of revolution of the electron in an orbit $\propto \frac{Z^2}{n^3}$

D. Coulombic force of attraction on the electron $\propto \frac{Z^3}{n^4}$

Answer: A::C::D

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2. The radius of certain orbit of H-atom is 2.12 A. Then the energy of that energy level is

A. $-\frac{13.6}{4}$ eV/atom

B. $\frac{2.18 \times 10^{-18}}{4}$ J/atom

C. $(- 1312(/(4)$ KJ/atom

D. $\frac{-1313.6}{4}$ Kcal/mole

Answer: A::B::D

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3. The incorrect relations (s) about the velocity of photon is (are)

A. Dependent on its wavelength

B. Depend on its intensity

C. equal to cube of its amplitude

D. Independent of its wavelength

Answer: A::B::C

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4. The correct statement among the following

A. A node is a point in space where the wave-funtion Y has zero amplitude .

B. The number of maximum (peaks) in radial probability distribution function is (n-l)

C. Radial probability density is $4\pi r^2 R_{n.l}^2(r)$

D. Ψ represents probability of finding electron

Answer: A::B::C::D

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5. Select the correct statement(s)

A. An orbital with l = 0 is symmetrical about the nucleus

B. an orbital with l= 1 is spherically symmetrical about the nucleus

C. $3d_{Z^2}$ is spherically symmetrical about the z-axis

D. All are correct

Answer: A::C

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6. The energy difference between the following two successive levels is minimum

A. all energy gaps are not similar

B. the energy gap decreases as n increases

C. the energy gap increases as n incareases

D. the energy gap change unpredictably as n increases

Answer: A::B

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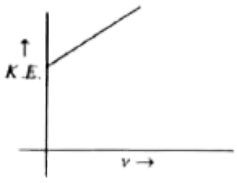
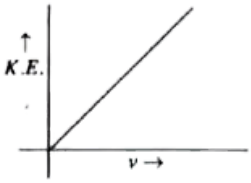
7. Kinetic energy of photoelectrons is independent of the of incident radiation.

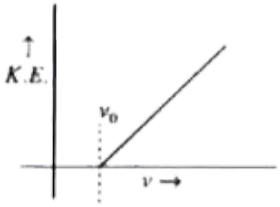
A.



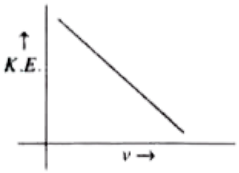
B.



C.



D.



Answer: A::B::D

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8. Which arrangement of the orbitals of H-atom of their energy is correct?

A. $2s < 3s = 2p_x = 3p_y < 4s = 4p_z = 4d_{xy}$

B. $2s < 3s < 4s$

C. $2s < 3s < 3p_x = 3p_y < 4s = 4p_s = 4d_{xy}$

D. $2s < 3s < 3p_x = 2p_x < 4s < 4p_s < 4d_{xy}$

Answer: A::B

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9. The radii of maximum probability for 3s, 3p and 3d electrons are in the order :

A. $\left(r_{\max}\right)_{3d} > \left(r_{\max}\right)_{3p} > \left(r_{\max}\right)_{3s}$

B. $\left(r_{\max}\right)_{3d} > \left(r_{\max}\right)_{3s} > \left(r_{\max}\right)_{3p}$

C. $\left(r_{\max}\right)_{3s} > \left(r_{\max}\right)_{3p} > \left(r_{\max}\right)_{3d}$

D. $\left(r_{\max}\right)_{3d} < \left(r_{\max}\right)_{3s} < \left(r_{\max}\right)_{3p}$

Answer: A::B::D

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10. Explain Pauli's Exclusion principle with an example.

A. Nucleus of an atom contains no negative charge

B. Electrons move in circular orbits around the nucleus

C. Electrons occupy orbitals of lowes energy

D. All the four quantum numbers of two electrons in an atom cannot be equal

Answer: A::B::C

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11. Which of the following statements is correct

A. The concepts of “penetration” and “shielding" are important in deciding the energetic ordering or orbitals in multi-electron atoms

B. A wave-function can have positive and negative values

C. “Radial nodes” can appear in radial probability distribution functions

D. The absolute size of an orbital is given by the principal quantum number.

Answer: A::B::C

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12. If . R_H. is the Rydberg constant, then the energy of an electron in the ground state of hydrogen atom is

A. $\frac{R_H C}{h}$

B. $\frac{1}{R_H C h}$

C. $\frac{hC}{R_H}$

D. $-R_H hC$

Answer: A::B::C

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13. For which of the following species, the expression for the energy of electron in n^{th} orbit $\left[E_n = -\frac{13.6}{n^2} \times Z^2 eV \text{ atom}^{-1}\right]$ has the validity ?

A. Tritium

B. Li^{2+}

C. Deuterium

D. He^{2+}

Answer: A::B::C

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14. Which of the following sets of quantum number is/are not possible ?

A.

n	l	m_l	m_s
4	4	-2	+1/2

B.

n	l	m_l	m_s
3	0	3	-1/2

C.

n	l	m_l	m_s
3	2	-3	-1/2

D.

n	l	m_l	m_s
5	3	0	$+1/2$

Answer: A::C

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15. The value of n_1 in Balmer series is

A. it may emit another quantum in Balmer series again

B. it must emit another quantum in ultraviolet region of Lyman series

C. second quatum of wavelength 122nm will be emitted

D. second quantum will be emitted in Paschen series i.e., near infrared region

Answer: B::C

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16. In which of the following conditions the de Broglie wavelentgh of particle A will be less than that of particle B $\left(m_A > m_B\right)$?

A. Linear momentum of these particles are same

B. Move with same speed

C. Move with same kinetic energy

D. Have fallen through same height

Answer: B::D

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17. Which of the following sets of quantum numbers are followed ?

A. n = 1,l = 0 and m = 0

B. n = 2, l = 1 and m = + 1

C. n = 1, l = 0 and m = + 1

D. n = 2,l = 2 and m = 0

Answer: A::B

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18. Which of the following radius of orbits in hydrogen atom are possible ?

A. 52.9 pm

B. 182 pm

C. 211 pm

D. 364 pm

Answer: A::C

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19. Which of the following is/are correct about the radial probability curves ?

A. $3d_z^2$ has three angular nodes

B. The number of angular nodes are l

C. The number of radial nodes is equal to n-l-1

D. The number of maxima in 2s – orbitals are two

Answer: B::C::D

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20. Which among the following is/are correct about chromium ?

A. Its electronic configuration is $3d^4 4s^1$

B. Total spin of chromium =3

C. Spin multiplicity of 3d-subshell of chromium = 6

D. Magnetic moment of chromium is $\sqrt{48}$

Answer: A::B::C::D

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21. Select the correct statement(s)

A. In wave mechanical model the energy of e in the orbital remains same

B. d_{xy} orbital is lies in yz plane

C. Nodal planes are yz and xy in $d_{x^2-y^2}$ orbital

D. Rest mass of photon is zero and increases with it.s velocity

Answer: A::D

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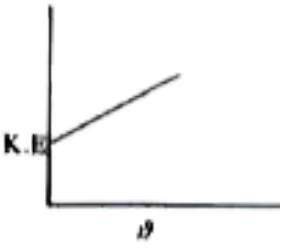
ADDITIONAL PRACTICE EXERCISE (Level-II (ADVANCED)) (Linked Comprehension Type Questions)

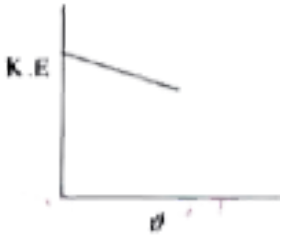
1. When a beam of photons of a suitable frequency strikes the metal surface, electrons are emitted from metal. This process is called photoelectric effect. The effect occurs when energy of incident beam is greater than that of the work function.

Which of the following graphs represents photoelectric effect ?

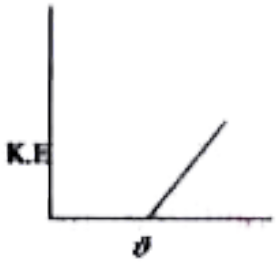
A.

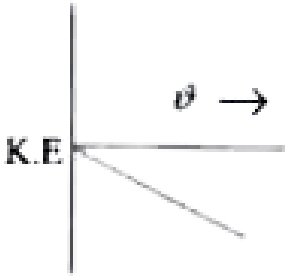


B.



C.





D.

Answer: C

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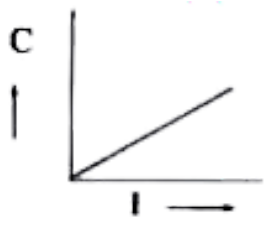
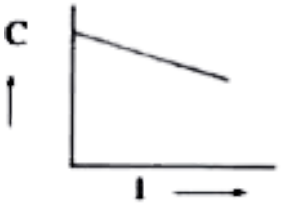
2. When a beam of photons of a suitable frequency strikes the metal surface, electrons are emitted from metal. This process is called photoelectric effect. The effect occurs when energy of incident beam is greater than that of the work function

The graph between photo electron current (c) and intensity of photon (I)

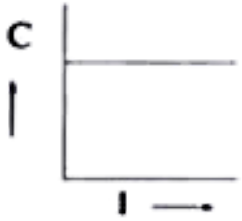


A.

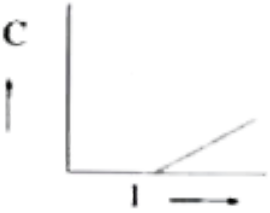
B.



C.



D.



Answer: A

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3. When a beam of photons of a suitable frequency strikes the metal surface, electrons are emitted from metal. This process is called photoelectric effect. The effect occurs when energy of incident beam is

greater than that of the work function.

Kinetic energy of photoelectron varies with

A. Nature of metal

B. Intensity

C. Amplitude

D. Both a & c

Answer: A

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4. The letters n, l and m proposed by Bohr, Sommerfeld and Zeeman respectivelt for quantization of angular momentum in classical physics were later on obtained as the results of solution of Schrodinger wave equation based on quantum mechanics. The term n, l, m are named as principal quantum number, azimuthal quantum number and magnetic number respectively. The fourth quantum number i.e., spin quantum number (s) was given by Uhlenback on the basis of two spins of electrons.

The first two quantum number also decides the nodes of an orbital.

The numerical value $\Psi_{4,3,0}$ denotes

A. 3d-orbital

B. 4f-orbital

C. 2s-orbital

D. 4d-orbital

Answer: B

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5. The letters n, l and m proposed by Bohr, Sommerfeld and Zeeman respectivelt for quantization of angular momentum in classical physics were later on obtained as the results of solution of Schrodinger wave equation based on quantum mechanics. The term n, l, m are named as principal quantum number, azimuthal quantum number and magnetic number respectively. The fourth quantum number i.e., spin quantum number (s) was given by Uhlenback on the basis of two spins of electrons.

The first two quantum number also decides the nodes of an orbital.

The numerical value $\Psi_{4,3,0}$ denotes

A. $\sqrt{2}h$

B. $2h$

C. $\frac{h}{\sqrt{2}}$

D. $\frac{h}{2\pi}$

Answer: A

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6. The letters n, l and m proposed by Bohr, Sommerfeld and Zeeman respectivelt for quantization of angular momentum in classical physics were later on obtained as the results of solution of Schrodinger wave equation based on quantum mechanics. The term n, l, m are named as principal quantum number, azimuthal quantum number and magnetic number respectively. The fourth quantum number i.e., spin quantum number (s) was given by Uhlenback on the basis of two spins of electrons.

The first two quantum number also decides the nodes of an orbital.

The numerical value $\Psi_{4,3,0}$ denotes

A. Only n and l decide energy level

B. Only I decides energy level

C. Only n decides energy level

D. n, l and m decide energy level

Answer: C

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7. Which quantum number describes the orientation of the orbital in space ?

A. Principal

B. Secondary

C. Magnetic

D. Spin

Answer: C

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8. The behaviour of an electron in an atom is described mathematically by a wave function, or orbital. It turns out that each wave function contains three variables, called quantum numbers, which are represented as n, l and m_1. These quantum numbers describe the energy level of an orbital and define the shape and orientation of the region in space where the electron will be found.

Radial nodes are maximum in

A. 4s

B. 4p

C. 3d

D. 5f

Answer: A

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9. The behaviour of an electron in an atom is described mathematically by a wave function, or orbital. It turns out that each wave function contains three variables, called quantum numbers, which are represented as n, l and m_1. These quantum numbers describe the energy level of an orbital and define the shape and orientation of the region in space where the electron will be found.

Radial nodes are maximum in

A. I,ii,iv

B. I,ii,iii

C. ii,iii,iv

D. I,iii,iv

Answer: B

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10. The behaviour of an electron in an atom is described mathematically by a wave function, or orbital. Spin of the electron produce angular momentum equal to $S = \sqrt{s(s+1)}\frac{h}{2\pi}$ where$S = +\frac{1}{2}$. Total spin of an atom $= +\frac{n}{2}$ or $\frac{h}{2}$ Where n is the number of unpaired electron.

The substance which contain species with unpaired electrons in their orbitals behave as paramagnetic substances. The paramagnetism is expressed in terms of magnetic moment the magnetic moment of an atom

$$\mu_s\sqrt{s(s+1)}\frac{eh}{2\pi mc} = \sqrt{\left(\frac{n}{2}\right)\left(\frac{n}{2}+1\right)}\frac{eh}{2\pi mc}s = \frac{n}{2} \Rightarrow \mu_s = \sqrt{n(n+2)}B.M$$

n = number of unpaired electrons

1 B.M. (Bohr magneton) = $\frac{eh}{4\pi mc}$

If magnetic moment is zero the substances is di-magnetic.

Which of the following ion has lowest magnetic moement.

A. Fe^{2+}

B. Mn^{2+}

C. Cr^{3+}

D. V^{3+}

Answer: D

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11. The behaviour of an electron in an atom is described mathematically by a wave function, or orbital. Spin of the electron produce angular momentum equal to $S = \sqrt{s(s+1)}\frac{h}{2\pi}$ where$S = +\frac{1}{2}$. Total spin of an atom $= +\frac{n}{2}$ or $\frac{h}{2}$ Where n is the number of unpaired electron.

The substance which contain species with unpaired electrons in their orbitals behave as paramagnetic substances. The paramagnetism is expressed in terms of magnetic moment the magnetic moment of an atom

$$\mu_s\sqrt{s(s+1)}\frac{eh}{2\pi mc} = \sqrt{\left(\frac{n}{2}\right)\left(\frac{n}{2}+1\right)}\frac{eh}{2\pi mc}s = \frac{n}{2} \Rightarrow \mu_s = \sqrt{n(n+2)}B.M$$

n = number of unpaired electrons

1 B.M. (Bohr magneton) = $\frac{eh}{4\pi mc}$

If magnetic moment is zero the substances is di-magnetic.

If an ion of $_{25}Mn$ has a magnetic of 3.873 B.M. Then Mn is in which state.

A. +2

B. +3

C. +4

D. +5

Answer: C

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ADDITIONAL PRACTICE EXERCISE (Level-II (ADVANCED)) (Matrix Matching Type Questions)

1. Match the following

Column-I	Column-II
A) Electron moving in 2^{nd} orbit in He^+ ion	P) Radius of orbit in which electron is moving is 0.529Å
B) Electron moving in 3^{rd} orbit in H-atom	Q) Total energy of electron is $(-)13.6 \times 9eV$
C) Electron moving in 1^{st} orbit in Li^{+2} ion	R) Velocity of electron is $\frac{2.188\times10^6}{3}$ m/sec
D) Electron moving in 2^{nd} orbit is Be^{+3} ion	S) De-broglie wavelength of electron is $\sqrt{\frac{150}{13.6}}$ Å

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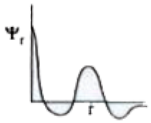
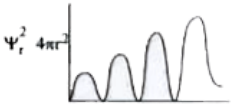
2. Match the following

Column-I	Column-II (Type of orbital)
A) 	P) 4s
B) 	Q) $5p_x$
C) Y(q, f) = K (independent of q & f)	R) 3s
D) atleast one angular node is present	S) $6d_{xy}$

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3. Match the following

Column-I	Column-II
A) Orbital angular momentum of an Electron	P) $\sqrt{s(s+1)}\frac{h}{2\pi}$
B) Angular momentum of an electron in an orbit	Q) $\sqrt{n(n+2)}$
C) Spin angular momentum of an electron	R) $\frac{nh}{2\pi}$
D) Magnetic moment of atom	S) $\sqrt{l(l+1)}\frac{h}{2\pi}$

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4. Match the following

Column-I	Column-II
(l' and 'm' are respectively the azimuthal and magnetic quantum numbers)	
A) Number of values of (l) for an energy level	P) 0, 1, 2, ...(n–1)
B) Actual values of (l) for an energy level	Q) $+l$, ...+2, +1, 0, –1, –2, ...$-l$
C) Number of 'm' values for a particular type of orbital	R) $(2l + 1)$
D) Actual values of 'm' for a particular type of orbital	S) n

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5. Match the following

Column-I	Column-II
A) 2s	P) $n = 4, l = 2, m = 0$
B) $2p_z$	Q) $n = 4, l = 2, m = -2$ or $+2$
C) $4d_{x^2-y^2}$	R) $n = 2, l = 0, m = 0$
D) $4d_{z^2}$	S) $n = 2, l = 0, m = 0$

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ADDITIONAL PRACTICE EXERCISE (Level-II (ADVANCED)) (Integers)

1. In a sample of excited hydrogen atoms electrons make transition from n = 2 to n = 1. Emitted photons strike on a metal of work function (ϕ) 4.2 eV. Calcualte the wavelength (in A°) associated with ejected electrons having maximum kinetic energy.

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2. If the electron in hydrogen atom jumps from the third orbit to second orbit, the wavelength of the emitted radiation is given by $\lambda = \frac{36}{xR}$. Then value of x is

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3. What is the energy of state in a triply ionized beryllium $\left(Be^{++}\right)$ whose radius is equal to that of ground state of hydrogen ?

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4. Difference between the wave length of 1^{st} line of Balmer series and last line of Paschen series for Li^{2+} ion is $\frac{1}{xR_H}$ then .x. is

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5. The amount of energy required to remove the electron from a Li^{+2} ion in its ground state is x times that of the amount of energy required to remove the electron from an H-atom in its ground state find .x.

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6. If each hydrogen atom in the ground state, 1.0 inole of H atoms are excited by absrobing photons of energy 8.4 eV, 12.09 eV and 15.0 eV of energy, then the number of spectral lines emitted is equal to

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7. For 1s orbital Hydrogen atom radial wave function is given as: $R(r) = \frac{1}{\sqrt{\pi}}\left(\frac{1}{a_0}\right)^{3/2} e^{-r/a_0}$ (where $a_0 = 0.529A^\circ$) .The ratio of radial probability density of finding electron at $r = a_0$ to the radial probability density of finding electron at the nucleus is given as $\left(x.e^{-y}\right)$. Calculate the value of (x + y).

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ADDITIONAL PRACTICE EXERCISE (PRACTICE SHEET (ADVANCED)) (More than one correct answer Type Questions)

1. The aufbau principle implies that a new electron will enter an orbital for which

A. (n + l) is minimum

B. l has a lower value

C. (n + l) value is maximum

D. if (n + l) value is same then lower n value is preferable

Answer: A::D

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2. Equal number of total nodes is present in

A. 5s

B. 5p

C. 50

D. 50

Answer: A::B::C

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3. Which electronic level would allow the hydrogen atom to emit a photon but not to absorb a photon?

A. 3

B. 2

C. 1

D. 4

Answer: A::B::D

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4. A hydrogen sample is prepared in a particular excited state A. Photons of energy 2.55eV/atom gel absorbed into the sample to take some of the electrons to a further excited state B. As per the number of photons when an electron in the higher excited state returns to the ground state, which of the following are may not be possible?

A. 15

B. 10

C. 6

D. 3

Answer: A::B::D

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5. Radius of 3^{rd} orbit of Li^{2+} ion is x cm then which is not the de Broglie wavelength of electrons in the first orbit is (in cm)

A. $6\pi x$

B. $\frac{2\pi x}{9}$

C. $\frac{2\pi x}{3}$

D. $\frac{8\pi x}{3}$

Answer: A::B::C

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6. In an oil drop experiment, the following charges (in arbitrary units) were found on a series of oil droplets : 2.30×10^{-15}, 6.90×10^{-15}, 1.38×10^{-14}, 5.75×10^{-15}, 3.45×10^{-15}, 1.96×10^{-14}. The experimental value suggests not possible magnitude of the charge on the electron is in the same arbitrary unit)

A. 2.30×10^{-15}

B. 1.38×10^{-14}

C. 6.90×10^{-15}

D. 1.15×10^{-15}

Answer: A::B::C

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7. Which of the following is not the Ratio of frequency of revolution of electron in the 2^{nd} excited state of He^{+} and 2^{nd} state of hydrogen is:

A. $\frac{27}{32}$

B. $\frac{32}{27}$

C. $\frac{1}{54}$

D. $\frac{27}{2}$

Answer: B::C::D

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8. A photon with a wavelength of $4000A^{\circ}$ is used to break the iodine molecule, then the % of energy converted to the K.E. of iodine atoms if bond dissociation energy of I_2 molecule is 246.5 kJ/mol

A. 8 %

B. 12 %

C. 17 %

D. 25 %

Answer: C

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9. When lithium is irradiated with light, one finds a stopping potential of 1.83V for $\lambda = 3000A^\circ$ and 0.80V for $\lambda = 4000A^\circ$. With the known charge on the electron, the work function of lithium is

A. 4.6eV

B. $3.68 \times 10^{-19} J$

C. $2.3eV$

D. $1.2eV$

Answer: B::C

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10. The correct Schordinger.s wave equation for a electron with total energy E and potential energy V is not correctly given by

A. $\frac{\delta^2\Psi}{\delta x^2} + \frac{\delta^2\Psi}{\delta z^2} + \frac{\delta^2\Psi}{\delta z^2} + \frac{8\pi^2}{mh^2}(E - V)\Psi = 0$

B. $\frac{\delta^2\Psi}{\delta x^2} + \frac{\delta^2\Psi}{\delta y^2} + \frac{\delta^2\Psi}{\delta z^2} + \frac{8\pi m}{h^2}(E - V)\Psi = 0$

C. $\frac{\delta^2\Psi}{\delta x^2} + \frac{\delta^2\Psi}{\delta y^2} + \frac{\delta^2\Psi}{\delta z^2} + \frac{8\pi^2 m}{h^2}(E - V)\Psi = 0$

D. $\bar{V}^2\Psi = 0$

Answer: A::B

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11. $\Psi^2(r, \theta, \phi)$ represents (for schrodinger wave mechanical model)

A. Amplitude of electron wave

B. Probability density of electron

C. product with $4\pi r^2 dr$ gives Total probability density of electron

D. orbit

Answer: B::C

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12. For $4p_y$ orbital There have

A. 1 nodal plane

B. 2 nodal planes

C. 1 radial node

D. 2 radial nodes

Answer: A::D

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13. Select the correct statement(s) regarding $3p_y$ orbital

A. Total no. of nodes are 2

B. Number of maximuma in the curve $4\pi r^2 R^2$ vs r are two

C. Quantum no. n, l and m for orbital may be 3,1,-1 respectively

D. The magnetic quantum number may have a positive value

Answer: A::B::C::D

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14. Select the correct statement(s)

A. Radial function [(R(r)] a part of wave function is dependent on quantum number n only

B. angular function depends only on the direction, and is dependent to the distance from the nucleus

C. $\Psi(r, \theta, \phi)$ is the probability density of finding the electron at a particular point in space

D. Radial distribution function $\left(4\pi r^2\right)$ gives the probability of the electron being present at a distance r from the nucleus

Answer: B::C::D

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15. For which of the following orbital, the radial as well as number of nodal planes have all the same value ?

A. $3P_x$

B. $4P_y$

C. $3s$

D. $5d_{xy}$

Answer: A::D

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16. An α-particle and a proton are accelerated from rest by the same potential, thenthe ratio of their de-Broglie wavelength is

A. $\sqrt{2}$

B. $\frac{1}{\sqrt{2}}$

C. $2\sqrt{2}$

D. 2

Answer: A::B::D

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17. Incorrect Wave number of the second line of Paschen series for H is (R = 109700 cm^{-1})

A. 18750Å

B. 3452Å

C. 7801Å

D. 1542656Å

Answer: A::B::D

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18. Photoelectric emission is observed from a metallic surface for frequencies v_1 and v_2 of the incident light $\left(v_1 > v_2\right)$. If the maximum values of kinetic energy of the photoelectrons emitted in the two cases are in the ratio $1 : n$, then the threshold frequency of the metallic surface is

A. $\frac{\upsilon_2 - \upsilon_1}{k - 1}$

B. $\frac{K\upsilon_1 - \upsilon_2}{K - 1}$

C. $\frac{K\upsilon_2 - \upsilon_1}{K - 1}$

D. $\frac{\upsilon_2 - \upsilon_1}{K}$

Answer: A::C::D

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19. A particle X moving with a certain velocity has a debroglie wave length of 1Å, If particle Y has a mass of 25% that of X and velocity 75% that of X, debroglies wave length of Y will be -

A. 1Å

B. 5.3Å

C. 0.2Å

D. 3Å

Answer: A::C::D

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20. If the radius of first Bohr orbit of H atom is x, then de Broglie wavelength of electron in 3^{rd} orbit is nearly

A. $2\pi x$

B. $6\pi x$

C. $9\pi x$

D. $x\pi/3$

Answer: A::C::D

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21. If E_1, E_2 and E_3 represent respectively the kinetic energies of an electron, an alpha particle and a proton respectively each having same deBroblie wavelength then which is incorrect relation?

A. $E_1 > E_3 > E_2$

B. $E_2 > E_3 > E_1$

C. $E_1 > E_2 > E_3$

D. $E_1 = E_2 = E_3$

Answer: B::C::D

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22. Electronic transition in He ion takes from n_2 to n_1 shell such that :

$2n_2 + 3n_1 = 18, 2n_2 - 3n_1 = 6$

What will be the total number of photons emitted when electrons transit to n_1 shell ?

A. 21

B. 15

C. 20

D. 10

Answer: D

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23. For which of the following sets of quantum numbers, an electron will have the highest energy ?

A.

n	l	m	s
3	2	1	-1/2

B.

n	l	m	s
4	3	-1	+1/2

C.

n	l	m	s
4	1	-1	+1/2

D.

n	l	m	s
5	0	0	-1/2

Answer: B

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24. Which of the following statements concerning the four quantum numbers is true?

A. n gives idea of the size of an orbit

B. I gives the shape of an orbital

C. m gives the energy of the electron in the orbital

D. s gives the direction of spin of the electron in an orbital

Answer: A::B::D

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25. d^6 onfiguration will not result in total spin of:

A. $\frac{3}{2}$

B. $\frac{1}{2}$

C. 2

D. 4

Answer: A::B::D

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26. The probability of finding electrons in de orbital is:

A. zero along X-and Y-axis

B. maximum along X-and Z-axis

C. maximum along Y-and Z-axis

D. maximum at an angle of 45° with X-axis

Answer: A::D

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27. In a hydrogen like atom, electron is in 2^{nd} excited state, the binding energy of fourth state of this atom is 13.6 eV, then

A. A 25 eV photon can set free the electron from the second excited state of this sample.

B. 3 different types of photon will be observed if electrons make transition up to ground state from the second excited state

C. If 23 eV photon is used then K.E. of the ejected electron is 1eV.

D. 2^{nd} line of balmer series of this sample has same energy value as 1^{st} excitation energy of H-atoms

Answer: A::B

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28. In Which of the following situations the heavier of the two particles have smaller de Broglie wavelength ? The two particles

A. move with same speed

B. move with same linear momentum

C. move with same kinetic energy

D. have fallen from same height

Answer: A::C::D

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29. A hydrogen-like atom (atomic number Z) is in a higher excited state of quantum number n. This excited atom can make a transition to the first excited state by successively emitting two photons of energies 10.20 eV and 17.00 eV respectively. Alternatively the atom from the same excited state can make a transition to the second excited state by snccessively emitting two photons of energies 4.25 eV and 5.95 eV respectively. Determine the values of n and Z (ionization energy of hydrogen atom = 13.6 eV)

A. n=5

B. z=2

C. n=6

D. z=3

Answer: C::D

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30. In an electron transition of hydrogen atom orbital momentum may change by :

A. Hund.s rule

B. $\frac{h}{\pi}$

C. $\frac{h}{2\pi}$

D. $\frac{h}{4\pi}$

Answer: B::C

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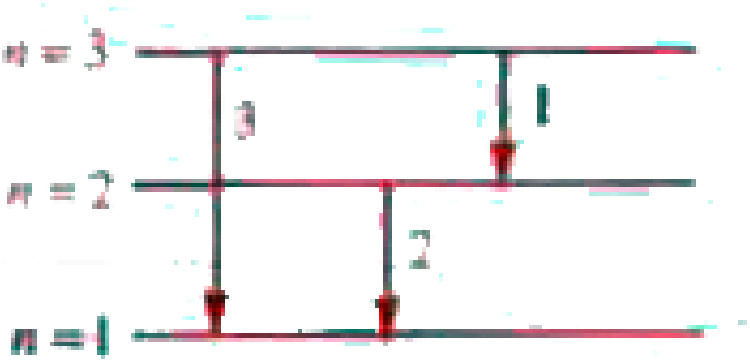

31.

For above transitions in hydrogen like atoms, select the incorrect relation(s).

A. $v_3 = v_1 + v_2$

B. $v_3 = \frac{v_1 v_2}{v_1 + v_2}$

C. $\lambda_3 = \lambda_1 + \lambda_2$

D. $\lambda_3 = \frac{\lambda_1 \lambda_2}{\lambda + \lambda_2}$

Answer: A::D

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32. If the electron of the hdyrogen atom is replaced by another particle of same charge but of the double mass, then :

A. radii of different shells will increase

B. energy gap between two levels will become double

C. ionization energy of the atom will be double

D. speed of new particle in a shell will be lesser than the speed of electron in the same shell

Answer: C::D

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33. The radial distribution function [P(r)] is used to determine the most probable radius, which is used to find the electron in a given orgital $\frac{dP(r)}{dr}$ for 1s-orbital of hydrogen like atom having atomic number Z, is

$\frac{dP}{dr} = \frac{4Z^3}{a_0^3} \frac{2r - \left(2Zr^2\right)}{a_0} e^{-27x/a_0}$: Then which is the following statements is/are correct ?

A. At the point of maximum value of radial distribution function $\frac{dP(r)}{dr} = 0$, one anti-node is present

B. Most probable radius of Li^{2+} is $\frac{a_0}{3}$ pm

C. Most probable radius of He^{+} is $\frac{a_0}{2}$

D. Most probable radius of hydrogen atom is (a_0)

Answer: A::B::C::D

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ADDITIONAL PRACTICE EXERCISE (PRACTICE SHEET (ADVANCED)) (Linked Comprehension Type Questions)

1. When electron jumps from higher orbit to lower orbit, then energy is radiated in the form of electro magnetic radiation and these radiations are used to record the emission spectrum Energy of electron may be calculated as $E = \frac{2\pi^2 m_e Z^2 e^4}{n^2 h^2}$

where m_e = rest mass of electron

$$\Delta E = \left(E_{n_2} - E_{n_1}\right) = 13.6 \times Z^2 \times \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] \text{eV per atom}$$

This equation was also used by Rydberg to calculate the wave number of a particular line in the spectrum.

$$\bar{\upsilon} = \frac{1}{\lambda} = R_H Z^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] m^{-1}$$

Where , $R_H = 1.1 \times 10^7 m^{-1}$ (Rydberg constant)

For Lyman, Balmer, Paschen, Brackett and Pfund series the value of n_1 = 1,2,3,4,5 respectively and $n_2 = \infty$ for series limit, If an electron jumps from higher orbit n to ground state than number of spectral line will be ${}^nC_2$.

Ritz modified the Rydberg equation by replacing the rest mass of electron with reduced mass (μ).

$\frac{1}{\mu} = \frac{1}{m_N} + \frac{1}{m_e}$, Here m_N mass of nucleus , m_e = mass of electron.

The emission spectrum of He^+ involves transition of electron from $n_1 \rightarrow n_2$ such that $n_2 + n_1 = 8$ and $n_2 - n_1 = 4$. What will be the total number of lines in the spectrum ?

A. 10

B. 15

C. 20

D. 21

Answer: A

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2. When electron jumps from higher orbit to lower orbit, then energy is radiated in the form of electro magnetic radiation and these radiations are used to record the emission spectrum Energy of electron may be calculated as $E = \frac{2\pi^2 m_e Z^2 e^4}{n^2 h^2}$

where m_e = rest mass of electron

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Ritz modified the Rydberg equation by replacing the rest mass of electron with reduced mass (μ).

$\frac{1}{\mu} = \frac{1}{m_N} + \frac{1}{m_e}$, Here m_N mass of nucleus , m_e = mass of electron.

What will be the value of modified Rydberg.s constant, if the nucleus having mass m_N and the electron having mass m_e revolve around the centrer of the mass?

A. $R_H \times \frac{m_N}{m_e}$

B. $R_H \times \frac{m_e}{m_N}$

C. $R_H \times \frac{m_e}{m_N + m_e}$

D. $R_H \times \frac{m_N}{m_N + m_e}$

Answer: D

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3. When electron jumps from higher orbit to lower orbit, then energy is radiated in the form of electro magnetic radiation and these radiations are used to record the emission spectrum Energy of electron may be calculated as $E = \frac{2\pi^2 m_e Z^2 e^4}{n^2 h^2}$

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$$\Delta E = \left(E_{n_2} - E_{n_1}\right) = 13.6 \times Z^2 \times \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] \text{eV per atom}$$

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Ritz modified the Rydberg equation by replacing the rest mass of electron with reduced mass (μ).

$\frac{1}{\mu} = \frac{1}{m_N} + \frac{1}{m_e}$, Here m_N mass of nucleus , m_e = mass of electron.

The ratio of the wavelength of the first line to that of second line of Paschen series of H-atom is:

A. $256 : 175$

B. $175 : 256$

C. $15 : 16$

D. $16 : 15$

Answer: B

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ADDITIONAL PRACTICE EXERCISE (PRACTICE SHEET (ADVANCED)) (Matrix Matching Type Questions)

1. Match the following

Column-I	Column-II
A) Cathode rays	P) Helium nuclei
B) Dumb-bell	Q) Uncertainty principle
C) Alpha particles	R) Electromagnetic radiation
D) Moseley	S) p-orbital
E) Heisenberg	T) Atomic number
F) X-rays	U) Electrons

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ADDITIONAL PRACTICE EXERCISE (PRACTICE SHEET (ADVANCED)) (Integer Type Questions)

1. Photon having energy equivalent to the binding energy of 4^{th} state of He^{+} atom is used to eject an electron from the metal surface of work function 1.4 eV. If electrons are further accelerated through the potential difference of 4V then the minimum value of De-broglie wavelength associated with the electron is :

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2. Principal quantum number of the shell to which the g-subshell first arise is _____.

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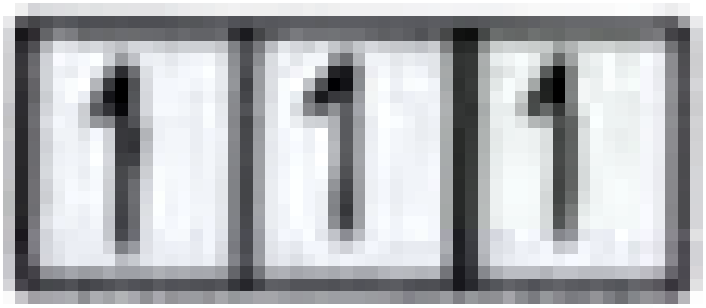
3. Spin multiplicity of p-subshell with configuration



is _____ .

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4. When 4f level is completely filled with electrons, the next electron will enter into a subshell whose (n+1) is equal to -

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5. The maximum number of electrons that can have principal quantum number, n = 3 and spin quantum number $m_s = -1/2$ is _____.

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6. The number of waves make by a Bohr electron in an orbit of maximum magnetic quantum number +2 is .

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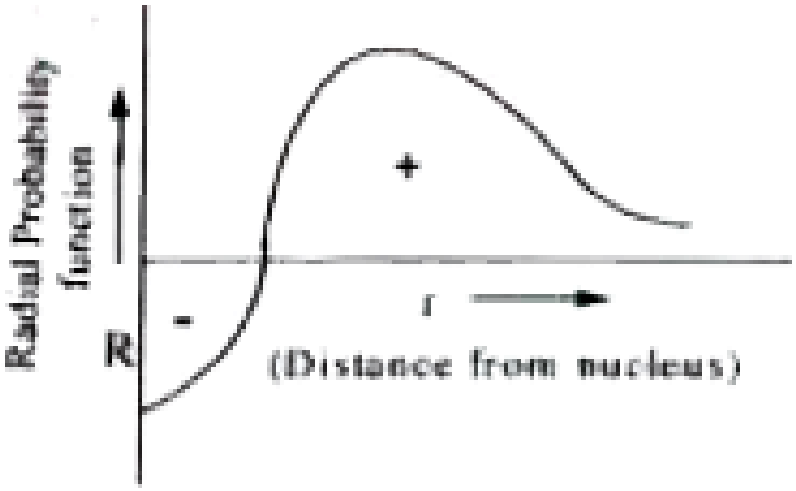

7. Number of nodes in above plot is :

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8. Calculate the value of A.

$A = \frac{E_1, 2}{2E_{2,1}}$ Where $E_{n,z}$= Energy of electron in n^{th} orbit , Z = atomic number of hydrogen like specie.

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PROBLEMS

1. How many protons and neutrons are there in one atom of ${}_{6}^{13}C$

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2. Calculate the number electrons which weigh one gram.

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3. An ion with mass number 37 possesses one unit of negative charge. If the ion contains 11.1% more neutrons than the electrons, write its symbol.

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4. A certain particle carries $-2.5 \times 10^{-16} C$ of static charge. Calculate the number of electrons present in it.

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5. What is the wave length in meters of an FM radio wave with frequency 102.5 MHz ?

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6. The wavelength of a blue light is 4800Å. Calculate the frequency and wave number of this light.

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7. The wavelength of a radiation emitted by a sodium lamp is 600 nm. Find the frequency ?

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8. The vividh bharati station of All India Radio, Delhi broadcasts on a frequency of 1.368 kHz. Calculate the wave length of the electromagnetic

radiation emitted by the transmitter. Which part of the electromagnetic spectrum does it belong ?

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9. Neon gas is generally used in the sign boards. If it emits with wavelength of 616 nm, calculate

(i) the frequency of emission

(ii) energy of quantum and

(iii) distance travelled by this radiation in 30 s.

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10. Calculate the energy of one mole of photons of radiations whose frequency is $3 \times 10^{12} Hz$

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11. How many photons of light with a wave length of 4000 pm are necessary to provide one joule of energy?

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12. The threshold frequency of a metal is $1.11 \times 10^{16} Hz$. What is the maximum kinetic energy of the photo electron produced by applying a light of 15Å on the metal?

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13. What is the ratio between the energies of two types of radiation whose wavelengths are 6000 Å and 2000 Å respectively.

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14. The work function of a metal is 4.2eV. If the radiation of 2000Å falls on the metal, find the kinetic energy of the metal

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15. Electrons are emitted with zero velocity from a metal surface when it is exposed to radiation of wavelength 6800 Å. Calculate threshold frequency $\left(V_0\right)$ and work function $\left(W_0\right)$ of metal.

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16. The threshold frequency for a metal is $7.0 \times 10^{14} s^{-1}$. Calculate the kinetic energy of an electron emitted when radiation of frequency $10^{15} s^{-1}$ hits the metal.

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17. Calculate the wave number and wave length of H_α line in the Balmer series of hydroge emission spectrum.

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18. Why many lines are observed in the hydrogen emission spectrum ?

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19. Hydrogen atoms are de-excited from N shell. Illustrate the spectral lines obtained in the emission.

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20. What is the wavelength of light emitted when the electron in a hydrogen atom undergoes transition from an energy level with n = 4 to an energy level with n = 2

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21. Calculate the wave number of the first spectral line in the Lyman series of He^+ spectrum

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22. Why the total energy of atomic electron is negative ?

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23. The radius of the fourth orbit in hydrogen atom is 0.85 nm. Calculate the velocity of the electron in this orbit.

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24. Why is the transition from n=3 to n=1 gives a spectral triplet

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25. What is the ratio of the radii of the 3rd orbits of He^+ and Li^{2+} ?

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26. The ionisation energy of He^+ is 19.6×10^{-18}J atom^{-1} Calculate the energy of first stationary state of Li^{2+} ion.

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27. How many times the normal electrons of hydrogen atom revolve round the nucleus in on sec ?

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28. What is the circumference of the second orbit of hydrogen atom?

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29. Calculate the wave length of an electron of mass $9.1 \times 10^{-31} kg$, moving with a velocity of $2.05 \times 10^{7} ms^{-1}$.

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30. Find the momentum of a particle whose de Broglie wavelengh is $1Å$.

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31. If the kinetic energy of an electron is $4.55 \times 10^{-25} J$, find its wavelength (Planck's cosntant, $h = 6.625 \times 10^{-34} kgm^2 s^{-1}$, $m = 9.1 \times 10^{-31} kg$).

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32. Calculate the circumference of Bohr's L shell.

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33. Find the number of waves made by a Bohr electron in one complete revolution in the 3rd orbit.

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34. When would the wavelength associated with an electron become equal to that with proton ? (Mass of electron $= 9.10 \times 10^{-31} kg$, Mass of proton $= 1.6725 \times 10^{-27} kg$)

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35. Calculate the uncertainty in the velocity of an electron, if the uncertainity in position is 100 pm.

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36. The uncertainty in the position and velocity of a particle are $10^{-10}m$ and $5.25 \times 10^{-24}ms^{-1}$. What is the mass of the particle ? $\left(h = 6.625 \times 10^{-34}Js\right)$

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37. What is the product of uncertainties in position and velocity of an electron ?

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38. A golf ball has a mass 40g and a speed of $45ms^{-1}$. If the speed can be measured with inaccuracy of 2%, calculate the uncertainty in position.

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39. s-orbitals have no direction. Comment.

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40. How many peaks and radial nodes are present in the radial probability curve of 3s-orbital ?

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41. Calculate the radial distance between two peaks in the radial probability of 2s orbital.

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42. How many nodal planes and nodal regions are present for 3p orbital?

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43. The quantum numbers of six electrons are given below. Arrange them in order of increasing energies. Do any of these combination have same energy.

1. $n = 4 \quad l = 2 \quad m_l = -2 \quad m_s = -1/2$
2. $n = 3 \quad l = 2 \quad m_l = 1 \quad m_s = +1/2$
3. $n = 4 \quad l = 1 \quad m_l = 0 \quad m_s = +1/2$
4. $n = 3 \quad l = 2 \quad m_l = -2 \quad m_s = -1/2$
5. $n = 3 \quad l = 1 \quad m_l = -1 \quad m_s = +1/2$
6. $n = 4 \quad l = 1 \quad m_l = 0 \quad m_s = +1/2$

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44. How many electrons in an atom may have the following quantum numbers ?

(a) $n = 3, m_s = -1/2$

(b) n = 4, l = 0

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45. How many sub-shells are associated with n=4 ? How many electrons will be present in the sub-shell having ms value of -1/2 for n=4 ?

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46. Among the following pairs of orbitals which orbital will experience the larger effective nuclear charge ?

(i) 2s and 3s (ii) 4d and 4f (iii) 3d and 3p

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47. The bromine atom possesses 35 electrons. It contains 6 electrons in 2p orbital, 6 electrons in 3p orbital and 5 electrons in 4p orbital. Which of these electrons experience the lowest effective nuclear charge ?

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48. Metal atom with atomic number 21 has the differentiating electron enetering in 3d but not in 4s. However, in the formation of divalent cation 4s electrons are removed. Why?

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SUBJECTIVE EXERCISE - 1 (LONG ANSWER QUESTIONS)

1. Explain Rutherford 's nuclear of an atom . What are its drawbacks ?

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2. Write Planck's equation .

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3. What are the facts in support of the belief that electrons are an essential constituent particles of atoms ?

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SUBJECTIVE EXERCISE - 1 (SHORT ANSWER QUESTIONS)

1. Find energy of photons which corresponds to light of frequency $3 \times 10^{12} Hz$

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2. Calculate the wave numbers corresponding to the following wavelengths (a) 2000Å (b) 800 nm

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3. When a light of wavelength 300 nm falls on the surface of potassium metal, electrons with kinetic energy of $1.5 \times 10^5 Jmol^{-1}$ are emitted, then calculate the minimum energy needed to remove an electron from the metal.

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4. The threshold frequency $\left(v_0\right)$ for a metal is $5 \times 10^{14} S^{-1}$. Calculate the kinetic energy of emitted electron when a radiation with frequency of $2 \times 10^{15} \text{sec}^{-1}$ hits the metal surface.

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5. Calculate the kinetic energy of emitted electron when a radiation with frequency of $2 \times 10^{15} \text{sec}^{-1}$ hits the metal surface.

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6. Calculate the frequency (v) and wave number $\left(\bar{v}\right)$ of the yellow light with a wavelength of 580 nm emitted from sodium lamp.

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SUBJECTIVE EXERCISE - 1 (VERY SHORT ANSWER QUESTIONS)

1. What is the charge , mass and charge to mass ratio of an electron ?

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2. What is a black body ?

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3. What are the units of wavelength, wavenumber and frequency.

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4. What is the wave number of a radiation of wavelength 400 nm ?

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5. What is the value of Planck's constant

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SUBJECTIVE EXERCISE - 3 (VERY SHORT ANSWER QUESTIONS)

1. What is an atomic orbital ?

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2. What is the shape of p-orbital ?

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3. How many electrons are present in sulphur ?

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4. Write the electronic configuration of 'Magnesium'.

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5. To which element do the following electronic configuration correspond to

(i) $1s^2 2s^2 2p^6 3s^1$ (ii) $1s^2 2s^2 2p^6 3s^2 3p^1$

(iii) $1s^2 2s^2 2p^6 3s^2 3p^6$

(iv) $1s^2 2s^2 2p^5$ (v) $1s^2 2s^1$

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6. Explain the significance of Ψ^2.

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7. What is Hund's rule ?

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8. State and explain Pauli's exclusion principle.

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9. What is Aufbau principle ?

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10. Which of the following orbitals are possible ? (2s,1p,3f,2p)

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11. How many sub-shells are associated with n=4 ? How many electrons will be present in the sub-shell having ms value of -1/2 for n=4 ?

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12. The bromine atom possesses 35 electrons. It contains 6 electrons in 2p orbital, 6 electrons in 3p orbital and 5 electrons in 4p orbital. Which of these electrons experience the lowest effective nuclear charge ?

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13. How many unpaired electrons are present in divalent manganese ion ?

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OBJECTIVE EXERCISE - 2

1. Ratio of masses of proton and electron is

A. 1.8

B. 1.8×10^3

C. Infinite

D. None of these

Answer: B

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2. The charge of an electron is 1.6×10^{-19} coulombs. What will be the value of charge on Na^+ ion

A. $1.6 \times 10^{-19} C$

B. $3.2 \times 10^{-19} C$

C. $2.4 \times 10^{-19} C$

D. $11 \times 1.6 \times 10^{-19} C$

Answer: A

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3. The constancy of e/m ratio for electron shows that

A. Electron's mass is $1/1837^{th}$ of the mass of proton

B. Electrons are universal particles of all matter

C. Electrons are produced in discharge tubes only

D. None of the above

Answer: B

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4. The costancy of e/m ratio for electron shows that

A. e, p, n, α

B. n, p, e, α

C. n, p, α, e

D. n, α, p, e

Answer: D

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5. The ratio between the neutrons present in carbon atom and silicon atoms with mass numbers 12 and 28 is

A. $7:3$

B. $3:7$

C. $1:2$

D. $2:1$

Answer: B

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6. The number of nucleons in the isotope of an atom ${}_{z}X^{m}$ are

A. m

B. Z

C. $m + Z$

D. $m - Z$

Answer: A

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7. An oxide of nitrogen has a molecular weight of 30. Total number of electrons in one molecule of the compound is

A. 15

B. 30

C. 45

D. 60

Answer: A

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8. Maximum sum of the number of neutrons and protons in an isotope of hydrogen

A. 6

B. 5

C. 4

D. 3

Answer: D

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9. Consider the following pairs of ions

A) Sc^{+3} and Ti^{+4}

B) Mn^{+4} and Fe^{+2}

C) Fe^{+2} and Co^{+3}

D) Cu^{+} and Zn^{+2}

Among these pairs of ions, isoelectronic pairs would include

A. B, C and D

B. A, C and D

C. A, B and D

D. A, B and C

Answer: B

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10. Mass numbers of Li, Be and B are 7, 9 and 10 respectively. Which of the following has two electrons, three protons and four neutrons?

A. B^+

B. Be^+

C. Li^+

D. Be

Answer: C

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11. The energy required to melt 1g. Ice is 33J. The number of quanta of radiation of frequency $4.67 \times 10^{13} \text{sec}^{-1}$ that must be absorbed to melt 10g ice is

A. 1.065×10^{22}

B. 3.205×10^{23}

C. 9.076×10^{20}

D. None

Answer: A

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12. According to Planck's Quantun theory, the correct statements are

(a) The vibrating particle in the black body does not emit continuously

(b) Radiation is emitted in the form of small packets called Quanta

(c) Energy associated with emmitted radiations is inversely proportional to frequency.

(d) The emitted radiant energy is propagated in the form of waves.

A. a,b,c

B. b,c

C. a,b,d

D. b,d,c

Answer: C

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13. Energy equal to the mass of one electron is

A. $8.2 \times 10^{-7} erg$

B. $9.2 \times 10^{-8} erg$

C. $8.2 \times 10^{-10} erg$

D. $4.1 \times 10^{-8} erg$

Answer: A

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14. Which of the following statements is incorrect?

A. Particle nature of radiations can be experi mentally demonstrated by Compton effect

B. Wave nature of electrons can be experi mentally demonstrated by diffraction experiment

C. The value of Planck's constant, h is $6.62 \times 10^{-34} J$.

D. Intensity of light is directly proportional to its frequency

Answer: D

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15. Find the ratio of energy of a photon of 2000 Å wavelength radiation to that of 4000 Å radiation.

A. $1:4$

B. $4:1$

C. $1:2$

D. $2:1$

Answer: D

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16. The energy of an electromagnetic radiation is 3×10^{-12} ergs. What is its wavelength in nanometers ? ($h = 6.625 \times 10^{-27}$ erg.sec, $C = 3 \times 10^{10} cm.\ \sec^{-1}$

A. 400

B. 228.3

C. 3000

D. 662.5

Answer: D

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17. If a metal is irradiated with light of frequency $3 \times 10^{19} \sec^{-1}$, electron is emitted with kinetic energy of $6.625 \times 10^{-15} J$. The threshold frequency of the metal is

A. $2 \times 10^{19} \sec^{-1}$

B. $1.25 \times 10^{19} \text{sec}^{-1}$

C. $6.625 \times 10^{35} \text{sec}^{-1}$

D. $6.625 \times 10^{19} \text{sec}^{-1}$

Answer: A

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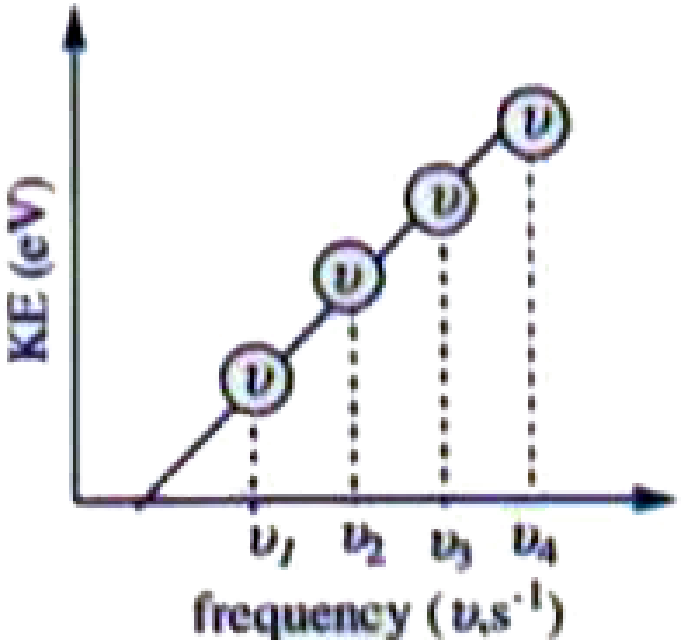
18. In a photoelectric experiment, kinetic energy of photoelectrons was plotted aganist the frequency of incident radiation (v), as the shown in

figure. Which of the following statements is correct?



A. The threshold frequency is v_1

B. The slope of this line is equal to Plank's constant.

C. As the frequency of incident radiation increase frequency, kinetic energy of photoelectrons decreases

D. It is impossible to obtain such a graph.

Answer: B

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19. Calculate the mass of a photon with wavelength 3.6 Å.

A. $6.135 \times 10^{29} Kg$

B. $6.135 \times 10^{-33} Kg$

C. $6.135 \times 10^{19} Kg$

D. $6.135 \times 10^{16} Kg$

Answer: B

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20. The wavelength of the first member of the Balmer series in hydrogen spectrum is xÅ. Then the wave length $(\text{in } \text{Å})$ of the first member of Lyman series in the same spectrum

A. $\frac{5}{27}x$

B. $\frac{4}{3}x$

C. $\frac{27}{5}x$

D. $\frac{5}{36}x$

Answer: A

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21. Which of the following transitions will have minimum wavelength ?

A. $n_4 \rightarrow n_1$

B. $n_2 \rightarrow n_1$

C. $n_4 \rightarrow n_2$

D. $n_3 \rightarrow n_1$

Answer: A

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22. The ratio of wavelength values of series limit lines $\left(n_2 = \infty\right)$ of Balmer series and Paschen serie are

A. $4:9$

B. $9:4$

C. $2:3$

D. $3:2$

Answer: A

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23. What electronic transition in Li^{2+} produces the radiation of the same wave length as the first line in the Lyman series of hydrogen?

A. n = 4 to n = 2

B. n = 9 to n= 6

C. n = 9 to n = 3

D. n = 6 to n = 3

Answer: D

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24. The ratio of the wave lengths of the first line in the Lyman series of the spectrum of Hydorgen atom and the first line in the Balmer series of the spectrum of He^+ is

A. $20/27$

B. $27/20$

C. $27/5$

D. $5/27$

Answer: A

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25. The number of spectral lines that are possible when electrons in 7^{th} shell in different hydrogen atoms return to the 2^{nd} shell is

A. 12

B. 15

C. 14

D. 10

Answer: B

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26. In a certain electronic transition from the quantum level, 'n' to the ground state in atomic hydrogen in one or more steps, no line belonging to the Bracket series is observed. What wave number may be observed in the Balmer series ? (R = Rydberg Constant)

A. $\frac{8R}{9}, \frac{5R}{36}$

B. $\frac{3R}{16}, \frac{8R}{9}$

C. $\frac{5R}{36}, \frac{3R}{16}$

D. $\frac{3R}{4}, \frac{3R}{16}$

Answer: C

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27. The minimum and maximum values of wave length in the Lyman series of a H atom are, respectively

A. 364.3 nm and 653.4 nm

B. 91.2 nm and 121.5 nm

C. 41.2 nm and 102,6 nm

D. 9.12 nm and 121.5 nm

Answer: B

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28. Which of the following transitions of an electron in hydrogen atom emits of the lowest wavelength?

A. $n_1 = \infty$ to $n_1 = 2$

B. $n_2 = 4$ to $n_1 = 3$

C. $n_2 = 2$ to $n_1 = 1$

D. $n_2 = 5$ to $n_1 = 3$

Answer: C

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29. In a hydrogen atom, the electron is at a distance of 4.76Å from the nucleus. The angular momentum of the electron is

A. $\frac{3h}{2\pi}$

B. $\frac{h}{2\pi}$

C. $\frac{h}{\pi}$

D. $\frac{2h}{\pi}$

Answer: A

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30. Which of the following statements regarding spectral series is correct?

A. The lines in the Balmer series correspond to the electronic transition from higher energy level two n = 1 energy level.

B. Paschen series appears in the infra-red-region

C. The lines of Lyman series appear in the visible region

D. Transition from higher energy levels to 4th energy level produces Pfund series which fall in the infrared region.

Answer: B

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31. In a series in the line spectrum of hydrogen the wavelength of radiation is 6,563Å. The name of the series and the orbits in which electron transition takes place are

A. Balmer series, 3rd to 2nd orbit

B. Lyman series, 2nd to 1st orbit

C. Pfund series, 6th to 5th orbit

D. Paschen series, 4th to 3rd orbit

Answer: A

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32. The frequency of the spectral line obtained when the electron in $n = 3$ of Hydrogen atom drops to the ground state is

A. $2.925 \times 10^{15} Hertz$

B. 2.925×10^{13} Hertz

C. 2.92×10^{14} Hertz

D. 36559×10^{10} Hertz

Answer: A

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33. When a greater number of electrons from excited hydrogen atoms reach the ground state, then

A. The intensity of spectral lines in Lyman series increases

B. The number of lines in Lyman series increases

C. Both the intensity and number lines in Lyman series increase.

D. There is no observable change in spectrum

Answer: A

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34. The first spectral line in the Pfund series of Hydrogen spectrum is given by (RH = Rydberg constant)

A. $\frac{9R_H}{400}$

B. $\frac{56R_H}{36}$

C. $\frac{11R_H}{900}$

D. $\frac{7R_H}{144}$

Answer: D

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35. A certain transition in H spectrum from an excited state to ground state in one or more steps gives rise to total 10 lines. How many of these belong to uv spectrum?

A. 3

B. 4

C. 5

D. 6

Answer: B

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36. The radii of two of the first four Bohr orbits of the hydrogen atom are in the ratio 1:4. The energy difference between them may be

A. 0.85 eV

B. 10.2 eV

C. 3.40 eV

D. 13.6 e.V

Answer: B

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37. Which one of the following statements is not correct?

A. Rydberg constant and wave number have same units

B. Lyman series of hydrogen spectrum occurs in the ultraviolet region

C. The angular momentum of the electron in the ground state of hydrogen atom is equal to $b/2\pi$

D. The radius of the first Bohr orbit of hydrogen atom is $2.116 \times 10^{-8} cm$

Answer: D

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38. The ratio of radii of first orbits of H, He^{+} and Li^{2+} is

A. $1:2:3$

B. $6:3:2$

C. $1:4:9$

D. $9:4:1$

Answer: B

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39. The ratio of the radii of the first three orbits in an atom of hydrogen is

A. $1:4:9$

B. $9:4:1$

C. $1:2:3$

D. $3:2:1$

Answer: A

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40. The radius of hydrogen atom in the ground state is 0.53Å, the radius of Li^{2+} in the similar state is

A. 1.06Å

B. 0.265Å

C. 0.175Å

D. 0.53Å

Answer: C

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41. In hydrogen atom the kinetic energy of electron is 3.4 eV. The distance of that electron from the nucleus

A. 2.116Å

B. 0.529Å

C. 1.587Å

D. 21.16Å

Answer: A

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42. The radius of first Bohr's orbit for hydrogen is 0.53Å. The radius of third Bohr's orbit would be

A. 0.79Å

B. 1.59Å

C. 3.18Å

D. 4.77Å

Answer: D

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43. The energy of second Bohr orbit of hydrogen atom is $-328 kJ.mol^{-1}$, hence energy of fourth Bohr orbit would be

A. $-41\ \text{kJ mol}^{-1}$

B. $-82\ \text{kJ mol}^{-1}$

C. $-164\ \text{kJ mol}^{-1}$

D. $-1312\ \text{kJ mol}^{-1}$

Answer: B

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44. Which of the following transistions in hydrogen atom will require the highest amount of energy

A. $n = 1$ to $n = 2$

B. $n = 1$ to $n = 2$

C. $n = 2$ to $n = 1$

D. $n = 3$ to $n = 4$

Answer: B

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45. The energy of an electron in the first Bohr's orbit of a hydrogen atom is $-2.18 \times 10^{-18} J$. Its energy in the second orbit would be

A. $-1.09 \times 10^{-18} J$

B. $-4.36 \times 10^{-18} J$

C. $-5.45 \times 10^{-19} J$

D. $-8.72 \times 10^{-18} J$

Answer: C

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46. The total energy of electron in an atom is a combination of potential energy and kinetic energy. If total energy is $-E$ for an electron in an atom, then its K.E. and P.E. respectively are

A. $2E, \ -E$

B. $2E, E$

C. $E, \ -2E$

D. $E, \ -E$

Answer: C

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47. The radius of which of the following orbit is same as that of the first Bohr's orbit of hydrogen atom?

A. $He^{+}(n = 2)$

B. $Li^{2+}(n = 2)$

C. $Li^{2+}(n = 3)$

D. $Be^{3+}(n = 2)$

Answer: D

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48. The change in velocity when electron jumps from the first orbit to the second orbit is

A. Half its original velocity

B. Twice its original velocity

C. One fourth its original velocity

D. Equal to its original velocity

Answer: A

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49. As an electron is brought from an infinite distance close to nucleus of atom, the energy of electron

A. Increases to a greater +ve value

B. Decreases to a smaller +ve value

C. Increases to a smaller -ve value

D. Decreases to a greater -ve value

Answer: D

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50. In Bohr series of lines of hydrogen spectrum, the third line from the red end corresponds to which one of the following inter - orbit jumps of the electron for Bohr orbits in an atom of hydrogen ?

A. $3 \rightarrow 2$

B. $5 \rightarrow 2$

C. $4 \rightarrow 1$

D. $2 \rightarrow 5$

Answer: B

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51. The Ionisation potential of Hydrogen is 2.17×10^{-1} erg/atom. The energy of the electron in the second orbit of the hydrogen atom is

A. $-\frac{2.17 \times 10^{-1}}{2}$

B. $-\frac{2.17 \times 10^{-1}}{2^2}$

C. $-\frac{2.17 \times 10^{17}}{2^2}$

D. $-\frac{2.17 \times 10^{11}}{2^2}$

Answer: B

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52. Kinetic energy of electron in a mono electronic species is +1313 lJ/mole. Then which of the following statements are correct

(I) The electron is present in the 2^{nd} orbit of He^{+} ions

(II) The electron is present in the 2^{nd} orbit of H atom

(III) The electron is present in the 3^{rd} orbit of Li^{+2} ion

(IV) The electron is present in the 4^{th} orbit of He^{+} ion

A. I and II

B. II and III

C. I and III

D. III and IV

Answer: C

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53. Ionisation energy of He^{+} is 19.6×10^{-18}J atom^{-1} The energy of the first stationary state of Li^{2+} is

A. -4.41×10^{-18} J. atom^{-1}

B. -4.41×10^{-17} J. atom^{-1}

C. -44.1×10^{-16} J. atom^{-1}

D. -8.72×10^{-18} J. atom^{-1}

Answer: B

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54. The wavelength of radiation required to remove the electron of hydrogen atom $\left(\text{Ionisation energy } 21.7 \times 10^{-12}\text{erg}\right)$ from n=2 orbit to $n = \infty$is

A. $3.664 \times 10^{-4} cm$

B. $3.66 \times 10^{-5} cm$

C. $3.66 \times 10^{-6} cm$

D. $3.664 \times 10^{-7} cm$

Answer: B

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55. The velocity of electron in hydrogen atom is 7.29×10cm/sec. The potential energy of that electron is

A. $-13.6eV$

B. $-3.4eV$

C. $3.02eV$

D. $-1.70eV$

Answer: C

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56. In an atom two electrons move around the nucleus in circular orbits of radii R and 4R. The ratio of the time taken by them to complete one

revolution is

A. $1:4$

B. $4:1$

C. $1:8$

D. $8:7$

Answer: C

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57. E_1 for He is $-54.4eV$. The E_2 for He^+ would be

A. $-6.8eV$

B. $-13.6eV$

C. $-27.2eV$

D. $-108.8eV$

Answer: B

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58. Using Bohr's equation for the energy levels of the electron in Hydrogen atom, determine the energy of an electtron in n = 4

A. $-5.45 \times 10^{-19} J$

B. $-1.84 \times 10^{-29} J$

C. $-1.36 \times 5.10^{-19} J$

D. $1.84 \times 10^{-29} J$

Answer: C

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59. The de Broglie wavelength associated with a moving particle of fixed mass is inversely proportional to

A. Its kinetic energy

B. Square root of its kinetic energy

C. Square of its kinetic energy

D. Cube of its kinetic energy

Answer: B

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60. For an electron to have the same de Broglie wave length as that of a Deuteron, its velocity should be --- times that of Deuteron

A. 1836

B. $1/1836$

C. 3672

D. $1/3672$

Answer: C

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61. What possibly can the ratio be of the de Broglie wavelengths for two electrons having the same initial energy and accelerated through 50 volts and 200 volts ?

A. $3:10$

B. $10:3$

C. $1:2$

D. $2:1$

Answer: D

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62. The wavelength in meters, of an object of mass 1.0g moving with a velocity of $1.0 \times 10^4 cms^{-1}$ is $\left(h = 6.626x10^{-34}Js\right)$

A. 6.626×10^{-27}

B. 6.626×10^{-26}

C. 6.626×10^{-31}

D. $6.626 \times 10^{-2} m$

Answer: D

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63. A hydrogen molecule and helium atom are moving with the same velocity. Then the ratio of their de Broglie wavelength is

A. $3.313 \times 10^{-20} cm^{-1}$

B. $5.012 \times 10^{-20} cm^{-1}$

C. $8.325 \times 10^{-20} cm^{-1}$

D. $5.27 \times 10^{-21} cm^{-1}$

Answer: C

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64. Wavelength of an electron is 5Å Velocity of the electron is

A. $0.79 \times 10^{6} ms^{-1}$

B. $5.79 \times 10^{16} ms^{-1}$

C. $5.79 \times 10^{6} ms^{-1}$

D. $5.79 ms^{-1}$

Answer: A

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65. The wavelength associated with a golf ball weighing 200g and moving at a speed of 5 m/h is of the order

A. $\frac{1}{40\pi} \times 10^{-42}$

B. $\frac{1}{2\pi} \times 10^{-40}$

C. $\frac{1}{4\pi} \times 10^{-40}$

D. $\frac{1}{0.4\pi} \times 10^{-42}$

Answer: C

Watch Video Solution

66. What possibly can the ratio be of the de Broglie wavelengths for two electrons having the same initial energy and accelerated through 50 volts and 200 volts ?

A. Value of n

B. Size

C. Energy

D. Shape

Answer: D

Watch Video Solution

67. The wavelength in meters, of an object of mass 1.0g moving with a velocity of $1.0 \times 10^4 cms^{-1}$ is $\left(h = 6.626 \times 10^{-34} Js\right)$

A. $n = 3, l = 2$

B. $n = 4, l = 1$

C. $n = 2, l = 0$

D. $n = 3, l = 3$

Answer: D

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68. The size of a mircorscopic particle is 1 micron and its mass is $6 \times 10^{-13} g$. If its position may be measured to within $0.1\ \%$ of its size, the uncertainity in velocity $\left(\text{in cm}^{-1}\right)$ is

A. $\frac{10^{-7}}{4\pi}$

B. $\frac{10^{-5}}{4\pi}$

C. 10^{-5}

D. 10^{-8}

Answer: A

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69. The uncertainty in the position of an electron $\left(\text{mass } 9.1 \times 10^{-28} g\right)$ moving with a velocity of $3.0 \times 10^{4} cm^{-1}$ accurate up to $0.011\ \%$, will be

A. 1.92 cm

B. 7.68 cm

C. 0.175 cm

D. 3.84 cm

Answer: C

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70. Uncertainity in the position of an electron $\left(\text{mass } = 9.1 \times 10^{-9} kg\right)$ moving with a velocity $300 m.s^{-1}$, accurate upto $0.001\,\%$, will be $\left(h = 6.63 \times 10^{-34} J.S\right)$

A. $19.2 \times 10^{-2} m$

B. $5.76 \times 10^{-2} m$

C. $1.92 \times 10^{-2} m$

D. $3.84 \times 10^{-2} m$

Answer: C

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71. A particle of mass one microgram is confined to move along one direction (x-axis) within a region 1 mm is extension. What is the uncertainity in its velocity ?

A. $3.313 \times 10^{-20} cm^{-1}$

B. $5.012 \times 10^{-20} cm^{-1}$

C. $8.325 \times 10^{-20} cm^{-1}$

D. $5.27 \times 10^{-21} cm^{-1}$

Answer: D

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72. A microscope using suitable photons is empolyed to locate an electron in an atom within a distance of $0.1Å$. What is the uncertainity involved in the measurement of its velocity?

A. $0.79 \times 10^{6} ms^{-1}$

B. $5.79 \times 10^{16} ms^{-1}$

C. $5.79 \times 10^{6} ms^{-1}$

D. $5.79 ms^{-1}$

Answer: C

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73. If the uncertainty in velocity of a particle of mass 0.1 kg is $6.626 \times 10^{8} m.s^{-1}$, the uncertainty in its distance (in m) is $\left(h = 6.626 \times 10^{-34} Js\right)$

A. $\frac{1}{40\pi} \times 10^{-42}$

B. $\frac{1}{2\pi} \times 10^{-40}$

C. $\frac{1}{4\pi} \times 10^{-40}$

D. $\frac{1}{0.4\pi} \times 10^{-42}$

Answer: D

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74. There is no difference between a 2p and a 3p orbital regarding

A. Value of n

B. Size

C. Energy

D. Shape

Answer: D

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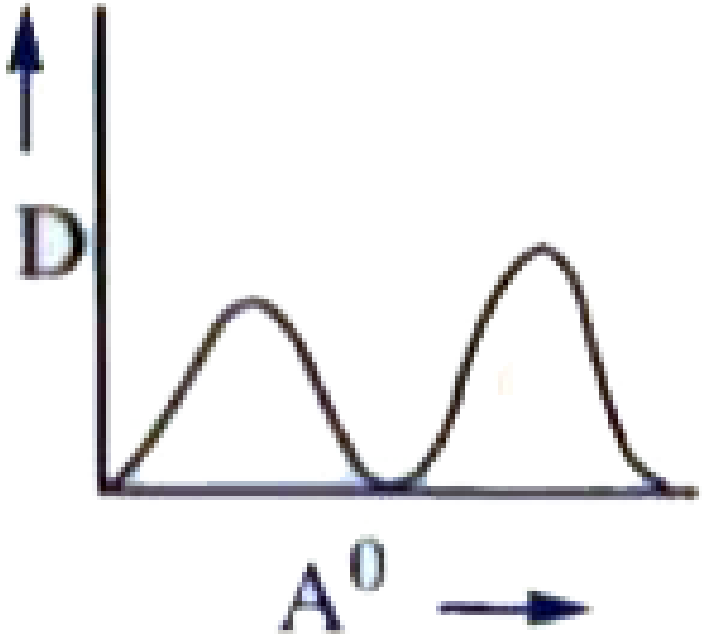
75. The set of quantum numbers 'n' and 'l' possible for the orbital shown in the radial probability curve are



A. $n = 3, l = 2$

B. $n = 4, l = 1$

C. $n = 2, l = 0$

D. $n = 3, l = 3$

Answer: C

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76. The probability of finding electron in XY plane for P_z - orbital is

A. 100 %

B. 50 %

C. 99.9 %

D. 0 %

Answer: D

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77. What are the values of the orbital angular momentum of an electron in the orbitals 1s, 3s, 3d and 2p ?

A. $0, 0, \sqrt{6}h, \sqrt{2}h$

B. $1, 1\sqrt{4}h, \sqrt{2}h$

C. $0, 1, \sqrt{6}h, \sqrt{3}h$

D. $0, 0, \sqrt{20}h, \sqrt{6}h$

Answer: A

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78. The maximum number of electrons that can be filled into all the orbitals corresponding to the azimuthal quantum number, 1 = 3 is

A. 2

B. 6

C. 10

D. 14

Answer: D

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79. The number of sub levles in the quantum level n = 3 is

A. 1

B. 2

C. 3

D. 4

Answer: C

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80. The number of different spatial arrangements for the orbital with 1 = 2 is

A. 1

B. 3

C. 5

D. 7

Answer: C

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81. The maximum number of electrons that can be present in an orbit with $s = +1/2$ and $l = 2$

A. 1

B. 3

C. 5

D. 7

Answer: C

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82. The maximum number of electrons with $S = +1/2$ in an orbital for which $I = 2$ is

A. 1

B. 3

C. 5

D. 7

Answer: A

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83. If the value of principal quantum number is 3, the total possible values for magnetic quantum number will be

A. 5

B. 9

C. 8

D. 10

Answer: B

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84. An electron has magnetic quantum number as ' - 3'. Its principal quantum number is

A. 3

B. 2

C. 1

D. 4

Answer: D

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85. In a multi- electron atom, which of the following orbitals described by the three quantum numbers will have the same energy in the absence of magnetic and electric field

i) n = 1, l = 0, m = 0

ii) n= 2, l = 0, m = 0

iii) n = 2, l = 1, m = 1

iv) n = 3,l = 2, m = 1

v) n = 3,l = 2, m = 0

A. i and ii

B. ii and iiii

C. iii and iv

D. iv and v

Answer: D

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86. How many electrons maximum can have $n + 1 = 4$ in an atom.

A. 8

B. 2

C. 6

D. 18

Answer: A

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87. If magnetic quantum number of a given electron is represented -3, then what will be its principal quantum number?

A. 2

B. 3

C. 4

D. 1

Answer: C

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88. The radial probability distribution curve obtained for an orbital wave function has 3 peaks and 2 radial nodes. The valence electron of which one of the following metals does this wave function correspond to ?

A. Cu

B. Li

C. K

D. Na

Answer: D

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89. The number of waves made by an electron moving in an orbit having a maximum magnetic quantum number of $+4$ is

A. 4

B. 5

C. 3

D. 6

Answer: B

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90. Which combination of quantum numbers n, 1, m, s for the electron in an atom does not provide a permissible solution of the wave equation ?

A. $3, 4, -2, 1/2$

B. $3, 3, 1, -1/2$

C. $3, 2, 1, 1/2$

D. $3, 1, 1, -1/2$

Answer: B

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91. The correct set of quantum numbers for the unpaired electron of Cl atom is :

A. $2, 0, 0, +1/2$

B. $2, 1, -1, +1/2$

C. $3, 1, 1, +1/2$

D. $3, 0, 0, +1/2$

Answer: C

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92. Which one of the following pairs of atoms/ ions have identical ground state configurations?

A. Li^+ and He^+

B. Cl^- and Ar

C. Na and K

D. F^+ and Ne

Answer: B

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93. From the given sets of quantum numbers the one that is inconsistent with the theory is

A. $n = 3, l = 2, m = -3, s = +1/2$

B. $n = 4, l = 3, m = 3, s = +1/2$

C. $n = 4, l = 3, m = 2, s = +1/2$

D. $n = 4, l = 3, m = 2, s = +1/2$

Answer: A

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94. How many 'd' electrons are present in Cr^{2+} ion?

A. 4

B. 5

C. 6

D. 3

Answer: A

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95. The atomic number of the element with the maximum number of unpaired 2p electrons in the ground state is

A. 1

B. 7

C. 13

D. 8

Answer: B

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96. The total number of electrons present in all the 's' orbitals, all the 'p' ortitals and all the 'd' orbitals of cesium ion are respectively

A. 8, 26, 10

B. 10, 24, 20

C. 8, 22, 24

D. 12, 20, 22

Answer: B

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97. The number of unpaired electrons present in palladium (Z = 46) atom is

A. 1

B. 2

C. Zero

D. 3

Answer: C

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98. Which atom has as many 's' electrons as P-electrons

A. H

B. N

C. Na

D. Mg

Answer: D

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99. An element has 2 electrons in its K-shell. 8 electrons in L-shell, 13 electrons in M-shell and one electron in N-shell. The element is

A. Cr

B. Fe

C. V

D. Ti

Answer: A

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100. Atomic number of the element which has diffe rentiating electron enters into a d-subshell for the first time

A. 29

B. 24

C. 21

D. 19

Answer: C

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101. The atomic number of an element 'M' is 26. How many electrons are present in the M-shell of the element in its M^{3+} state ?

A. 11

B. 15

C. 14

D. 13

Answer: D

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102. Consider the ground state of Cr atom (Z = 24). The numbers of electrons with the azimuthal quantum numbers, $l = 1$ and 2 are, respectively

A. 12 and 4

B. 16 and 5

C. 16 and 4

D. 12 and 5

Answer: D

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103. Which is the first element to have 4d-electron in its electronic configurations

A. Ca

B. Sc

C. Y

D. La

Answer: C

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104. In the ground state, an element has 13 electrons in its "M - shell". The element is

A. Copper

B. Chromium

C. Nickel

D. Iron

Answer: B

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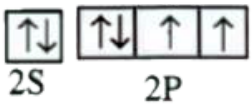
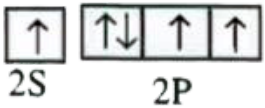
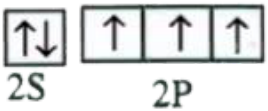
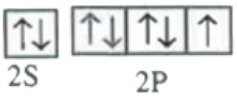
105. In which of the following Aufbau principle is violated?

A. 

B. 

C. 

D. 

Answer: B

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106. Which of the following electronic configuration is not possible?

A. $1s^2 2s^2 2p^6$

B. $1s^2 2s^2 2p^7$

C. $1s^2 2s^2$

D. $1s^2 2s^2 2p^5$

Answer: B

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107. The configuration $1s^2 2s^2 2p^5 3s^1$ shows

A. Ground state of fluorine

B. Excited state of fluorine

C. Exited state of neon atom

D. Excited state of argon.

Answer: C

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108. Which of the following has maximum unpaired d-electrons?

A. Zn^+

B. Fe^{2+}

C. Ni^{3+}

D. Cu^+

Answer: B

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109. Given this set of quantum numbers for a multi electron atom $2, 0, 0,$ and $-1/2$. The next higher allowed set of n and 1 for this atom in its ground state

A. $n = 2, l = 0$

B. $n = 2, l = 1$

C. $n = 3, l = 0$

D. $n = 3, l = 1$

Answer: B

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110. Which of the following isolated gaseous atoms has highest net electronic spin

A. $Sc(Z = 21)$

B. $Cr(Z = 24)$

C. $Fe(Z = 25)$

D. $Ni(Z = 28)$

Answer: B

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111. If the Nitrogen atom had electronic configura - tion $1s^7$, it would have energy lower than that of the normal ground state configuration $1s^2 2s^2 2p^3$, because the electrons would be closer to the nucleus. Yet, $1s^7$ is not observed because it violates

A. Heisenberg uncertainty principle

B. Hund's rule

C. Pauli exclusion principle

D. Bohr postulate of stationary orbits

Answer: C

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112. Which one of the following sets of quantum numbers is not possible for an electron in the ground state of an atom with atomic number 19 ?

A. $n = 2, l = 0, m = 0$

B. $n = 2, l = 1, m = 0$

C. $n = 3, l = 1, m = -1$

D. $n = 3, l = 2, m = \pm 2$

Answer: D

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113. According to aufbau principle, the correct order of energy of 3d, 4s and 4p-orbitals is

A. $4p < 3d < 4s$

B. $4s < 4p < 3d$

C. $4s < 3d < 4p$

D. $3d < 4s < 4p$

Answer: C

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114. The electrons identified by quantum numbers n and I

(i) n = 4,l = 1

(i) n = 4,l = 0

(iii) n = 3,l = 2

(iv) n = 3,l = 1

can be placed in order of increasing energy, from to highest as

A. $(iv) < (ii) < (iii) < (i)$

B. $(ii) < (iv) < (i) < (iii)$

C. $(i) < (iii) < (ii) < (iv)$

D. $(iii) < (i) < (iv) < (ii)$

Answer: A

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115. Which of the following sets of quantum numbers is correct for an electron is 4f - orbital ?

A. $n = 4, l = 3, m = +4, s = +\frac{1}{2}$

B. $n = 4, l = 4, m = -4, s = -\frac{1}{2}$

C. $n = 4, l = 3, m = +4, s = +\frac{1}{2}$

D. $n = 3, l = 2, m = -2, s = +\frac{1}{2}$

Answer: C

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116. Which one of the following represents an impossible arrangement of electron ?

A.

m	l	m	s
3	2	-2	1/2

B.

m	l	m	s
4	0	0	1/2

C.

m	l	m	s
3	2	-3	1/2

D.

m	l	m	s
5	3	0	1/2

Answer: C

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117. If n = 6, the correct sequence for filling of electrons will be

A. $ns \rightarrow np \rightarrow (n-1)d \rightarrow (n-2)f$

B. $ns \rightarrow (n-2)f \rightarrow (n-1)d \rightarrow np$

C. $ns \rightarrow (n-1)f \rightarrow (n-2)f \rightarrow np$

D. $ns \rightarrow (n-2)f \rightarrow np \rightarrow (n-1)d$

Answer: B

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118. The number of unpaired electrons present in palladium (Z = 46) atom is

A. 1

B. 2

C. Zero

D. 3

Answer: C

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119. The incorrect electronic arrangment is

A. 2, 8, 13, 1

B. 2, 8, 12, 2

C. 2, 8, 8, 1

D. 2, 8, 8, 2

Answer: B

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120. Which of the following has non-spherical sub shell of electron ?

A. He

B. B

C. Be

D. Li

Answer: B

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121. Which of the following is violation of Pauli's exclusion principle ?

A.

B.

C.

D.

Answer: B

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122. What are the total number of orbitals and electrons for m = 0, if there are 30 protons in an atom

A. 6 orbitals, 12 electrons

B. 5 orbitals, 10 electrons

C. 7 orbitals, 14 electrons

D. 4 orbitals, 8 electrons

Answer: C

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123. Which one of the following sets of ions have same outer shell electronic configuration ? (APM-2016)

A. $Cr^{3+}, Mn^{3+}, Fe^{2+}$

B. Cr^{+}, Mn^{3+}, Fe^{3+}

C. $Cr^{3+}, Mn^{2+}, Fe^{2+}$

D. Cr^{+}, Mn^{2+}, Fe^{3+}

Answer: D

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OBJECTIVE EXERCISE - 3 (RECENT AIPMT/NEET QUESTIONS)

1. The de Broglie wavelength associated with a ball of mass 1kg having kinetic energy 0.5J is

A. $6.626 \times 10^{-34} m$

B. $13.20 \times 10^{-34} m$

C. $10.38 \times 10^{-21} m$

D. $6.626 \times 120^{-34} Å$

Answer: A

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2. X -rays are emitted during

A. α, n reaction

B. K - capture

C. n, α reaction

D. β - emission

Answer: B

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3. Which of the following radioisotopes is used as anticancerous ?

A. Na - 24

B. C - 14

C. U - 235

D. Co - 60

Answer: D

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4. Decay constant of a radioactive substance is 69.3sec^{-1}, find $t_{1/16}$ of the same substance

A. $4 \times 10^{-2}\text{sec}$

B. $2 \times 10^{-2}\text{sec}$

C. $1 \times 10^{-2}\text{sec}$

D. none of these

Answer: A

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5. In the ground state of Cu^{+}, the number of shells occupied, subshells occupied, filled orbitals and unpaired electrons respectively are

A. 4, 8, 15, 0

B. 3, 6, 15, 1

C. 3, 6, 14, 0

D. 4, 7, 14, 2

Answer: C

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6. Assume that you are travelling at a speed of 90km/h in a small car with a mass of 1050kg. If the uncertainity in the velocity of the car is $1\,\%\,(\Delta v = 0.9 km/h)$, what is the uncertainity (in meters) in the position of the car ?

A. $\Delta x \geq 1 \times 10^{-35} m$

B. $\Delta x \geq 2 \times 10^{-37} m$

C. $\Delta x \geq 2 \times 10^{-36} m$

D. $\Delta x \geq 4 \times 10^{-38} m$

Answer: B

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7. Smallest wavelength occurs for

A. Lyman series

B. Balmer series

C. Paschen series

D. Brackett series

Answer: A

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8. Which of the following is wrong for Bohr's model ?

A. It establishes stability of atom

B. It is inconsistent with Heisenberg uncertai nity principle

C. It explains the concept of spectral lines for hydrogen like species

D. Electrons behave as particle and wave

Answer: D

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9. Threshold frequency of a metal is $5 \times 10^{13} s^{-1}$ upon which $1 \times 10^{14} s^{-1}$ frequency light is focussed. Then the maximum kinetic energy of emitted electron is

A. 3.3×10^{-21}

B. 3.3×10^{-20}

C. 6.6×10^{-21}

D. 6.6×10^{-20}

Answer: B

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10. In Bohr's orbit, $\frac{nh}{2\pi}$ indicates

A. Momentum

B. Kinetic energy

C. Potential energy

D. Angular momentum

Answer: D

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11. A particle is moving three times as fast as an electron. The ratio of the de Broglie wavelength of the particle to that of the electron is 1.813×10^{-4}. Calculate the particle's mass and identify the particle.

A. Neutron

B. α - particle

C. Deuteron

D. Tritium

Answer: A

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12. What is the maximum number of orbitals that can be identified with the following quantum numbers? $n = 3, 1 = 1, m_l = 0$

A. 1

B. 2

C. 3

D. 4

Answer: A

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13. Calculate the energy in joule corresponding to light of wavelength 45nm (Planck's constant $h = 6.63 \times 10^{-34} Js$, speed of light

$c = 3 \times 10^8 ms^{-1}$)

A. 6.67×10^{15}

B. 6.67×10^{11}

C. 4.42×10^{-15}

D. 4.42×10^{-18}

Answer: D

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14. The angular momentum of electron in 'd' orbital is equal to

A. $2\sqrt{3}h$

B. $0h$

C. $\sqrt{6}h$

D. $\sqrt{2}h$

Answer: C

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15. Magnetic moment 2.84B.M. is given by (Atomic number, Ni = 28, Ti = 22, Cr = 24, Co = 27)

A. Cr^{2+}

B. Co^{2+}

C. Ni^{2+}

D. Ti^{3+}

Answer: C

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16. The number of d - electrons in $Fe^{2+}(Z = 26)$ is not equal to the number of electrons in which one of the following

A. d - electron in Fe (Z = 26)

B. p - electrons in Ne (Z = 10)

C. s - electrons in Mg (Z = 12)

D. p - electrons in Cl (Z = 17)

Answer: D

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17. How many electrons can fit in the orbital for which n = 3 and l = 1?

A. 2

B. 6

C. 10

D. 14

Answer: A

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18. Two electrons occupying the same orbital are distinguished by

A. Principal quantum number

B. Magnetic quantum number

C. Azimuthal quantum number

D. Spin quantum number

Answer: D

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19. Which of the following pairs of d-orbitals will have electron density along the axes?

A. d_{z^2}, d_{xz}

B. d_{xz}, d_{yz}

C. $d_{z^2}, d_{x^2-y^2}$

D. d_{xz}, d_{yz}

Answer: C

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20. Which one is the wrong statement ?

A. The energy of 2s orbitals less than the energy of 2p orbital in case of hydrogen like atoms

B. de-Broglies wavelength is given by $\lambda = \frac{h}{mv}$ where m = mass of the particle, $\upsilon =$ group velocity of the particle

C. The uncertainity principle is $\Delta E \times \Delta th/4\pi$

D. Half filled and fully filled orbitals have greater stability due to greater exchange energy, greater symmetry and more balanced arrangement

Answer: A

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