CHEMISTRY

FOR IIT JEE ASPIRANTS OF CLASS 11 FOR CHEMISTRY

STRUCTURE OF ATOM

EXAMPLE

1. Find the e/m value of α-particle $\left(He^{+2}\right)$ w.r.t H-atom?

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2. An oil drop has $8.0 \times 10^{-19} C$ charge. How many electrons does this oil drop has?

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3. In an oil drop experiment, the charges on oil drops were found as $1.5 \times 10^{-15}, 3 \times 10^{-15}, 4.5 \times 10^{-15}, 6.0 \times 10^{-15}$. Calculate the magnitude of the charge on the electron.

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4. the ratio e/m of electron is independent of (a) Nature of cathode, anode rays (b) Nature of gas of discharge tube (c) Applied voltage (d) Size of discharge tube

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5. The value of charge on the oil droplets experimentally observed were $-1.6 \times 10^{-19}, -2.4 \times 10^{-19}$ and -4×10^{-19} C. The value of electronic charge, indicated by these results is

(1) -1.6×10^{-19}

(2) -2.4×10^{-19}

(3) -4×10^{-19}

(4) -0.8×10^{-19}

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6. Which of the following statement is not correct regarding cathode rays?

(1) Cathode rays originate form the cathode

(2) (2) Charge and mass of the particles constituting cathode rays depends upon the nature of the gas

(3) Charge and mass of the particles present does not depend upon the material of the cathode

(4) The ratio charge/mass of the particles is much greater than that of anode rays.

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7. What will be the difference in mass number if the number of neutrons halved and the number of electrons doubled in $._6^{12} C$

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8. Calculate the no of protons neutrons and electrons in $._{17}^{37}Cl$

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9. Calculate the no of protons, neutron and electron in $._{7}^{14}N^{3-}$ ion

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10. The no of electrons, protons and neutron in a species are equal to 10,11,12 respectively. Assign proper symbol to the species.

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11. The mass number of three isotopes of an element are 10,12,14 units. Their percentage aboundance is 80,15 and 5 units respectively. What is the atomic weight of the element?

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12. Naturally occurring boron consists of two isotopes whese atomic weights are 10.01 and 11.01. The atomic weight of natural boron is 10.81. Calculate the percentage of each isotope in natural boron.

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13. Calculate the number of electrons, protons and neutrons in (i) Phosphorus (P) atom (ii)

phosphate ion. $\left(PO_4^{3-}\right)$

Mass numbers : $P = 31, O = 16$

Atomic numbers : $P = 15, O = 8$

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14. Atomic number of an element is equal to the number of

(1) Electrons

(2) Protons

(3) Neutrons

(4) Electrons and protons

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15. The isotopes of an element differ in

(1) The number of neutrons in the nucleus

(2) The charge on the nucleus

(3) The number of extra-nuclear electrons

(4) Both the nuclear charge and the number of extranuclear electrons.

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16. the vividh bharati station of All india Radio, Delhi , broadcasts on a frequency of 1,368 kHz (kilo hertz). Calculate the wavelength of the electromagnetic radiation emitted by transmitter . Which part of the electromagnetic spectrum does it belong to

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17. the wavelength range of the visible spectrum extends from violet (400 nm) to red (750 nm). Express these wavelengths in frequencies (Hz) . (1nm =$10^{-9}m$)

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18. Calculate (a) Wavenumber and (b) frequency of yellow radiation having wavelength $5800A^{\circ}$.

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19. calculate energy of one mole of photons of radiation whose frequency is $5 \times 10^{14} hz$

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20. 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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21. When electromagnetic radiation of wavelength 300 nm falls on the surface of sodium, electrons are emitted with kinetic energy of $1.68 \times 10^5 J\text{ml}^{-1}$. What is the minimum energy needed to remove an electron from sodium ? What is the maximum wavelength that will cause a photoelectron to be emitted.

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22. Calculate the energy of photons of radiation whose wavelength is $5000 A^{\circ}$?

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23. What is the number of photons of light with a wave length 4000 pm that provide 1J energy ?

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24. Calculate the energy of one moles of quanta of radiation whose frequency is $5 \times 10^{10} \sec^{-1}$

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25. Compare the energies of two radiation one with a wavelength of $300nm$ and other with $600nm$.

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26. the threashold frequency v_0 for a metal is $7 \times 10^{14} s^{-1}$. Calculate the kinetic energy of an electron emitted when radiation of fequency $v = 1.0 \times 10^{15} s^{-1}$ hits the metal .

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27. The minimum energy requried to overcome the attractive forces between an electron and the surface of Ag metal is 5.52×10^{-19}J. what will be the maximum kinetic energy of electrons ejected out from Ag which is being exposed to UV light of $\lambda = 360Ã…$?

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28. When light of 470 nm falls on the surface of potassium metal, electrons are emitted with a velocity of $6.4 \times 10^4 ms^{-1}$. What is the minimum energy required to remove one moles electrons from potassium metal?

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29. When a certain metal was irradiated with light of frequency $3.2 \times 10^{16} s^{-1}$ the photoelectrons emitted had twice the KE as did photoelectrons emitted when the same metal was irradiated with light of frequency$2.0 \times 10^{16} s^{-1}$. Calculate the thereshold frequency of the metal.

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30. Threshold wavelength of a metal is 230 nm. What will be the kinetic energy of photoelectrons ejected when the metal is irradiated with wavelength 180 nm? $\left(h = 6.626 \times 10^{-34} J \sec\right)$

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31. what are the frequency and wavelength of a photon emitted during a transition from n = 5 state to the n =2 state in the hydrogen atom?

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32. Calculate the shortest and longest wavelength in hydrogen spectrum of Lyman series.

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33. What transition of Li^{+2} spectrum will have same wavelength as that of second line of Balmer series in He^{+} spectrum ?

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34. How many lines in the spectrum will be observed when electrons returns from seventh shell to second shell.

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35. Calculate the wave number and wave length of H_{α} line in Brackett series of H-emission spectrum

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36. Calculate the radius of Bohr's 3rd orbit in Li^{+2} ion

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37. Calculate the velocity of an electron placed in (III) orbit of H-atom . Also calculate the no . of revalution /sec around the nucleus .

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38. calculate the energy assoclated with the first orbit of He^{+} . What is the radius of this orbit?

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39. The ionisation energy of H atom is 13.6 eV. What will be the ionisation energy of $He^{\oplus}$ and Li^{2+} ions ?

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40. what will be the wavelength of a ball of mass 0.1 kg moving with a velocity of $10ms^{-1}$?

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41. The mass of an electron is $9.1 \times 10^{-25}J$, if its K.E. is $3.0 \times 10^{-25}J$. Calculate its wavelength.

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42. calculate the mass of a photon with wavelength 3.6 A

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43. Calculate de Broglie wavelength of an electron travelling at 1% of the speed of light.

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44. Two particles A and B are in motion. If the wavelength associated with particle A is $5 \times 10^{-8} m$, calculate the wavelength associated with particle B if its momentum is half of A.

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45. An electron beam energes from an accelerator with kinetic energy 100eV. What is its de-Broglie wavelength?

$\left[m = 9.1 \times 10^{-31} kg, h = 6.6 \times 10^{-34} Js, 1eV = 1.6 \times 10^{-19} J\right]$

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46. The kinetic energy of an electron is $4.55 \times 10^{-25} J$. Calculate the wavelength .

$\left[h = 6.6 \times 10^{-34} Js, \text{mass of electron } = 9.1 \times 10^{-31} kg\right]$

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47. The dual nature of radiations was proposed by

(1) Max Planck **(2) de-Broglie**

(3) Einstein

(4) Schrodinger

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48. Which of the following statement is not correct?

(1) All electromagnetic radiations travel with the same velocity

(2) Matter waves generally have velocity less than electromagnetic waves

(3) Matter waves are emitted by material particles

(4) Electromagnetic waves are associated with electric and magnetic fields but matter waves are not.

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49. Which of the following has the largest de Broglie wavelength (all have eual velocity)?

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50. A microscope using suitable photons is employed to locate an electron in an atom within a distance of 0.1 Ã.... What is the uncertainty involved in the measurement of its velocity ?

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51. A golf ball has a mass of $40g$ and a speed of $45m/s$. If the speed can be measured within accuracy of 2%, calculate the uncertainty in the

position.

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52. An electron has a speed of $40m/s$, accurate up 99.99% .What is the uncertainty in locating position ?

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53. Heisenberg's uncertainty principle rules out the exact simultaneous measurement of

(1) probability and intensity

(2) energy and velocity

(3) charge density and radius

(4) Position and momentum

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54. If uncertainty (Δx) in position is along X-axis, then uncertainty in momentum (Δp) is along

(1) X-axis

(2) Y-axis

(3) Z-axis

(4) any axis

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55. The uncertainty found from the uncertainty principle $(\Delta x. \Delta p = h / 4\pi)$ is

(1) the minimum value

(2) the maximum value

(3) the exact value

(4) only an approximate value

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56. The magnetic quantum number for the valence electron of Caesium is

(1) 3

(2) 0

(3) -3

(4) Any number between +3 to -3

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57. The magnetic quantum number represents

(1) Size of the orbital

(2) Spin angular momentum

(3) Orbital angular momentum

(4) Spatial orientation of orbital.

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58. Which of the following statements concerning the four quantum numbers is false?

(1) n gives idea of the size of an orbital

(2) 1 gives the shape of an orbital

(3) m gives the energy of the electron in the orbital

(4) s gives the direction of spin of the electron in the orbital.

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59. What is the toal number of orbitals associated with the principal quantum number $n=3$?

Hint : The total number of orbitals in a shell is given by formula $=n^2$?

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60. Usings,p,d,f notations, describe the orbital with the following quantum numbers.

(i) $n=2, l=1$

(ii) $n=4, l=0$

9iii) $n=5, l=3$

(iv)$n=3, l=2$

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EXERCISE (CHECK YOUR GRASP)

1. (i) Calculate the number of electrons which will together with one gram

.

(ii) Calculate the mass and charge on one mole of electrons .

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2. (i) Calculate the number of electrons which will together with one gram

.

(ii) Calculate the mass and charge on one mole of electrons .

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3. Calculate the total number of electrons present in one mole of methane.

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4. how many neutrons and protons are there in the following nuclei ?

$._{6}^{13}C,_{8}^{16}O,_{12}^{24}Mg,_{26}^{56}Fe,_{38}^{88}Sr$

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5. Write the complete symbol for the atom with the given atomic number (Z) and atomic mass (A).

a. $Z=17, A=35,$

b. $Z=92, A=233,$

c. $Z=4, A=9$

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6. Symbols $._{35}^{79} Br$ and $.^{79} Br$ can be written whereas symbols $._{79}^{35} Br$ and $._{35} Br$ are not accepted. Answer in brief.

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7. Can a moving cricket ball have a wave character ?

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8. What is the significance of de Broglie relationship ?

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9. We do not see a car moving as a wave on the road. Explain.

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10. Heisenberg uncertainty principle has no significance in our every day life. Explain.

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11. A microscope using suitable photons is employed to locate an electron in an atom within a distance of 0.1 Ã…. What is the uncertainty involved in the measurement of its velocity ?

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12. Calculate the uncertainty in position of an electron if the uncertainty in its velocity is $5.7 \times 10^5 ms^{-1}, h = 6.6 \times 10^{-34} kgm^2 s^{-1}$ mass of electron $= 9.1 \times 10^{-31} kg$

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13. **From the following sets of quantum numbers, state which are possible. Explain why the others are not possible.**

(i) $n = 0, l = 0, m_l = 0, m_s = +1/2$ **(ii)** $n = 1, l = 0, m_l = 0, m_s = -1/2$

(iii) $n = 1, l = 1, m_l = 0, m_s = +1/2$ **(iv)** $n = 1, l = 0, m_l = +1, m_s = +1/2$

(v) $n = 3, l = 3, m_l = -3, m_s = +1/2$ **(vi)** $n = 3, l = 1, m_l = 0, m_s = +1/2$

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14. **The quantum numbers of six electrons are given below. Arrange them in order of increasing energies. If any of these combination(s) has/have the same energy lists:**

1. $n = 4, l = 2, m_i = -2, m_s = -1/2$

2. $n = 3, l = 2, m_l = 1, m_s = +1/2$

3. $n = 4, l = 2, m_l = -2, m_s = -1/2$

4. $n = 3, l = 2, m_i = -1, m_s = +1/2$

5. $n = 3, l = 1, m_l = -1, m_s = +1/2$

$n = 4, l = 1, m_l = 0, m_s = +1/2$

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15. How many electron in an atom may have the following quantum number ?

a. $n = 4, m_s = -\frac{1}{2}$

b. $n = 3, l = 0$

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EVALUATE YOUR SELF - 1

1. Which of the following is never true for cathode rays?

A. They possess kinetic energy

B. They are electromagnetic waves

C. They produce heat

D. They produce mechanical pressure.

Answer: B

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2. The mass of neutron is same as that of

A. same as that of proton

B. slightly less than that of a proton

C. slightly more than that of a proton

D. much different from that of proton

Answer: C

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3. The mass of the neutron is of the order of

A. $10^{-23} kg$

B. $10^{-24} kg$

C. $10^{-26} kg$

D. $10^{-27} kg$

Answer: D

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EVALUATE YOUR SELF - 2

1. Do isobars have the same number of neutrons?

A. protons

B. electrons

C. nucleons

D. neutrons.

Answer: C

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2. The number of neutrons in dipositive zinc ion with mass number 70 is.

A. 34

B. 40

C. 36

D. 38

Answer: B

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3. The introduction of a neutron into the nuclear composition of an atom would lead to a change in:

A. The number of electrons also

B. The chemical nature of the atom

C. Its atomic number

D. Its atomic weight

Answer: D

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EVALUATE YOUR SELF - 3

1. An electron travels with a velocity of x ms^{-1}. For a proton to have the same de-Broglie wavelength, the velocity will be approximately:

A. $\frac{v}{1840}$

B. $\frac{1840}{v}$

C. $1840v$

D. v

Answer: A

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

A. Interference

B. $E = mc^2$

C. Diffraction

D. $E = hv$

Answer: D

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3. if electron , hydrogen , helium and neon nuclei are all moving with the velocity of light , then the wavelength associated with these particles are in the order

A. Electrongt hydrogengt heliumgt neon

B. Electrongt heliumgt hydrogengt neon

C. Electronlt hydrogenlt heliumlt neon

D. Neonlt hydrogen ltheliumlt electron

Answer: A

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EVALUATE YOUR SELF - 4

1. If the uncertainty in the position of an electron is zero the nucertainty in its momentum be

A. zero

B. greater than h/4 π

C. less than h/ 4 π

D. infinite

Answer: D

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2. If a light of wavelght λ hits moving electron the uncertainty in measurement of its position will be

A. greater than λ

B. less than λ

C. equal to λ

D. It can have any value

Answer: C

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EVALUATE YOUR SELF - 5

1. The designation of a sub-shell with $n = 4$ and $l = 3$ is

A. 4s

B. 4p

C. 4d

D. 4f

Answer: D

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2. The shape of the orbital with l = 1 and m = 0 is

A. spherical

B. dumb-bell

C. clover-leaf

D. dough-nut

Answer: B

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3. Which of the following orbitals is not symmetrical about the Z-axis?

A. p_z

B. d_z2

C. s

D. d_{xz}

Answer: D

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EVALUATE YOUR SELF - 6

1. Maximum number of electrons in an orbital having n = 4 and l = 2 are :

A. 6

B. 10

C. 18

D. 32

Answer: B

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2. Which shell would be the first to have g sub-shell ?

A. $4th$

B. $5th$

C. $6th$

D. $7th$

Answer: B

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3. If m has seven values, the value of azimuthal quantum number should be

A. 1

B. 2

C. 3

D. 4

Answer: C

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CUQ (SUBATOMIC PARTICLES)

1. One of the fundamental particles is missing in one of the isotopes of hydrogen atom. The particle and isotope are respectively

A. Neutron, protium

B. Neutron, tritium

C. Proton, protium

D. Electron, tritium

Answer: A

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2. The charge of an electron is $1.6 \times 10^{-19} C$ 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. $10 \times 1.6'10^{-19}C$

Answer: A

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3. Which of the following is correct for cathode rays in discharge tube

A. Independent of the nature of the cathode

B. Independent of the nature of the gas

C. Deflection is observed in presence of electric and magnetic field

D. All the above

Answer: D

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4. The specific charge for a cathode ray.

A. Has the smallest value when the discharge tube is filled with H_2

B. Is constant

C. Varies with the atomic number of gas in the discharge tube

D. Varies with the atomic number of an element forming the cathode ray

Answer: B

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5. The specific charge for positive rays is much less than the specific charge for cathode rays.

This is because:

A. Positive rays are positively charged

B. Charge on positive rays is less

C. Positive rays comprise ionised atoms whose mass is much higher

D. Experimental method for determination is wrong.

Answer: C

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6. In s_1 be the specific charge (e/m) of cathode rays and (S_2) be that of positive rays , then which is true ?

A. $S_1 = S_2$

B. $S_1 > S_2$

C. $S_1 < S_2$

D. Any one of these

Answer: B

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7. The massive particle among the following is

A. α- Particle

B. Deuteron

C. Proton

D. β- particle

Answer: A

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8. Which of the following statements about the electron is incorrect?

A. It is a negatively charged particle.

B. The mass of electron is equal to the mass 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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CUQ (ATOMIC MODELS)

1. Ernest Rutherford's model of the atom didn't specifically include the __ .

A. Proton

B. Electron

C. Nucleus

D. Neutron

Answer: D

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2. The conclusions of Rutherford scattering experiment does not include:

A. α- Particle can come within a distance of the order of 10^{-14} m of the nucleus.

B. The radius of the nucleus is less than 10^{-14} m

C. Scattering follows Coulomb's law

D. The (+) vely charged particles of an atom move with extremely high velocities.

Answer: D

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CUQ (ATOMIC NUMBER & MASS NUMBER)

1. A neutral atom, with atomic number greater than one consists of

A. Protons only

B. Protons and neutrons

C. Neutrons and electrons

D. Neutrons, electrons and protons

Answer: D

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2. The ratio between the neutrons in C and Si with respect to atomic masses 12 and 28 is

A. $7 : 3$

B. $3 : 7$

C. $1 : 2$

D. $2 : 1$

Answer: B

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3. Many elements have non-intergral atomic masses because

(1)the constituents neutrons, protons, and electrons, commbine to give

fractional masses

(2) they have isotopes

(3) their isotopes have nonintergal masses

(4) their isotopes have different masses

A. Their isotopes have different atomic number

B. Their isotopes have different masses

C. Their isotopes have non-integral masses

D. Their constituents, protons, electrons and neutrons combine to give fractional masses

Answer: B

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4. Among the following which is not isoelectronic with others

A. HF

B. H_2O

C. NH_3

D. CO

Answer: D

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5. Set of iso electronic ions among the following is

A. Na^{+}, CI^{-}, O^{-2}

B. K^{+}, Ca^{+2}, F^{-}

C. CI^{-}, K^{+}, S^{-2}

D. H^{+}, Be^{+2}, Na^{+}

Answer: C

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CUQ (ELECTROMAGNETIC RADIATION)

1. All types of electromagnetic radiations possess same

A. Wave length

B. Frequency

C. Energy

D. Velocity when they passed through vacuum

Answer: D

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2. The radiation having maximum wave length is

A. Ultraviolet rays

B. Radio waves

C. X-rays

D. Infra-red rays

Answer: B

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3. Electromagentic radiation, which of the following 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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4. The product of which of the following is equal to the velocity of light

A. Wave length and wave number

B. Wave length and frequency

C. Frequency and wave number

D. Wave length and amplitude

Answer: B

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CUQ (PLANK.S QUANTUM THEORY AND PHOTO ELECTRIC EFFECT)

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

A. Interference

B. $E = mc^2$

C. Diffraction

D. $E = hv$

Answer: D

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2. The photoelectric emission from a surface starts only when the light incident upon the surface has certain minimum:

A. Intensity

B. Wavelength

C. Frequency

D. Velocity

Answer: C

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3. A metallic surface ejects electrons when hit by green light but none when hit by yellow light .

Will the electrons be ejected if the same surface is hit by red light

A. Yes

B. No

C. Yes, if the red bream is quite intense

D. Yes, if the red beam continues to fall upon

Answer: B

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4. Kinetic energy of photo electrons is independent on........of incident radiation.

A. Wavelength

B. Wave number

C. Frequency

D. Intensity

Answer: D

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CUQ (ATOMIC SPECTRA)

1. The best evidence that electrons are arranged in definite orbits or energy levels is based on the observation that

A. Atomic spectra consist of discrete lines and not continuous bands

B. Electrons in the beta ray have high kinetic energy

C. The penetrating power of cathode ray electrons depends upon the voltage used to produce them

D. Electrons revolve around the nucleus

Answer: A

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2. The band spectrum is caused by

A. Molecules

B. Atoms

C. Any substance in solid state

D. Any substance in liquid state

Answer: A

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CUQ (HYDROGEN SPECTRUM)

1. The hydrogen spectrum from an incandescent source of hydrogen is:

A. An emission band spectrum

B. An emission line spectrum

C. An absorption band spectrum

D. An absorption line spectrum

Answer: B

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2. Transition of electron from M-shell to K-shell results in the emission of

A. Cosmic rays

B. Infrared rays

C. Ultraviolet rays

D. X-rays

Answer: C

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3. Which of the following transition is associated with coloured spectral line

A. n=5 to n=3

B. $n = 4$ to $n = 2$

C. $n = 2$ to $n = 1$

D. $n = 3$ to $n = 1$

Answer: B

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4. Values of n_1 and n_2 for H_b spectral line in the hydrogen emission spectrum

A. 1 and 2

B. 2 and 3

C. 3 and 2

D. 2 and 4

Answer: D

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5. Rydberg constant is

A. Same for all elements

B. Different for different elements

C. A universal constant

D. Is different for lighter elements but same for heavier elements

Answer: B

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CUQ (BOHR.S ATOMIC MODEL)

1. The value of the total energy of an electron in the hydrogen atom is given by

A. mv^2

B. $1/2mv^2$

C. $-e^2/2r$

D. $-mv/r^2$

Answer: C

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2. The ratio between potential energy and total energy of an electron in H-atom according to Bohr atom

A. $1: -1$

B. $1:1$

C. $1:2$

D. $2:1$

Answer: D

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3. The equation corresponding to the wave number of spectral line in the Bracket series

A. $R\left[\left(1/2^2\right)-\left(1/4^2\right)\right]$

B. $R\left[\left(1/4^2\right)-\left(1/5^2\right)\right]$

C. $R\left[\left(1/3^2\right)-\left(1/5^2\right)\right]$

D. $R\left[\left(1/6^2\right)-\left(1/4^2\right)\right]$

Answer: B

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4. The wavelngth fo a spectrl line for an electronic transition is inversely related to :

A. Velocity of electron undergoing transition

B. Number of electrons undergoing transaction

C. The difference in energy levels involved in the transition

D. None of these

Answer: C

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5. ΔE value is maximum in

A. $E_2 - E_1 = \Delta E$

B. $E_3 - E_2 = \Delta E$

C. $E_4 - E_3 = \Delta E$

D. $E_5 - E_4 = \Delta E$

Answer: A

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CUQ (dE-BROGLIE.SAND HEISENBERG UNCERTAINITY PRINCIPLE)

1. Diffraction of the electron beam is an evidence of the fact that

A. Electrons repel each other

B. Light has wave properties

C. Electron has wave property

D. Electron has momentum

Answer: B

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2. Wave properties are only important for particles having

A. High mass and low velocities

B. Low mass and no velocity

C. High mass and high velocities

D. Low mass and high velocities

Answer: D

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3. 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's uncertainty principle.

C. Hund's rule of maximum multiplicity.

D. Aufbau principle.

Answer: B

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CUQ (QUANTUM MECHANICAL MODEL OF ATOM)

1. ψ^2 ,(psi) the wave function resperesents the probability of finding electron . Its value depends :

A. Inside the nucleus

B. Far from the nucleus

C. Near the nucleus

D. Upon the type of orbital

Answer: D

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2. In the Schrodinger's wave equation Ψ represents

A. Orbitals

B. Wave function

C. Amplitude function

D. Both 2 & 3

Answer: D

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3. The electron density of $3d_{xy}$ orbital in YZ plane is

A. 0.5

B. 0.95

C. 0.3333

D. Zero

Answer: D

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4. In an orbital, the signs of lobes indicate the

A. Sign of the wave function

B. Sign of the probability distribution

C. Presence or absence or electron

D. Sign of charge

Answer: A

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5. The number of radial nodes, nodal planes for an orbital with $n = 4, 1 = 1$ is

A. $3, 1$

B. $2, 1$

C. $2, 0$

D. $4, 0$

Answer: B

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CUQ (QUANTUM NUMBERS)

1. The quantum number which determines the number of sub-energy level is in any main energy level is

A. n

B. l

C. m

D. s

Answer: A

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2. Among the various quantum numbers (n,l,m, s) describing an electron which can have the largest value

A. n

B. l

C. m

D. s

Answer: A

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3. The orbital angular momentum of an electron in an atom depends on

A. m

B. l

C. n

D. All

Answer: B

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4. A 3d electron having $s = +1/2$ can have a magnetic quantum number

A. $+2$

B. $+3$

C. -3

D. -4

Answer: A

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5. The $2p_x$, $2p_y$ and $2p_z$ orbitals of atom have identical shapes but differ in their ....

A. Size

B. Shape

C. Orientation

D. Spin

Answer: C

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6. The orbital with maximum number of possible orientations

A. s

B. p

C. d

D. f

Answer: D

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7. The quantum number which cannot say any thing about an orbital is

A. n

B. l

C. m

D. s

Answer: D

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8. Which is not an atomic orbital?

A. $2d$

B. $5p$

C. $3p$

D. $4d$

Answer: A

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9. The quantum number in which the valence electrons of magnesium differs in

A. m

B. n

C. l

D. s

Answer: D

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10. The set of quantum numbers not possible 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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CUQ (ELECTRONIC CONFIGURATION)

1. According to $(n+l)$ rule after completing 'np' level the electron enters into

A. $(n-1)d$

B. $(n+1)s$

C. nd

D. $(n+1)p$

Answer: B

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2. If Pauli's exclusion principle is not known, the electronic arrangement of lithium atom is

A. $1s^2 2s^1$

B. $1s^1 2s^2$

C. $1s^3$

D. $1s^2 2s^1 2p^1$

Answer: C

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3. A p-orbital can accommodate upto :

A. Four electrons

B. Two electrons with parallel spins

C. Six electrons

D. Two electrons with opposite spins

Answer: D

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4. Due to which of the following reasons the nitrogen shows three unpaired electrons

A. Hund's rule

B. Aufbau principle

C. Pauli's principle

D. Heisenberg's principle

Answer: A

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5. Mg^{+2}, Al^{+3} have identical___

A. Configuration

B. Atoms

C. Ions

D. Molecules

Answer: A

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6. What will be the maximum number of electrons having the same spin in an atom with $n + l = 4$?

A. 2

B. 6

C. 8

D. 18

Answer: C

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7. The valency shell electron configuration of an atom is $4s^2 4p^5$. The maximum no of electron having parallel spin in this configuration are

A. 7

B. 4

C. 3

D. 5

Answer: B

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EXERCISE - I (C. W.)

1. The value of charge on the oil droplets experimentally observed were -1.6×10^{-19} and -4×10^{-19} coulomb. The value of the electronic charge, indicated by these results is

A. 1.6×10^{-19}

B. -2.4×10^{-19}

C. -4×10^{-19}

D. -0.8×10^{-19}

Answer: D

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2. The charge to mass ratio of $\alpha -$ particles is approximately to the charge to mass ratio of protons:

A. Half

B. Twice

C. 4 times

D. 6 times

Answer: B

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3. The increasing order of specific charge for electron (e) , proton (p) , neutron (n) and alpha particle(a) is

A. e, p, n, α

B. n, p, e, α

C. n, α, p, e

D. n, p, α, e

Answer: C

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EXERCISE - I (C. W.) ATOMIC NUMBER, MASS NUMBER & EMR

1. The nitride ion in lithium nitride 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

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2. The wrong statement among the following is

A. Nitrogen atom, nitride ion have same atomic number

B. Aluminium atom and its ion have same mass number

C. Iron atom, ferrous ion have same electron configuration

D. Nuclear charge is same in both chlorine atom, chloride ion

Answer: C

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3. In which of the following species both cation and Anion have same number of electrons

A. CaO

B. KBr

C. NaF

D. MgS

Answer: C

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4. An atom contains electrons, protons and neutrons. If the mass of each neutrons is halved, and each electron is doubled, then the atomic mass of $\cdot_{12} Mg^{24}$

A. Gets doubled

B. Approximately remain same

C. Approximately get reduced by 5%

D. Approximately get reduced by 25%

Answer: D

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5. The electromagnetic radiations are,

(a) Visible light (b) IR light

UV light (d) Micro waves

The correct order of increasing energy from lowest to highest is

A. a gt b gt c gt d

B. a lt b lt c lt d

C. d lt b lt a lt c

D. b lt c lt d lt a

Answer: C

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EXERCISE - I (C. W.) PLANCK.S QUANTUM THEORY & PHOTO ELECTRIC EFFECT

1. Energy levels A,B,C of a certain atoms corresponding to increasing values of energy level i.e., $E_A < E_B < E_C$. If λ_1, λ_2 and λ_3 are the

wavelengths of radiations corresponding to the transitions C to B,B to A and C to A respectively which of the following statement is correct?

A. $\lambda_3 = \lambda_1 + \lambda_2$

B. $\lambda = \dfrac{\lambda_1 \lambda_2}{\lambda_1 + \lambda_2}$

C. $\lambda_1 + \lambda_2 + \lambda_3 = 0$

D. $\lambda_3^2 = \lambda_1^2 + \lambda_2^2$

Answer: B

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2. Planck's constant has the same dimensions as that of

A. Power

B. Work

C. Radiant energy

D. Angular momentum.

Answer: D

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3. The number of photons of light having wave number x in 1J of energy source is (Planck's constant =h, velocity of light = c)

A. hcx

B. hc/x

C. $\frac{x}{hc}$

D. $\frac{1}{hcx}$

Answer: D

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4. The work function of a photoelectric material is 3.3 eV. The thershold frequency will be equal to

A. $4 \times 10^{11} Hz$

B. $7.96 \times 10^{10} Hz$

C. $5 \times 10^{33} Hz$

D. $4 \times 10^{11} Hz$

Answer: A

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5. In photoelectric effect, the energy of the photon striking a metallic surface is $5.6 \times 10^{-19} J$. The kinetic energy of the ejected electrons is $12.0 \times 10^{-20} J$. The work function is:

A. 6.4×10^{-19}J

B. $6.8 \times 10^{-19} J$

C. $4.4 \times 10^{-19} J$

D. 6.4×10^{-20} J

Answer: C

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6. The kinetic energy of electrons ejected by using light having frequency equal to threshold frequency (v_0) is:

A. hv_0

B. Almost zero

C. Very large

D. h / v_0

Answer: B

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EXERCISE - I (C. W.) HYDROGEN SPECTRUM

1. Which of the following transitions are not allowed in the normal electronic emission spectrum of an atom?

A. $2s \rightarrow 1s$

B. $2p \rightarrow 1s$

C. $3d \rightarrow 4p$

D. $5p \rightarrow 3s$

Answer: C

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2. In hydrogen spectrum, the spectral line of Balmer series having lowest wavelength is

A. H_{α} – line

B. H_{β} – line

C. H_{γ} – line

D. $H_{\delta}-\text{line}$

Answer: D

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3. In Hydrogen atom electron is present in the N shell. If it loses energy, a spectral line many be observed in the region

A. Infra-red

B. Visible

C. Ultra-violet

D. All the above

Answer: D

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4. The electron present in 5th orbit in excited hydrogen atoms returned back to ground state. The no. of lines which appear in Lyman series of hydrogen spectrum

A. 5

B. 10

C. 4

D. 6

Answer: C

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5. Which of the following gives neither emission spectrum nor absorption spectrum?

A. He^+

B. H_2

C. H^{+}

D. He

Answer: C

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6. The following electonic transition corresponds to the shortest wave length (n= no. of orbit)

A. $n_5 \to n_1$

B. $n_5 \to n_3$

C. $n_5 \to n_2$

D. $n_5 \to n_4$

Answer: A

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7. Which of the following electron transition in hydrogen atom will require the energy equivalent to its ionization energy?

A. from $n = 1$ to $n = 2$

B. from $n = 2$ to $n = 3$

C. from $n = 1$ to $n = 3$

D. from $n = 1$ to $n = \infty$

Answer: D

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8. If the mass of the electron is reduced to half the Rudberg constant

A. Remains unchanged

B. Becomes half

C. Becomes double

D. Becomes one fourth

Answer: B

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EXERCISE - I (C. W.) BOHR.S ATOMIC MODEL

1. According to Bohr's theory, the angular momentum for an electron of 5th orbit is,

A. $10h / \pi$

B. $5h / 2\pi$

C. $25h / \pi$

D. $5\pi / 2h$

Answer: B

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2. The change in velocity when hydrogen electron jumps from K shell to L shell is

A. One-half of its original velocity

B. Twice to its original velocity

C. One-quarter of its original velocity

D. Equal to its original velocity

Answer: A

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3. Each hydrogen atom is excited by giving 10.2eV. The maximum number of spectral lines in the emission is equal to

A. 1

B. 2

C. 3

D. 4

Answer: A

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4. Consider the following statements

(I) Bohr's theory can also be used to explain the spectra of He^{+} ion

(II) Energy of an electron in the first Bohr orbit of hydrogen atom is $-13.6eV$

(III) Bohr's theory is only applicable to hydrogen atom and not to any other species

(IV) The energy of an electron in a hydrogen atom is quantised

The correct statements are

A. I, II, IV

B. II, III

C. II, IV

D. All

Answer: A

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5. The ionisation potential of H-atom is $13.6eV$. It is exposed to electromagnetic radiation of wavelength $1028A^{\circ}$ and gives out induced radiations, then

A. Longest wavelength of induced is $6568A^0$

B. Lowest wavelength of induced radiation is $102A^0$

C. Longest wavelength of induced radiation is $3252A^0$

D. Longest wavelength of induced is $1216A^0$

Answer: A

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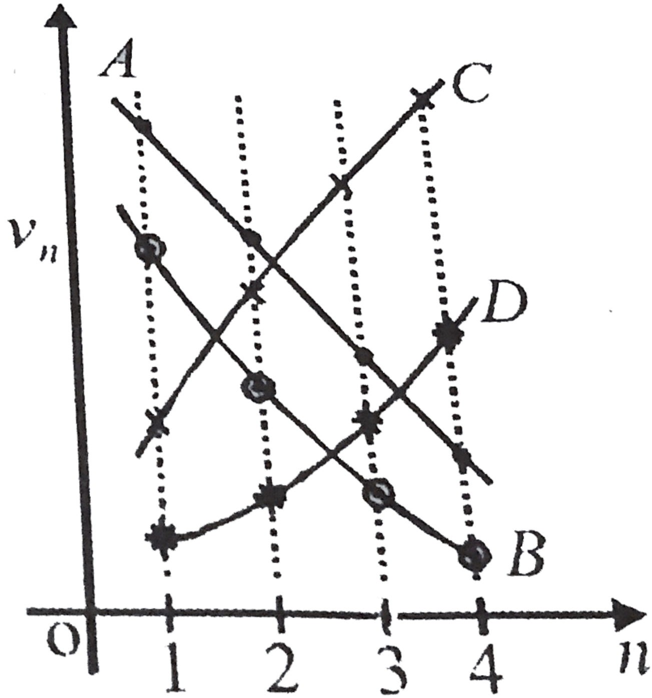
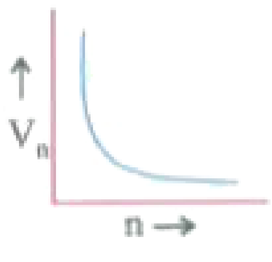
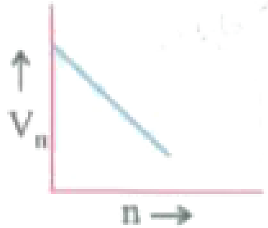
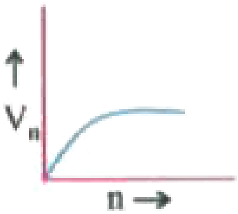
6. Which of the plots shown in the figure represents speed (v_n) of the electron in a hydrogen atom as a function of the principal quantum number (n)?

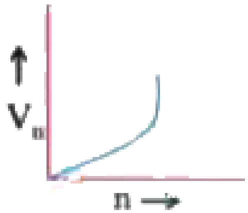


A.



B. 

C. 

D. 

Answer: A

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7. The difference in angular momentum associated with the electron in two successive orbits of hydrogen atoms is

A. $h/2\pi$

B. h/π

C. $h/2$

D. $(n-1)h/2\pi$

Answer: A

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8. Properties of electrons that are quantized in Bohr's atomic model are

A. Mass and energy

B. Energy and angular momentum

C. Angular momentum and mass

D. Mass and charge

Answer: B

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9. When greater number of excited hydrogen atoms reach the ground state, then

A. More number of lines are found in Lyman series

B. The intensity of lines in Balmer series increase

C. The intensity of lines in Lyman series increase

D. Both the intensity and number of lines in Lyman series increases

Answer: C

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10. To which of the following is Bohr's theory applicable

(I) He^{+} (II) Li^{+2} (III) Tritium (IV) Be^{+2}

The correct combination is

A. III, IV

B. I, II , III, IV

C. I, II

D. I, II, III

Answer: D

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EXERCISE - I (C. W.) DE-BROGLIE.S & HEISENBERG.S UNCERTAINITY PRINCIPLE

1. Which of the following has the largest de Brogile wavelength provided all have equal velocity?

A. Carbon dioxide molecule

B. Ammonia molecule

C. Oxygen molecule

D. Nitrogen molecule

Answer: B

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2. Among the following particles, which will have the shortest wavelength when accelerated by one million eV?

A. Neutron

B. Tritium atom

C. α -particle

D. Electron

Answer: C

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3. If wavelength is equal to the distance travelled by the electron in one second, then

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

B. $\lambda = \sqrt{\frac{h}{m}}$

C. $\lambda = \frac{h}{m}$

D. $\lambda = \sqrt{\frac{h}{p}}$

Answer: B

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4. If uncertainty in position and momentum are equal then uncertainty in velocity is.

A. $\sqrt{\frac{h}{\pi}}$

B. $\frac{1}{2}\sqrt{\frac{h}{\pi}}$

C. $\frac{1}{2m}\sqrt{\frac{h}{\pi}}$

D. $2m\sqrt{\frac{h}{\pi}}$

Answer: C

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EXERCISE - I (C. W.) QUANTUM MECHANICAL MODEL OF ATOM

1. The number of angular and radial nodes of 4d orbital respectively are

A. 3,1

B. 1,2

C. 3,0

D. 2,1

Answer: D

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2. The numbers of radial nodes of $3s$ and $2p$ orbitals are respectively:

A. 0,2

B. 2,0

C. 1,2

D. 2,1

Answer: B

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3. The basis of quantum mechanical model of an atom is

A. Angular momentum of electron

B. Quantum numbers

C. Dual nature of electron

D. Black body radiation

Answer: C

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4. In the plots of radial distribution function for the hydrogen 3s orbitals versus 'r', the no of peaks are

A. 3

B. 2

C. 1

D. 0

Answer: A

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5. Which of the following conditions is incorrect for a well behaved wave function (Φ)?

A. Ψ must be single valued at any particular point

B. Ψ must be positive

C. Ψ must be a continuous function of its coordinates

D. None of the above

Answer: B

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6. Consider the following statements:

(a) Electron density in the XY plane in $3d_{x^2-y^2}$ orbital is zero

(b) Electron density in the XY plane in $3d_{z^2}$ orbital is zero.

(c) $2s$ orbital has one nodel surface

(d) for $2p_z$ orbital, XY is the nodal plane.

Which of these are incorrect statements :

A. 2 and 3

B. 1, 2, 3, 4

C. Only 2

D. 1 & 3

Answer: A

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7. Which of the following statements is correct?

A. An orbital describes the path of an electron in an atom

B. An orbital is a region where the electron is not located

C. An orbital is a function which gives the probabilities of finding the electron in a given region

D. All the above

Answer: C

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8. For an electron in a hydrogen atom, the wave function ψ is proportional to exp, where a_0 is the Bohr's radius. What is the ratio of the probability of finding the electron at the nucleus to the probability of finding it at a_0?

A. e

B. e^2

C. $1/e^2$

D. zero

Answer: D

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9. Energy density in the region between $1s$ and $2s$ orbital is ....

A. High

B. Low

C. Zero

D. Abnormal

Answer: C

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10. Which of the following statement(s) is/are correct about angular nodes

A. They are independent from the radial wave function

B. They are directional in nature

C. The number of angular nodes of orbital is equal to azimuthal quantum number.

D. All are correct

Answer: D

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EXERCISE - I (C. W.) QUANTUM NUMBERS

1. The quantum number of the last electron of an element are given below. Predict the atomic number and name of the element from the following quantum numbers:

$n = 3, l = 2, m = 0, s = -\frac{1}{2}$

A. $n2l + 1$

B. $l = 2n + 1$

C. $n = 4l + 2$

D. $n = 2l^2$

Answer: C

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2. The set of quantum numbers, n = 3, l = 2, $m_l = 0$

A. Describes an electron in a 2s orbital

B. Is not allowed

C. Describes an electron in a 3p orbital

D. Describes one of the five orbitals of a similar type

Answer: D

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3. The orbital having minimum 'm' value

A. Spherical in shape

B. Dumbell in shape

C. Double dumbell in shape

D. Tetrahedral

Answer: C

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4. An orbital made of four lobes can have the following quantum numbers

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

B. $n=3, l=1, m=-2$

C. $n=3, l=2, m=0$

D. $n=3, l=3, m=-3$

Answer: C

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5. Number of electrons of maganese with magnetic quantum number value '0' is

A. 1

B. 8

C. 12

D. 13

Answer: D

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6. The total number of m values for $n = 4$ is

A. 8

B. 16

C. 12

D. 20

Answer: B

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7. Choose the incorrect statement

A. The shape of an atomic orbital depends upon the azimuthal quantum number

B. The orientation of an atomic orbitals depend upon the magnetic quantum number

C. The energy of fill 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 value of azimuthal and magnetic quantum numbers.

Answer: C

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8. Which of the following statement about quantum number is correct ?

A. Quantum numbers n, 1, m and m_s are needed to describe an electron in an atom completely.

B. Quantum numbers n, 1, m ands are obtained by solving the Schrodinger wave equation.

C. A subshell in an atom can be designated with two quantum numbers n and 1.

D. The maximum value of 1 is equal to n - 1 and that of m is $\pm l$

Answer: B

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9. Which of the following sets of quantum numbers represents the highest energy of an atom?

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

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

C. $n = 4, l = 0, m = 0, s = +1/2$

D. $n = 3, l = 0, s = +1/2$

Answer: B

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10. Describe the orbital with following quantum numbers:

(i) n=3, l=2

(ii) n=4, l=3

A. iii lt iv lt ii

B. ii lt iv lt i lt iii

C. i lt iii lt ii lt iv

D. iv lt ii lt iii lt i

Answer: D

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11. The raidal part of wave function dependds on the quantum numbers

A. n and l

B. l and m

C. l and s

D. m and s

Answer: B

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12. The minimum angular momentum of an electron with the magnetic quantum numbers $-1, 0, +1$

A. $\sqrt{\frac{3}{2}\frac{h}{p}}$

B. $\frac{h}{p}$

C. $\frac{2h}{p}$

D. $\frac{3}{2}\frac{h}{p}$

Answer: B

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13. The electrons occupying the same orbital have the same values for all the quantum number except for

A. n

B. l

C. m

D. s

Answer: D

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14. In order to designate and orbital in an atom the no of quantum no. required

A. One

B. Two

C. Three

D. Four

Answer: C

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15. the maximum number of electrons that can be accommodarted in all the ortbitals for which l=3 is ....

A. 2

B. 6

C. 10

D. 14

Answer: D

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16. The ionisation energy will be higher when the electron is removed from:

A. $n = 4l = 1s = + \frac{1}{2}$

B. $n = 3l = 0s = - \frac{1}{2}$

C. $n = 4l = 0s = + \frac{1}{2}$

D. $n = 4l = 2s = - \frac{1}{2}$

Answer: C

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EXERCISE - I (C. W.) ELECTRONIC CONFIGURATIONS

1. Statement-1 : The ground state configuration of Cr is $[Ar]3d^5 4s^1$

Statement-2 : The energy of atom is lessen in $3d^5 4s^1$ configuration compared to $3d^1 4s(2)$ configuration.

A. Pauli's exclusion principle

B. Aufbau Principle

C. Hund's rule

D. Heisenberg principle

Answer: C

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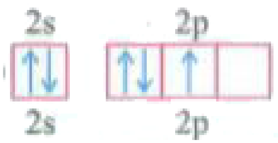
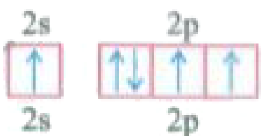
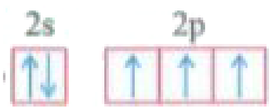
2. The orbital diagram in which the Aufbau principle is violated

A. 

B. 

C. 

D. 

Answer: B

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3. The electronic configuration of an element with atomic number 64 is

A. $6s^2 5d^1 4f^7$

B. $6s^2 5d^0 4f^8$

C. $6s^1 5d^0 4f^7$

D. $6s^1 5d^2 4f^7$

Answer: A

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4. Given reasons :

Zn is not regarded as a transition element.

(ii) Cr^{2+} is a strong reducing agent.

A. 4

B. 5

C. 6

D. 3

Answer: A

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5. Which of the following statements is incorrect?

A. Extra stability of half filled and completely filled orbitals among s and p block elements is reflected in trends of the across a period.

B. Extra stability of half filled and completely filled orbitals among s and p block elements is reflected in E.A. trends across a period.

C. Aufbau principle is incorrect for cases where energy difference between ns and (n - 1)d subshell is larger

D. Extra stability to half filled subshell is due to higher exchange energies.

Answer: C

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6. The ion that is most stable

A. Fe^{+}

B. Fe^{2+}

C. Fe^{3+}

D. Fe^{4+}

Answer: C

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7. Which have the same number of s-electrons as the d-electrons in Fe^{2+} ?

A. Li

B. Na

C. N

D. P

Answer: D

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8. If Hund's rule is not followed , magnetic moment of Fe^{2+}, $Mn^{\oplus}$ and Cr all having 24 electron will be in order

A. I & II

B. II & III

C. III & IV

D. I & IV

Answer: B

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EXERCISE - I (H. W.) SUBATOMIC PARTICLES

1. An oil drop has $6.39 \times 10^{-19} C$ charge .How many electrons does this oil drop has ?

A. 2

B. 4

C. 8

D. 16

Answer: B

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2. Charge of one mole of alpha particle is

A. $+2$ units

B. $+1$ units

C. $+2$ faraday

D. $+2$ coulombs

Answer: C

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3. The ratio of the e/m values of a proton and an α-particle is:

A. $2:1$

B. $1:2$

C. $1:1$

D. $1:3$

Answer: A

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EXERCISE - I (H. W.) ATOMIC NUMBER & MASS NUMBER

1. The charge on the atom containing 17 protons, 18 neutrons and 18 electrons is.

A. $+1$

B. -1

C. -2

D. None

Answer: B

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2. An isotone of $._{32}^{76} Ge$ is

(i) $._{33}^{77} As$ (ii) $._{34}^{77} Se$

(iii) $._{34}^{78} Se$ (iv) $._{32}^{77} Ge$

A. $_{32}^{77}Ge$

B. $_{33}^{77}As$

C. $_{34}^{77}Se$

D. $_{34}^{78}Se$

Answer: B

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3. The number of neutrons present in the deuterium isotope of hydrogen is

A. 2

B. 3

C. 5

D. 1

Answer: D

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EXERCISE - I (H. W.) ELECTROMAGNETIC RADIATION

1. Identify the incorrectly matched set from the following

List - I	List - II
1) Wavelength	Nanometers
2) Frequency	Hertz
3) Wavenumber	m^{-1}
4) Velocity	ergs

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2. If λ_1 and λ_2 are the wavelength of characteristic X - rays and gamma rays respectively, then the relation between them is

A. $\lambda_1 = \frac{1}{\lambda_2}$

B. $\lambda_1 = \lambda_2$

C. $\lambda_1 > \lambda_2$

D. $\lambda_1 < \lambda_2$

Answer: C

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EXERCISE - I (H. W.) PLANCK.S QUANTUM THEORY AND PHOTO ELECTRIC EFFECT

1. The charactertistic not associated with Planck's theory is:

A. Radiations are associated with energy

B. The magnitude of energy associated with a quantum is proportional to frequency

C. Radiation energy is neither emitted nor absorbed continuously.

D. Radiation energy is neither emitted nor absorbed discontinuously

Answer: D

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2. Ultraviolet light of $6.2eV$ falls on Caesium surface (work function $= 1.2eV$). The kinetic energy (in electron volts) of the fastest electron emitted is approximately

A. $5eV$

B. $4eV$

C. $3eV$

D. $2eV$

Answer: A

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3. Visible light photons do not show Compton effect because they

A. Move very slowly

B. Have no momentum

C. Have very less mass

D. Have larger wavelength

Answer: D

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4. As the frequency of the light increases, the momentum of its Photon

A. Increases

B. Decreases

C. Remains same

D. Cannot be predicted

Answer: A

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EXERCISE - I (H. W.) H-SPECTRUM

1. The line spectrum of two elements is not identical because

A. The elements do not have the same number of neutrons

B. They have different mass numbers

C. Their outermost electrons are at different energy levels

D. All of the above

Answer: C

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2. 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. Brackett

Answer: A

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3. When the atomic electron is at infinite distance from the nucleus, its energy is

A. infinity

B. zero

C. negative

D. positive

Answer: B

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4. The wave number of the $H_a -$ line in Balmer series of hydrogen spectrum is

A. $5R/36$

B. $3R/16$

C. $21R/100$

D. $3R/4$

Answer: A

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5. The electronic transition that emits maximum energy is [n= represents orbit]

A. $n_5 \rightarrow n_4$

B. $n_4 \rightarrow n_3$

C. $n_2 \rightarrow n_1$

D. $n_3 \rightarrow n_2$

Answer: C

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EXERCISE - I (H. W.) BOHR.S ATOMIC MODEL

1. With increasing atomic number of a single electron species, the energy difference between two orbits

A. Increases

B. Decreases

C. Remains constant

D. First increases followed by a decrease

Answer: A

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2. The ratio of the radius of the Bohr orbit for the electron orbiting the hydrogen nucleus that of the electron orbiting the deuterium nucleus is approximately

A. $1:1$

B. $1:2$

C. $2:1$

D. $1:4$

Answer: A

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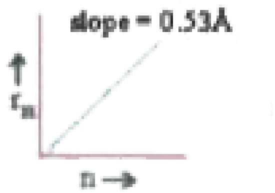
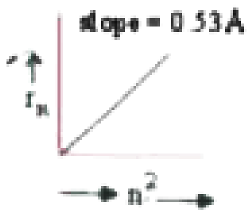
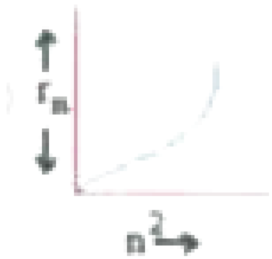
3. Which of the following curves may represent the radius of orbit (r_n) in a H-atoms as a function of principal quantum number(n)

A. 

B. 

C. 

D. None of these

Answer: B

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4. **How much energy is required to ionise a H atom if the electron occupies $n = 5$ orbit?**

A. $5.44ev$

B. $10.8ev$

C. $0.544ev$

D. $1.08ev$

Answer: C

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5. **If the speed of electron in the first bohr orbit of hydrogen atom is x then the speed of the electron in the third Bohr orbit of hydrogen is**

A. $x/9$

B. $x/3$

C. $3x$

D. $9x$

Answer: B

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EXERCISE - I (H. W.) dE-BROGLIE.S & HEISENBERG.S

1. If the following mater travel with equal velocity the longest wavelength is that of

A. Electron

B. α - particle

C. Proton

D. Neutron

Answer: A

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2. **Calculate the momentum of radiation of wavelength** $0.33nm$

A. 2×10^{-24}

B. 2×10^{-12}

C. 2×10^{-6}

D. 2×10^{-48}

Answer: A

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EXERCISE - I (H. W.) QUANTUM MECHANICAL MODEL OF ATOM

1. **Which of the following statements is not correct?**

A. The wave function depicting the dependence on r involves two quantum numbers n and l

B. The wave function depicting the angular dependence involves two quantum numbers l and m

C. The spin quantum number is not the outcome of the Schrodinger equation.

D. The lowest energy state of an atom corresponds to n = 0.

Answer: D

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2. In a main energy level, the orbital with more number of nodal planes will be.......

A. Higher energy

B. Lower energy

C. Either 1 or 2

D. Neither 1 nor 2

Answer: A

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3. Choose the correct statement among the following :

A. Ψ represents the atomic orbital

B. The number of peaks in radial distribution is n-l

C. A node is a point in space around nucleus where the wave function Ψ has zero value

D. All of these

Answer: D

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4. The maximum probability of finding electron in the d_{xy} orbital is -

A. Along with x - axis

B. Along the y - axis

C. At an angle of 45° from the X and Y axis

D. At an angle of 90° from the x and y axis

Answer: C

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5. Which of the following statements regarding an orbital are correct

A. An orbital is a definite trajectory around the nucleus in which electron can move

B. An orbital always has spherical trajectory

C. An orbital is the region around the nucleus where there si a 90-95% probability of finding all the electrons of an atom

D. An orbital is characterized by 3 quantum numbers n, l and m

Answer: C,D

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6. Which of the following statements on the atomic wave function Ψ is not correct?

A. Ψ may be a real valued wave function

B. Ψ may be in some cases be a complex function

C. Ψ has a mathematical significance

D. Ψ proportional to the probability of finding an electron

Answer: D

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EXERCISE - I (H. W.) QUANTUM NUMBERS

1. What is the full degeneracy of the $n = 3$ state of a H-atom in the absence of a magnetic field?

A. 4

B. 10

C. 8

D. 18

Answer: D

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2. For the azimuthal quantum number 'l' the total number of magnetic quantum numbers is given by

A. $l = \frac{(m+1)}{2}$

B. $l = \frac{m-1}{2}$

C. $l = \frac{2m+1}{2}$

D. $l = \frac{2m-1}{2}$

Answer: B

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3. How many sets of four quantum numbers are possible for electron present in He^{2-} anion

A. 2

B. 4

C. 5

D. 7

Answer: B

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4. The set of quantum numbers, n = 2, l = 2, m_l = 0 :

A. Describes an electron in a 2s orbital

B. Describes one of the five orbitals of a similar type

C. Describes an electron in a 2p orbital

D. Is not allowed.

Answer: D

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5. The sub-energy level which can accommodate maximum number of electrons with parallel spin values is

A. $4p$

B. $6s$

C. $3d$

D. $6p$

Answer: C

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6. The azimuthal quantum number and the principal quantum number of the 17th electron are

A. $l = 1, n = 3$

B. $l = 3, n = 2$

C. $l = 1, n = 17$

D. $l = 2, n = 1$

Answer: A

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7. The orbital with lowest energy in which an electron with Azimuthal quantum no value 3 is

A. 4

B. 5

C. 1

D. 6

Answer: A

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8. The quantum numbers $n=3, l=1, m=\ +1$ and $s=\ +1/2$ represent the unpaired electron present in

A. Sodium atom

B. Aluminium atom

C. Fluorine atom

D. Potassium atom

Answer: B

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

A. 0

B. 2

C. 3

D. 1

Answer: A

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10. Which of the following sets of quantum numbers is correct for an electron in 4f-orbtial ?

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

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

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

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

Answer: A

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EXERCISE - I (H. W.) ELECTRONIC CONFIGURATIONS

1. Which of the following arrangements of electron is mostly likely to the stable ?

A. 

B. 

C. 

D. 

Answer: C

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2. Aufbay principle fails to explain the configuration of element with atomic number

A. 18

B. 21

C. 24

D. 27

Answer: C

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3. Total number of electron in any energy level is

A. $\sum_{l=0}^{l=n-1} 2(2l+1)$

B. $\sum_{l=0}^{l=n} 2(2l+1)$

C. $\sum_{l=0}^{l=n+1} 2(2l+1)$

D. $\sum_{l=1}^{l=n-1} 2(2l+1)$

Answer: A

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4. The atomic number at which filling of a g-orbital is likely to begin is :

A. 121

B. 116

C. 106

D. 124

Answer: A

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5. n and l values of an orbital A and 3 are 2 and another orbital B are 5 and 0. The energy of

A. B is more than A

B. A is more than B

C. A and B are same

D. A is four times than B

Answer: A

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6. Number of unpaired electrons of neutral manganese atoma and its divalent ion are in the ratio (the atomic number of manganese is 25 and

it loses two electrons to form the divalent ion)

A. $1 : 1$

B. $25 : 23$

C. $5 : 3$

D. $3 : 53$

Answer: A

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7. Which of the following electrons is most tightly bound by the nucleus

A. $4p$

B. $5s$

C. $4d$

D. $5d$

Answer: A

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8. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$ is not the electron configuration of

A. Mn^{3+}

B. Fe^{3+}

C. Cr^{+}

D. Co^{4+}

Answer: A

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9. Which one of the following statements is correct

A. 2's' orbital is spherical with two nodal planes

B. The de Broglie wavelength (λ) of a particle of mass 'm' and velocity 'V' is equal to m V /h

C. The principal quantum number (n) indicates the shape of the orbital

D. The electronic configuration of phosphorous is given by [Ne] $3s^2 3p_x^1 3p_y^1 3p_z^1$

Answer: D

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10. Which of the following has maximum number of unpaired electrons?

A. Zn

B. Fe^{2+}

C. Ni^{3+}

D. Cu^{+}

Answer: B

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11. The successive elements belonging to the 3d-series have the same number of electrons in the d-sub-shell. The elements are

A. $Ti \& V$

B. $V \& C$

C. $Cr \& Mn$

D. $Mn \& F$

Answer: C

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12. The electronic configuration in the valence shell of silicon is

The rule violated is

A. Auf-bau principle

B. Pauli's rule

C. Hund's rule

D. All

Answer: C

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13. In potassium, the order of energy levels is

A. $3s > 3d$

B. $4s < 3d$

C. $4s > 4p$

D. $4s = 3d$

Answer: B

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EXERCISE - II (C. W.) ATOMIC MODELS ATOMIC NUMBER & MASS NUMBER

1. The e/m ratio of cathode rays is x unit, when hydrogen is filled in the discharge tube. What will be its value when deuterium (D_2) is filled in it?

A. x unit

B. x/2 unit

C. 2x unit

D. x/4 unit

Answer: A

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2. a-particles are projected towards the following metals,with the same kinetic energy. Towards which metal, the distance of closest approach is minimum?

A. $Cu(Z = 29)$

B. $Ag(Z = 47)$

C. $Au(Z = 79)$

D. $Ca(Z = 20)$

Answer: D

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3. Which of the following nuclear reactions will generate an isotope ?

A. Neutron particle emission

B. Positron emission

C. α - particle emission

D. β - particle emission

Answer: A

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4. Chlorine exists in two isotopic forms $Cl - 37$ and Cl-35 but its atomic mass is 35.5. this indicates the ratio of Cl-37 and Cl-35 is appromimately

A. $1:2$

B. $1:1$

C. $1:3$

D. $3:1$

Answer: C

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5. The mass numbers of three isotopes of an element are 10,12,14 units. Their percentage abundance is 80,15 and 5 respectively. What is tha tomic weight of the element?

A. 10.5

B. 11.5

C. 12.5

D. 13.5

Answer: A

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6. An ion with mass number 56 contains 3 units of positive charge and 30.4% more neutrons then electrons. Assign the symbol to this ion.

A. ${}^{55}_{26}Fe^{3+}$

B. ${}^{57}_{26}Fe^{3+}$

C. ${}^{59}_{26}Fe^{3+}$

D. ${}^{56}_{26}Fe^{3+}$

Answer: D

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EXERCISE - II (C. W.) ELECTROMAGNETIC RADIATION

1. The frequency of a wave light is $1.0 \times 10^6 \sec^{-1}$. The wave length for this wave is

A. 3×10^4 cm

B. 3×10^{-4} cm

C. 6×10^4 cm

D. 6×10^6 cm

Answer: A

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2. The energy per quantum associated with light of wave length $250 \times 10^{-9} m$ is

A. $7.95 \times 10^{-19} J$

B. 7.95×10^{-26} J

C. 3.93×10^{-26} J

D. 3.93×10^{-19} J

Answer: A

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3. What is the energy of photons that corresponds to a wave number of $2.5 \times 10^{-5} cm^{-1}$

A. 2.5×10^{-20} erg

B. 5.1×10^{-23} erg

C. 4.97×10^{-21} erg

D. 8.5×10^{-2} erg

Answer: C

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EXERCISE - II (C. W.) PLANCK.S QUANTUM THEORY & PHOTO ELECTRIC EFFECT

1. Nitrogen laser produces a radiation at a wavelength of $337.1nm$. If the number of photons emitted is 5.6×10^{24}. Calculate the energy of this laser

A. 3.33×10^{6} J

B. 3.33×10^{5} J

C. 1.56×10^{6} J

D. 15.6×10^8 J

Answer: A

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2. The ratio of energies of photons with wavelength $2000A^0$ and $4000A^0$ is

A. $1/4$

B. 4

C. $1/2$

D. 2

Answer: D

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3. An Electro magnetic radiation of wavelength 484 nm is just sufficient of ionise a sodium atom. Calculate the ionisation energy of sodium in kJ/mo, approximately?

A. 494.5

B. 594.5

C. 694.5

D. 794.5

Answer: A

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4. When a certain metal was irradiated with light of frequency $4.0 \times 10^{16} s^{-1}$ the photoelectrons emitted had three times the kinetic energy as the kinetic energy of photoelectrons emitted when the metal was irradited with light of frequency $2.0 \times 10^{16} s^{-1}$. Calculate the critical frequency (ν_0) of the metal.

A. $2.0 \times 10^{16} s^{-1}$

B. $1.6 \times 10^{16} s^{-1}$

C. $3.0 \times 10^{16} s^{-1}$

D. $4.2 \times 10^{16} s^{-1}$

Answer: B

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5. The work function for Al, K and is 4.28 eV, 2.30 eV and 5.65 eV respectively. Their respective threshold frequencies would be

A. 2.52

B. 2.2

C. 2.35

D. 2.01

Answer: B

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EXERCISE - II (C. W.) H-SPECTRUM

1. The ratio of highest possile wavelength to lowest possible wavelength of Lyman series is

A. $4/3$

B. $9/8$

C. $27/5$

D. $16/5$

Answer: A

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2. The wave number of the first line in the Balmer series of hydrogen atom is $15200cm^{-1}$. What is the wave number of the first line in the

Balmer series of Be^{3+}?

A. $1.35 \times 10^5 cm^{-1}$

B. $1.66 \times 10^9 cm^{-1}$

C. $13.5 \times 10^5 cm^{-1}$

D. $1.43 \times 10^4 cm^{-1}$

Answer: A

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3. What is the lowest energy of the spectral line emitted by the hydrogen atom in the Lyman series?

(h = Planck's constant, c = velocity of light, R = Rydberg's constant).

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

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

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

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

Answer: C

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4. The ionization energy of H atom is x kJ. The energy required for the electron to jump from $n=2$ to $n=3$ will be:

A. $5x$

B. $36x/5$

C. $5x/36$

D. $9x/4$

Answer: C

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5. According to Bohr's theory, when an electron jumps from any higher orbit to the third orbit, spectral lines are emitted. These are called

A. 5

B. 10

C. 20

D. 1

Answer: B

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6. The Ratio of m^{th} to n^{th} wavelength of Lyman series in H-spectrum is equal to

A. $\frac{\lambda_m}{\lambda_n} = \frac{(m^2-1)\times n^2}{(n^2-1)\times m^2}$

B. $\frac{\lambda_m}{\lambda_n} = \frac{(n^2-1)\times m^2}{(m^2-1)\times n^2}$

C. $\frac{\lambda_m}{\lambda_n} = \left(\frac{(m+1)^2-1}{(m+1)^2}-1\right)$

D. $\frac{\lambda_m}{\lambda_n} = \frac{(n+1)^2}{(m+1)^2} \times \frac{(m+1)^2 - 1}{(n+1)^2 - 1}$

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 $He^+ = \frac{1}{3}$ 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 $He^+ = E_3$ of $Li^{+2} = E_4$ 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. What is the wavelength of a photon emitted during a transition from $n = 5$ state to the $n = 2$ state in the hydrogen atom

A. 434 nm

B. 234 nm

C. 476 nm

D. 244 nm

Answer: A

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9. Which of the following transitions of an electron in hydrogen atom emits radiation of the lowest wavelength?

A. $n_2 = \alpha$ 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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EXERCISE - II (C. W.) BOHR.S ATOMIC MODEL

1. The velocity of electron in first orbit of H-atom as compared to the velocity of light is

A. $\frac{1}{10}th$

B. $\frac{1}{100}th$

C. $\frac{1}{1000}th$

D. Same

Answer: B

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2. In a collection of H-atoms, all the electrons jump from n=5 to ground level finally (directly of indirectly) ,without emitting any line in Blamer series. The number of possible different radiations is :

A. 10

B. 8

C. 7

D. 6

Answer: D

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3. What is likely to be principal quantum number for a circular orbit of diameter $20.6nm$ of the hydrogen atom. If we assume Bohr orbit to be the same as that represented by the principal quantum number?

A. 10

B. 14

C. 12

D. 16

Answer: B

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4. The de-Broglie wavelength of an electron in the first Bohr orbit is

A. $2px$

B. $6px$

C. $9x$

D. $x / 3$

Answer: B

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5. A single electron in an ion has ionization energy equal to $217.6eV$. What is the total number of neutrons present in one ion of it?

A. 2

B. 4

C. 5

D. 9

Answer: C

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6. The ionisation energy for the Hydrogen atom in the ground state is $2.18 \times 10^{-18} J \text{atom}^{-1}$. The energy required for the following process $He^{+}(g) \rightarrow He^{2+}(g) + e^{-}$ is

A. $8.72 \times 10^{-18} \text{Jatom}^{-1}$

B. $8.72 \times 10^{-19} \text{Jatom}^{-1}$

C. $4.35 \times 10^{-18} \text{J atom}^{-1}$

D. $2.62 \times 10^{-19} \text{J atom}^{-1}$

Answer: A

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7. If the diameter of a carbon atom is $0.15nm$, calculate the number of carbon atom which can be placed side by side in a straight line length of scale of length $20cm$ long.

A. 13.3×10^{9}

B. 1.33×10^{9}

C. 6.2×10^{9}

D. 1.33×10^{7}

Answer: B

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8. An electronic transition in hydrogen atom result in the formation of $H\alpha$ line of Hydrogen in Lyman series, the energies associated with the electron in each of the orbits involved in the transition (in $kcalmol^{-1}$) are

A. $-313.6, \ -34.84$

B. $-313.6, \ -78.4$

C. $-78.4, \ -34.84$

D. $-78.4, \ -19.6$

Answer: B

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9. The wavelength of a spectral line emmited by hydrogen atom in the lyman series is $\frac{16}{15}R$ cm. what is the value of n_2

A. 2

B. 3

C. 4

D. 1

Answer: C

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EXERCISE - II (C. W.) dE-BROGLIE.S & HEISENBERG.S

1. If $E_1, E_2 \text{and} E_3$ represent respectively the kinetic energies of an electron , an alpha particle and a proton each having same de Broglie wavelength then :

A. $E_e = E_\alpha = E_p$

B. $E_e > E_\alpha > E_p$

C. $E_\alpha < E_p < E_e$

D. $E_e = E_p < E_n$

Answer: C

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2. Calculate the wavelength (in nanometer) associated with a proton moving at 1.0×10^3 m/s (Mass of proton $= 1.67 \times 10^{-27} kg$ and $h = 6.63 \times 10^{-34} is)$:

A. 0.032 nm

B. 2.5 nm

C. 4.0 nm

D. 0.4 nm

Answer: D

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3. The de-Brogile wavelength for a proton with a velocity 15% of the speed of light is:

A. 8.8×10^{-12} m

B. 8.8×10^{-15} cm

C. $8.8 \times 10^{-15} m$

D. 4.4×10^{-15} cm

Answer: C

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4. The velocities of two paricles A and B are 0.05 and $0.02 m/s$ respectively. The mass of B is five times the mass of A. The ratio of their de-Brogile wavelength is

A. $2:1$

B. $1:4$

C. $1:1$

D. $4:1$

Answer: A

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5. The mass of an electron is m, its charge is e and it is accelerated from rest through a potential difference, V. The velocity of electron can be calculated by formula:

A. $\sqrt{V/m}$

B. $\sqrt{eV/m}$

C. $\sqrt{(2eV/m)}$

D. None of these

Answer: C

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6. The uncertainity in the positions of an electron and proton is equal, the ratio of the uncertainities in the velocity of an electron and proton is

A. $10^3 : 1$

B. $1 : 1836$

C. $3672 : 1$

D. $183 : 1$

Answer: D

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7. A ball of mass $200g$ is moving with a velocity of $10m\sec^{-1}$. If the error in measurement of velocity is 0.1%, the uncertainty in its position is :

A. 3.3×10^{-31} m

B. 3.3×10^{-27} m

C. 5.3×10^{-25} m

D. 2.64×10^{-32} m

Answer: D

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8. The kinetic energy of an electron accelerated from rest through a potential difference of 5V will be

A. 5J

B. 5erg

C. 5eV

D. 8×10^{-10} eV

Answer: C

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1. Which of the following conditions is incorrect for a well behaved wave function (Φ)?

A. Ψ must be finite

B. Ψ must be single valued

C. Ψ must be infinite

D. Ψ must be continuous

Answer: C

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2. The spin magnetic momentum of electron in an ion is $4.84 BM$. Its total spin will be

A. ± 1

B. ± 2

C. $\geq \sqrt{\frac{h}{4\pi}}$

D. ± 2.5

Answer: B

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3. The maximum number of sub levels, orbitals 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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4. 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?

1) $n=1, l=0, m=0$

2) $n=2, l=0, m=0$

3) $n=3, l=1, m=1$

4) $n=3, l=2, m=1$

5) $n=3, l=2, m=0$

A. a& c

B. b & c

C. c & d

D. d & e

Answer: D

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5. The values of four quantum number of valence electron of an element are $n = 4, l = 0, m = 0$ and $s = +\frac{1}{2}$. The element is:

A. K

B. Ti

C. Na

D. Sc

Answer: A

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6. $\begin{array}{ccccc} \text{Given} & K & L & M & N \\ & 2 & 8 & 11 & 2 \end{array}$

The number of electrons present in $l = 2$ is -

(a). 3

(b). 6

(c). 5

(d). 4

A. 3

B. 6

C. 5

D. 4

Answer: A

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7. The outermost shell electronic configuration $3d^5, 4s^2$ represents

A. $+3/2$

B. $+5/2$

C. $+7/2$

D. $9/2$

Answer: A

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8. 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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9. An impossible set of four quantum number of an electron is

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

B. $n=4, l=0, m=0, s=+1/2$

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

D. $n = 5, l = 3, m = 0, s = -1/2$

Answer: C

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EXERCISE - II (C. W.) ELECTRONIC CONFIGURATIONS

1. How many electrons are present in the M-shell of an atom of the element with atomic number $Z = 24$?

A. 5

B. 6

C. 12

D. 13

Answer: D

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2. The atomic numbers of elements X, Y,and Z are $19, 21$, and 23, respectively. The number of eletron present in the M shells of these elements follows the order

A. $Z > X > Y$

B. $X > Y > Z$

C. $Z > Y > X$

D. $Y > Z > X$

Answer: C

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3. Which one of the following sets correctly represents the increase in the paramagnetic property of ions

A. $Cu^{+2} > V^{+2} > Cr^{+2} > Mn^{+2}$

B. $Cu^{+2} < Cr^{+2} < V^{+2} < Mn^{+2}$

C. $Cu^{+2} < V^{+2} < Cr^{+2} < Mn^{+2}$

D. $V^{+2} < Cu^{+2} < Cr^{+2} < Mn^{+2}$

Answer: C

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EXERCISE - II (H. W.) ATOMIC MODELS & ELECTROMAGNETIC RADIATION

1. Which has highest specific charge?

A. $Na^{+}(A = 23)$

B. $Mg^{2+}(A = 24)$

C. $AI^{3+}(A = 27)$

D. $Si^{4+}(A = 28)$

Answer: D

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2. a-particles are projected towards the following metals,with the same kinetic energy. Towards which metal, the distance of closest approach is minimum?

A. $Zn(z = 30)$

B. $Cd(Z = 48)$

C. $Hg(Z = 80)$

D. $AI(Z = 13)$

Answer: D

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3. The mass numbers of three isotopes of an element are 10,12,14 units. Their percentage abundance is 80,15 and 5 respectively. What is tha tomic weight of the element?

A. 0.25

B. 11.25

C. 12.25

D. 13.25

Answer: B

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4. Boron has two istopes B^{10} & B^{11} whose relative abundances are 20% & 80% respectively avg.atomic weight of Boron is?

A. 10

B. 11

C. 10.5

D. 10.8

Answer: D

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5. If the wavelength of green light is about $5000A^{\circ}$, then the frequency of its wave is

A. $16 \times 10^{14} \sec^{-1}$

B. $16 \times 10^{-14} \sec^{-1}$

C. $6 \times 10^{14} \sec^{-1}$

D. $6 \times 10^{-14} \sec^{-1}$

Answer: C

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6. The energy of photon of light having frequency of $3 \times 10^{15} S^{-1}$ is

A. $1.99 \times 10^{-18} J$

B. 1.99×10^{-17} J

C. 1.99×10^{-17} ergs

D. 1.99×10^{-18} ergs

Answer: A

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7. What is the energy of photons that corresponds to a wave number of $5 \times 10^{-5} m^{-1}$

A. 99.384×10^{-30} J

B. 993.84×10^{-30} J

C. 9.9384×10^{-30} J

D. 0.99384×10^{-30} J

Answer: C

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8. Suppose $10^{-17}J$ of energy is needed by the interior of human eye to see an object. How many photons of green light $(\lambda = 550nm)$ are needed to generate this minimum amount of energy ?

A. 14

B. 28

C. 39

D. 42

Answer: B

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9. The rato of the energies of two different radiations whose frequencies are $3 \times 10^{14} Hz$ and $5 \times 10^{14} Hz$ is

A. $3:5$

B. $5:3$

C. $3:1$

D. $5:1$

Answer: A

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10. Which one of the following frequency of radiation (in Hz) has a wavelength of 600 nm

A. 2×10^{13}

B. 5×10^{16}

C. 2×10^{14}

D. 5×10^{14}

Answer: D

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EXERCISE - II (H. W.) PLANK.S QUANTUM THEORY AND PHOTO ELECTRIC EFFECT

1. In photoelectric effect, the energy of the photon striking a metallic surface is $5.6 \times 10^{-19} J$. The kinetic energy of the ejected electrons is $12.0 \times 10^{-20} J$. The work function is:

A. 6.4×10^{-19}J

B. $6.8 \times 10^{-19} J$

C. $4.4 \times 10^{-19} J$

D. 6.4×10^{-20} J

Answer: C

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2. An Electro magnetic radiation of wavelength 484 nm is just sufficient of ionise a sodium atom. Calculate the ionisation energy of sodium in kJ/mo, approximately?

A. 494.5

B. 246.9

C. 989.0

D. 794.5

Answer: B

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EXERCISE - II (H. W.) H-SPECTRUM

1. Which of the following lines will have a wave no equal in magnitude to the value of R in the H-Spectral series

A. Limiting line of Balmer series

B. Limiting line of Lyman series

C. First line of Lyman series

D. First line of Balmer series

Answer: B

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2. The wave number of first line in Balmer series of Hydrogen is $15, 200cm^{-1}$ the wave number of first line in Balmer series of Be^{3+}

A. $2.43 \times 10^5 cm^{-1}$

B. $3.43 \times 10^5 cm^{-1}$

C. $4.43 \times 10^5 cm^{-1}$

D. $5.43 \times 10^5 cm^{-1}$

Answer: A

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3. What transition in the hydrogen spectrum would have the same wavelength as the Balmer transition $n = 4$ to $n = 2$ of He^{+} spectrum ?

A. $n_1 = 1, n_2 = 2$

B. $n_1 = 2, n_2 = 3$

C. $n_1 = 3, n_2 = 2$

D. $n_1 = 2, n_2 = 4$

Answer: A

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4. The wave number for the longest wavelength transition in the Balmer series of atomic hydrogen is

A. $15.2 \times 10^6 m^{-1}$

B. $13.6 \times 10^6 m^{-1}$

C. $1.5 \times 10^6 m^{-1}$

D. $1.3 \times 10^6 m^{-1}$

Answer: C

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5. The ionization potential of hydrogen atom is 13.6 eV. The wavelength of the energy radiation required for the ionization of H-atom

A. 1911 nm

B. 912 nm

C. 68 nm

D. 91.2 nm

Answer: D

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6. A gas of mono atomic hydrogen is excited by an energy of $12.75eV/\mathrm{atom}$. Which spectral lines of the following are formed in Lyman, Balmer and Paschen series respectively.

A. $3, 2, 1$

B. $2, 3, 1$

C. $1, 3, 2$

D. $1, 2, 3$

Answer: A

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7. The wave length of the radiation emitted by Hydrogen when compared to He^{+} ion is

A. 2 times that of He^{+} ion

B. 3 times that of He^{+} ion

C. 4 times that of He^{+} ion

D. Same as He^{+}

Answer: C

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EXERCISE - II (H. W.) BOHR.S ATOMIC MODEL

1. The energy of the second Bohr orbit of hydrogen atom is $-3.41eV$. The energy of the second orbit of He^{+} would be

A. $-0.85eV$

B. $-13.6eV$

C. $-1.70eV$

D. $-6.82eV$

Answer: B

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2. If the diameter of carbon atom is $0.15nm$, the number of carbon atoms which can be placed side by side is a straight line across length of $10.0cm$

is

A. 66.66×10^7

B. $66.\ 66 \times 10^8$

C. 6.2×10^9

D. 1.33×10^7

Answer: A

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3. The ionization energy of the ground state of hydrogen atom is $2.18 \times 10^{-8} J$. The energy of an electron in its second orbit would be

A. -1.09×10^{-18} J

B. -2.18×10^{-18} J

C. -4.36×10^{-18} J

D. -5.45×10^{-19} J

Answer: D

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4. The velocity of an electron in the first Bohr orbit of hydrogen atom is $2.19 \times 10^6 ms^{-1}$. Its velocity in the second orbit would be

A. $1.10 \times 10^6 ms^{-1}$

B. $4.38 \times 10^6 ms^{-1}$

C. $5.5 \times 10^5 ms^{-1}$

D. $8.76 \times 10^6 ms^{-1}$

Answer: A

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5. Energy of electron moving in the second orbit of He^+ ion is

A. $-13.6ev$

B. $-3.4ev$

C. $-1.51ev$

D. $-0.84ev$

Answer: A

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6. According to Bohr's theory of hydrogen atom

A. There is only fixed set of allowed orbitals for the electron

B. The allowed orbitals of the electrons are elliptical in shape

C. The moment of an electron from one allowed to another allowed orbital is forbidden

D. No light is emitted as long as the electron remains in an allowed orbital

Answer: D

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7. The ratio of radius of 2nd and 3rd Bohr orbit is

A. $3:2$

B. $9:4$

C. $2:3$

D. $4:9$

Answer: D

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8. According to Bohr's theory, which one of the following values of angular momentum of hydrogen atom is not permitted.

A. $\frac{1.25h}{\pi}$

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

C. $\frac{1.5h}{\pi}$

D. $\frac{0.5h}{\pi}$

Answer: A

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EXERCISE - II (H. W.) dE-BROGLIE.S AND HEISENBERG.S

1. The mass of the electrons 9.8×10^{-28} gram and uncertainty in the velocity equal to $2 \times 10^{-3} cm / \sec$. The uncertainty in the position of an electron is $\left(h = 6.62 \times 10^{-27}\right.$ ergsec)

A. $2.9 \times 10^{+2}$ cm

B. 2.9×10^{-2} cm

C. $2.9 \times 10^{-12} cm^{-1}$

D. $2.9 \times 10^{+12} cm^{-1}$

Answer: A

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2. The velocity of an electron with de Broglie wavelength of 1.0×10^2 nm is:

A. 7.2×10^5 cm/sec

B. 72×10^5 cm/sec

C. 7.2×10^4 cm/sec

D. 3.6×10^5 cm/sec

Answer: A

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3. The wave length of a electron with mass $9.1 \times 10^{-31} kg$ and kinetic energy $3.0 \times 10^{-25} J$ is

A. 89.67 nm

B. 8.96 nm

C. 456.7 nm

D. 896.7 nm

Answer: D

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4. A cricket ball of 0.5 kg is moving with a velocity of $100 ms^{-1}$. The wavelength associated with its motion is :

A. $1/100$m

B. 6.6×10^{-34} m

C. 1.32×10^{-35} m

D. 6.6×10^{-28} m

Answer: C

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5. A microscope using suitable photons is employed to locate an electron in an atom within a distance of 0.1 Ã…. What is the uncertainty involved in the measurement of its velocity ?

A. $2.69 \times 10^{6} ms^{-1}$

B. $5.79 \times 10^{5} ms^{-1}$

C. $5.79 \times 10^{6} ms^{-1}$

D. $4.62 \times 10^{6} ms^{-1}$

Answer: C

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6. The mass of photon moving with the velocity of $3 \times 10^8 m/\sec$ with wave length $3.6 A^\circ$ is

A. $6.135 \times 10^{-33} kg$

B. $6.135 \times 10^{-27} kg$

C. $4.126 \times 10^{-29} kg$

D. $4.126 \times 10^{-25} kg$

Answer: A

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7. If the velocity of electron in Bohr's first orbit is $2.19 \times 10^6 ms^{-1}$. The de-Broglie's wavelength is

A. 332 pm

B. 313 pm

C. 3.32 pm

D. 3.13 pm

Answer: A

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8. Uncertainity in position of a particles of 25 gram in space is $10^{-5}m$. Hence uncertainity in velocity $(m/\sec)$ is $\left(h = 6.6 \times 10^{-34} J - \sec\right)$

A. 2.1×10^{-28}

B. 2.1×10^{-34}

C. 0.5×10^{-34}

D. 5×10^{-24}

Answer: A

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9. An electron, a proton and an alpha particle have K.E. of $16E$, $4E$ and E respectively. What is the qualitative order of their de-Broglie wavelengths:

A. $\lambda_e > \lambda_p > \lambda_\alpha$

B. $\lambda_p = \lambda_\alpha > \lambda_e$

C. $\lambda_p < \lambda_c < \lambda_\alpha$

D. $\lambda_\alpha > \lambda_e = \lambda_p$

Answer: A

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10. The wavelengths of electron waves in two orbits is 3:5. The ratio of kinetic energy of electrons will be

A. $25 : 9$

B. $5 : 3$

C. $9 : 25$

D. $3:5$

Answer: A

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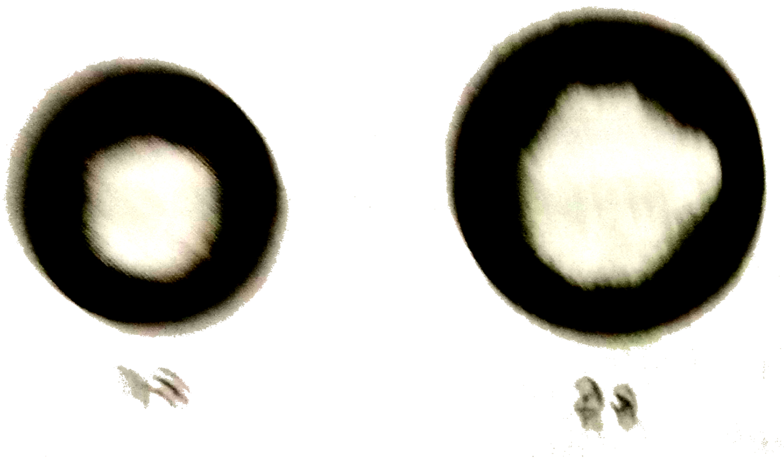
EXERCISE - II (H. W.) QUANTUM MECHANICS & NUMBERS

1. The probability density plots of 1 s and 2s orbitals are given in figure.



The density of dots in a region represetns the probability density of finding electrons in the region. On the basis of above diagram which of the following statements is incorrect?

A. 1 s and 2s orbitals are spherical in shape

B. The probability of finding the electron is maximum near the nucleus.

C. The probability of finding the electron at a given distance is equal in all directions.

D. The probability density of electrons for 2s orbitals decreases uniformly as distance from the nucleus increases.

Answer: D

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2. The maximum number of electrons with spin value $+1/2$ in the orbital with azimuthal quantum number value 1=2 and magnetic quantum number $m = +1$ is...

A. 5

B. 6

C. 3

D. 1

Answer: D

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3. Which of the following sets of quantum number is not possible?

A. $n = 4, l = 1, m = +1, m_s = +\frac{1}{2}$

B. $n = 4, l = 1, m = 0, m_s = +\frac{1}{2}$

C. $n = 4, l = 1, m = 2, m_s = +\frac{1}{2}$

D. $n = 4, l = 1, m = -1, m_s = +\frac{1}{2}$

Answer: C

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4. The total number of electrons present in all s orbitals, all the p orbitals, and all the d orbitals of cesium ion are, respectively,

A. $6, 26, 10$

B. $10, 24, 20$

C. $8, 22, 24$

D. $12, 20, 23$

Answer: B

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5. The quantum number $+1/2$ and $-1/2$ for the electron spin represent

A. rotation of electron in clockwise and anti clockwise direction respectively

B. rotation of electron in anti-clockwise 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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6. The correct set of quantum numbers for the unpaired electron of chlorine atom is

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

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

C. $3, 0, 0, +1/2$

D. $3, 1, -1, \pm 1/2$

Answer: D

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7. In the case of the alkali metals-

A. Spin

B. Azimuthal

C. Magnetic

D. Principle

Answer: A

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EXERCISE - II (H. W.) ELECTRONIC CONFIGURATIONS

1. An element has 2 electrons in 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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2. A compound of vanadium has a magnetic moment of 1.73 BM. The electronic configuration of vanadium ion in the compound is:

A. $[Ar]3d^2$

B. $[Ar]3d^1 4s^0$

C. $[Ar]3d^3$

D. $[Ar]3d^0 4s^{-1}$

Answer: B

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3. A transition element X has a configuration $[Ar]3d^4$ in its $+3$ oxidation state. Its atomic number is

A. 25

B. 26

C. 22

D. 19

Answer: A

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4. Which one of the following ions has same numbr of unpaired electrons as those present in V^{+3} ions?

A. Fe^{+3}

B. Ni^{2+}

C. Mn^{+2}

D. Cr^{+3}

Answer: B

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EXERCISE - II (H. W.) MATRIX MATCHING

1. Given below are the spectral lines for an atom of hydrogen. Mark the lines which are not correctly matched with the value of n_1 and n_2?

	Series	n_1	n_2	Region
(i)	Lyman	1	2, 3, ...	Ultraviolet
(ii)	Balmer	2	3, 4, ...	Infrared
(iii)	Paschen	3	4, 5, ...	Infrared
(iv)	Pfund	4	5, 6, ...	Infrared

A. (i) and (ii)

B. (i) and (iii)

C. (ii) and (iv)

D. (i) and (iv)

Answer: C

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2. Match the constants given in column I with their values given in column II and mark the appropriate choice.

Column I		Column II	
(A)	Rydberg constant	(i)	6.626×10^{-34} J s
(B)	Planck's constant	(ii)	3.00×10^{8} m s^{-1}
(C)	Velocity of light	(iii)	750×10^{-9} m
(D)	Wavelength of red light	(iv)	109,677 cm^{-1}

A. $\begin{matrix} A & B & C & D \\ iii & ii & i & i \end{matrix}$

B. $\begin{matrix} A & B & C & D \\ ii & iv & i & iii \end{matrix}$

C. $\begin{matrix} A & B & C & D \\ i & iii & iv & ii \end{matrix}$

D. $\begin{matrix} A & B & C & D \\ iv & i & ii & iii \end{matrix}$

Answer: D

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3. Match the Column-I with Column-II and mark the appropriate choice

Column-I	Column-II
(Atom)	(No of unpaired electrons)
(A) $_{15}P$	i) 6 unpaired electrons
(B) $_{24}Cr$	ii) 2 unpaired electrons
(C) $_{26}Fe$	iii) 3 unpaired electrons
(D) $_{14}Si$	iv) 4 unpaired electrons

A. $\begin{matrix} A & B & C & D \\ ii & i & iii & i \end{matrix}$

B. $\begin{matrix} A & B & C & D \\ i & iii & ii & iv \end{matrix}$

C. $\begin{matrix} A & B & C & D \\ iii & i & iv & ii \end{matrix}$

D. $\begin{matrix} A & B & C & D \\ iv & ii & i & iii \end{matrix}$

Answer: C

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4. $List - I$ | $List - II$

(A)No of electrons present in an orbit	$(1)2$
(B)Number of orbitals in an orbit	$(2)n$
(C)Nuber of electrons in an orbital	$(3)n_2$
(D)Number of sub shells in an orbit	$(4)2n^2$

The correct match is

A. $\begin{matrix} A & B & C & D \\ 4 & 2 & 1 & 3 \end{matrix}$

B. $\begin{matrix} A & B & C & D \\ 1 & 2 & 3 & 4 \end{matrix}$

C. $\begin{matrix} A & B & C & D \\ 4 & 3 & 1 & 2 \end{matrix}$

D. $\begin{matrix} A & B & C & D \\ 2 & 1 & 3 & 4 \end{matrix}$

Answer: C

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5. Match the column I with Column II and mark the appropriate choice.

Column I		Column II	
(A)	Metals used as semiconductors	(i)	Aluminium
(B)	Electrolytic reduction	(ii)	Zone refining
(C)	Cyanide process	(iii)	Dressing of ZnS
(D)	Froth floatation process	(iv)	Extraction of Ag

A. $\begin{matrix} A & B & C & D \\ iii & iv & i & i \end{matrix}$

B. $\begin{matrix} A & B & C & D \\ ii & i & iv & iii \end{matrix}$

C. $\begin{matrix} A & B & C & D \\ iv & iii & i & ii \end{matrix}$

D. $\begin{matrix} A & B & C & D \\ i & ii & iv & iii \end{matrix}$

Answer: B

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6. **Match the values of column II with column I and mark the appropriate choice.**

Column I		Column II	
(A)	Mass of electron	(i)	1.673×10^{-27} kg
(B)	Mass of proton	(ii)	-1.602×10^{-19} C
(C)	Charge of electron	(iii)	9.1×10^{-31} kg
(D)	e/m for an electron	(iv)	1.76×10^{8} C/g

A. $\begin{array}{cccc} A & B & C & D \\ i & ii & iv & i \end{array}$

B. $\begin{array}{cccc} A & B & C & D \\ iii & i & ii & iv \end{array}$

C. $\begin{array}{cccc} A & B & C & D \\ i & iii & iv & i \end{array}$

D. $\begin{array}{cccc} A & B & C & D \\ i & iii & ii & iv \end{array}$

Answer: B

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7. **The energy of a photon wavelength** $k = 1$ **meter is (Planck's constant** $= 6.625 \times 10^{-34}$ **Js, speed of light =** $3 \times 10^{8} m / s$**)**

A. $\begin{matrix} A & B & C & D \\ 2 & 3 & 4 & 5 \end{matrix}$

B. $\begin{matrix} A & B & C & D \\ 1 & 2 & 3 & 4 \end{matrix}$

C. $\begin{matrix} A & B & C & D \\ 2 & 4 & 5 & 1 \end{matrix}$

D. $\begin{matrix} A & B & C & D \\ 3 & 4 & 5 & 1 \end{matrix}$

Answer: D

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8. $\begin{matrix} List-I & List-II \\ (I) hv = W + K.E & (a)\text{Quantization of angular momentumm} \\ (II) E = hv & (b)\text{Wave numbers of Balmer series} \\ (II) \bar{v} = R\left[\frac{1}{2^2} - \frac{1}{n^2}\right] & (c)\text{Quatum theory} \\ (IV) m.v.r = \frac{h}{2\pi} & (d)\text{Photoelectric effect} \end{matrix}$

The correct match is

A. $\begin{matrix} A & B & C & D \\ i & ii & iii & iv \end{matrix}$

B. $\begin{matrix} A & B & C & D \\ iii & iv & ii & i \end{matrix}$

C. $\begin{matrix} A & B & C & D \\ iv & iii & ii & i \end{matrix}$

D. $\begin{matrix} A & B & C & D \\ ii & iv & i & iii \end{matrix}$

Answer: C

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9. $\begin{array}{ll} List-I & List-II \\ (I)\text{Wave number} & (a)ms^{-1} \\ (II)\text{Frequency} & (b)nm \\ (III)\text{Wavelength} & (c)s^{-} \\ (IV)\text{Velcity} & (d)m^{-1} \end{array}$

The correct match is

A. $\begin{matrix} A & B & C & D \\ i & ii & iii & iv \end{matrix}$

B. $\begin{matrix} A & B & C & D \\ iv & iii & ii & i \end{matrix}$

C. $\begin{matrix} A & B & C & D \\ ii & iii & iv & i \end{matrix}$

D. $\begin{matrix} A & B & C & D \\ iii & iv & ii & i \end{matrix}$

Answer: B

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10.

$List - I$	$List - II$
(A)Energy	$(1)\ \frac{2\pi ze^2}{nh}$
(B)Velocity	$(2)\ \frac{-2\pi^2mz^2e^4}{n^2h^2}$
(C)Rydberg constant	$(3)\ \frac{2\pi^2mz^2e^4}{h^3c}$
(D)Radius	$(4)\ \frac{n^2h^2}{4\pi^2mze^2}$
	$(5)\ \frac{-4\pi^2mz^2e^4}{n^2h^2}$

The correct match is

A. $A = 2B = 4C = 5D = 1$

B. $A = 2B = 1C = 3D = 4$

C. $A = 3B = 2C = 1D = 4$

D. $A = 4B = 3C = 1D = 5$

Answer: B

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EXERCISE - III

1. Given: The mass of electron is 9.11×10^{-31}Kg Planck constant is 6.626×10^{-34}Js, the uncertainty involved in the measurement of velocity within a distance of 0.1Å is:-

A. $6.65 \times 10^{-35} m$

B. $5.79 \times 10^{5} ms^{-1}$

C. $5.79 \times 10^{6} ms^{-1}$

D. $5.79 \times 10^{7} ms^{-1}$

Answer: C

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2. The orbital with maximum number of possible orientations

A. spin quantum number

B. spin angular momentum

C. magnetic quantum number

D. orbital angular momentum

Answer: C

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3. The de-Broglie wavelength of a particle with mass $1g$ and velocity $100m/\sec$ is.

A. 6.63×10^{-33}m

B. 6.63×10^{-34} m

C. 6.63×10^{-35} m

D. 6.65×10^{-35} m

Answer: A

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4. The de Broglie wavelength associated with a ball of mass $1kg$ having kinetic enegry $0.5J$ is

A. 6.626×10^{-34} m

B. 13.20×10^{-34} m

C. 10.38×10^{-21}m

D. $6.626 \times 10^{-34} A^0$

Answer: A

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5. Consider the following sets of quantum numbers.

(i) $\begin{matrix} n & l & m & s \\ 3 & 0 & 0 & +1/2 \end{matrix}$

(ii) $\begin{matrix} n & l & m & s \\ 2 & 2 & 1 & +1/2 \end{matrix}$

(iii) $\begin{matrix} n & l & m & s \\ 4 & 3 & -2 & -1/2 \end{matrix}$

(iv) $\begin{matrix} n & l & m & s \\ 1 & 0 & -1 & -1/2 \end{matrix}$

(v) $\begin{array}{cccc} n & l & m & s \\ 3 & 2 & 3 & +1/2 \end{array}$

Which of the following sets of quantum number is not possible ?

A. I, ii, iii and iv

B. ii, iv and v

C. I and iii

D. ii, ii and iv

Answer: B

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6. The measurement of the electron position is associated with an uncertainty in momentum, which is equal to $1 \times 10^{-18} gcms^{-1}$. The uncertainty in electron velocity is (mass of an electron is $9 \times 10^{-28} g$)

A. $1 \times 10^{8} cms^{-1}$

B. $1 \times 10^{11} cms^{-1}$

C. $1 \times 10^9 cms^{-1}$

D. $1 \times 10^6 cms^{-1}$

Answer: C

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7. The groud state energy of hydrogen atom is $-13.6eV$. When its electron is in first excited state, its exciation energy is

A. $0eV$

B. $3.4eV$

C. $6.8eV$

D. $10.2eV$

Answer: D

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8. Two nuclei have their mass numbers in the ratio of 1:3. The ratio of their nuclear densities would be

A. $1:1$

B. $1:3$

C. $3:1$

D. $(3)^{1/3}:1$

Answer: A

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9. If uncertainty in position and momentum are equal then uncertainty in velocity is.

A. $\frac{1}{m}\sqrt{\frac{h}{\pi}}$

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

C. $\frac{1}{2m}\sqrt{\frac{h}{\pi}}$

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

Answer: C

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10. The uncertainties in the velocities of two particles, A and B are 0.05 and 0.02 ms^{-1}, respectively. The mass of B is five times to that of the mass A. What is the ratio of uncertainties $\left(\frac{\Delta_{X_A}}{\Delta_{X_B}}\right)$ in their positions

A. 2

B. 0.25

C. 0.4

D. 1

Answer: A

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11. The de-Broglie wavelength of a particle with mass $1g$ and velocity $100m/\sec$ is.

A. 6.6×10^{-33} m

B. $6.6 \times 10^{-36} m$

C. $3.3 \times 10^{+33}$m,

D. 3.3×10^{-36} m

Answer: B

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12. Maximum number of electrons in a sub-shell of an atom is determined by the following.

A. $4l + 2$

B. $2l + 1$

C. $4l - 2$

D. $2n^2$

Answer: A

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13. Which of the following sets of quantum numbers represent an impossible arrangement ?

	n	ℓ	m	s
(A)	3	2	–2	$(+)\frac{1}{2}$
(B)	4	0	0	$(-)\frac{1}{2}$
(C)	3	2	–3	$(+)\frac{1}{2}$
(D)	5	3	0	$(-)\frac{1}{2}$

A. $\begin{array}{cccc} n & l & m & s \\ 3 & 2 & -2 & +\frac{1}{2} \end{array}$

B. $\begin{array}{cccc} n & l & m & s \\ 4 & 0 & 0 & -\frac{1}{2} \end{array}$

C. $\begin{array}{cccc} n & l & m & s \\ 3 & 2 & -3 & +\frac{1}{2} \end{array}$

D. $\begin{array}{cccc} n & l & m & s \\ 5 & 3 & 0 & -\frac{1}{2} \end{array}$

Answer: C

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14. The energy absorbed by each molecule (A_2) of a substance is $4.4 \times 10^{-19} J$ and bond energy per molecule is $4.0 \times 10^{-19} J$. The kinetic energy of the molecule per atom will be.

A. 2.0×10^{-20} J

B. 2.2×10^{-19} J

C. 2.0×10^{-19} J

D. 4.0×10^{-20} J

Answer: A

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15. The energy of an electron in the first Bohr orbit of H atom is $-13.6eV$. The possible energy values (s) of the excited state (s) for electron in bohr orbits of hydrogen is (are)

A. $-6.8eV$

B. $-4.2eV$

C. $-3.4eV$

D. $+6.8eV$

Answer: C

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16. Which one of the following ions has electronic configuration $[Ar]3d^6$?

$(At. Nos. Mn = 25, Fe = 26, Co = 27, Ni = 28)$

A. Ni^{3+}

B. Mn^{3+}

C. Fe^{3+}

D. Co^{3+}

Answer: D

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17. The energies E_1 and E_2 of two radiations are $25eV$ and $50eV$ respectively. The relation between their wavelengths, i.e., λ_1 and λ_2 will be.

A. $\lambda_1 = \frac{1}{2}\lambda_2$

B. $\lambda_1 = \lambda_2$

C. $\lambda_1 = 2\lambda_2$

D. $\lambda_1 = 4\lambda_2$

Answer: C

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18. According to Bohr theory, which of the following transition in hydrogen atom will give rise to the least energetic proton?

A. $n = 6$ to $n = 1$

B. $n = 5$ to $n = 4$

C. $n = 6$ to $n = 5$

D. $n = 5$ to $n = 3$

Answer: C

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19. The total number of atomic orbitals in fourth energy level of an atom is.

A. 4

B. 8

C. 16

D. 32

Answer: C

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20. If $n = 6$, the correct sequence for filling of electrons will be.

A. $ns \to np \to (n-1)d \to (n-2)f$

B. $ns \to (n-2)f \to (n-1)d \to np$

C. $ns \to (n-1)d \to (n-2)f \to np$

D. $ns \to (n-2)f \to np \to (n-1)d$

Answer: B

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21. The orbital angular momentum of a p-electron is given as :

A. $\sqrt{6} \times \frac{h}{2\pi}$

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

C. $\sqrt{3} \times \frac{h}{2\pi}$

D. $\sqrt{\frac{3}{2}} \times \frac{h}{\pi}$

Answer: B

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22. The correct set of four quantum numbers for valence electrons of rubidium atom (Z=37) is

A. $5, 1, 1, +\frac{1}{2}$

B. $6, 0, 0, +\frac{1}{2}$

C. $5, 0, 0, +\frac{1}{2}$

D. $5, 1, 0, +\frac{1}{2}$

Answer: C

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23. Maximum number of electrons in a sub-shell with $l = 3$ and $n = 4$ is.

A. 14

B. 16

C. 10

D. 12

Answer: A

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24. What is the maximum number of electrons that can be associated with a following set of quantum numbers ? $(n = 3, l = 1 \text{ and } m = -1)$.

A. 4

B. 2

C. 10

D. 12

Answer: B

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25. Based on equation $E = -2.178 \times 10^{-18} J\left(\frac{Z^2}{n^2}\right)$, certain conclusions are written. Which of them is not correct ?

A. Equation can be used to calculate the change in energy when the electron changes orbital.

B. For n = 1, the electron has a more negative energy than it does for n = 6, which means that the electron is more loosely bound in the smallest allowed orbital.

C. The negative sign simply means that the energy of electron bound to the nucleus is lower than it would be if the electron were at the infinite distance from the nucleus.

D. Larger the value of n, larger is the orbit radius.

Answer: B

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26. The value of Planck's constant is $6.63 \times 10^{-34} Js$. The speed of light is $3 \times 10^{17} nms^{-1}$. Which value is the closed to the wavelength in nanometers of a quantum of light with frequency $6 \times 10^{10} s^{-1}$?

A. 50

B. 75

C. 10

D. 25

Answer: A

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27. What is the maximum number of orbitals that can be identified with the following quantum numbers ? $n = 3, l = 1, m_l = 0$.

A. 3

B. 4

C. 1

D. 2

Answer: C

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28. Calculate the energy in joule corresponding to light of wavelength $45nm$ **:**

(Planck' constant $h = 6.63 \times 10^{-34} Js$, speed of light $c = 3 \times 10^{8} ms^{-1}$)

A. 4.42×10^{-15}

B. 4.42×10^{-18}

C. 6.67×10^{15}

D. 6.67×10^{11}

Answer: B

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29. 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. p-electrons in $CI(Z = 17)$

B. d-electrons in $Fe(Z = 26)$

C. p-electrons in $Ne(Z = 10)$

D. s - electrons in $Mg(Z = 12)$

Answer: A

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30. The angular momentum of d electron is

A. $\sqrt{2}h$

B. $2\sqrt{3}h$

C. $0h$

D. $\sqrt{6}h$

Answer: D

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31. 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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32. Which of the following pairs of d-orbitals will hare 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. $d_{xy}, d_{x^2-y^2}$

Answer: C

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EXERCISE - IV ELECTROMAGNETIC RADIATION

1. Calculate the wavelength of photon having energy 5eV.

A. 2.47×10^{-6} cm

B. 2.47×10^{-5} cm

C. 24.7×10^{-5} cm

D. 24.7×10^{-6} cm

Answer: B

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2. The energy required to break one mole of $Cl - Cl$ bonds in Cl_2 is $242 kJmol^{-1}$. The longest wavelength of light capable of breaking a since $Cl - Cl$ bond is

A. 594 nm

B. 640 nm

C. 700 nm

D. 494 nm

Answer: D

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3. A photon of $300nm$ is abosorbed by a gas and then re-emits two photons . One re-emitted photon has wavelength $496nm$. Caluclate energy of other photon re-emitteed out .

A. 2.625×10^{-19} erg

B. 2.625×10^{-19} J

C. 2.625 J

D. 2.625 Cal

Answer: B

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4. The time period of a light is $2.0 \times 10^{-10} s$. The wavelength for this waveis

A. 0.06 m

B. 6m

C. 0.03 m

D. 0.3 m

Answer: A

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5. A 100 watt bulb emits monochromatic light of wavelength 400 nm. Calculate the number of photons emitted per second by the bulb.

A. $20.12 \times 10^{20} S^{-1}$

B. $2.012 \times 10^{20} S^{-1}$

C. $4.969 \times 10^{-19} S^{-1}$

D. $49.69 \times 10^{-19} S^{-1}$

Answer: B

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6. Neon gas emits at 616 nm. The distance travelled by this radiation in 30 sec is.

A. 9×10^{7} m

B. 9×10^{9} m

C. 4.5×10^{9} m

D. 7×10^{9} m

Answer: B

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7. A quantum of light having energy E has wavelength equal to $7200A^{\circ}$. The frequency of light which corresponds to energy equal to 3E, is

A. $1.25 \times 10^{14} s^{-1}$

B. $1.25 \times 10^{13} s^{-1}$

C. $1.25 \times 10^{13} s^{-1}$

D. $1.25 \times 10^{14} s^{-1}$

Answer: B

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8. Bond dissociation energy of AB molecules is $300 kJ / \text{mole}$. The number of moles of photons of wavelength $6625 A^{0}$ requires to dissociate 3 moles of AB molecules is

A. 1

B. 2

C. 4

D. 5

Answer: D

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9. A dye absorbs light of λ = 4530 Å and then fluorescence light of 5080 Å. Assuming that under given condition 47% of the absorbed energy is re-emitted out as flourescence, calculate the ratio of quanta emitted out to the number of quanta absorbed.

A. 0.527

B. 1.5

C. 52.7

D. 3

Answer: A

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10. A 25 watt bulb emits monochromatic yellow light of wavelength of 0.57μ m. Calculate the rate of emission of quanta per second .

A. 7.16×10^{-19}

B. 7.16×10^{19}

C. 3.5×10^{15}

D. 6.5×10^{19}

Answer: B

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11. An Electro magnetic radiation of wavelength 484 nm is just sufficient of ionise a sodium atom. Calculate the ionisation energy of sodium in

kJ/mo, approximately?

A. 246.9

B. 594.5

C. 694.5

D. 794.5

Answer: A

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12. Lifetimes of the molecules in the excited states are often measured by using pulsed radiation source of duration nearly in the nano second range. If the radiation source has the duration of 2 ns and the number of photons emitted during the pulse is 2.5×10^{15}, calculate the energy of the source.

A. 8.282×10^{10} J

B. 4.141×10^{-10} J

C. 6.262×10^{-9} J

D. 8.282×10^{-10} J

Answer: D

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EXERCISE - IV PLANCK.S QUANTUM THEORY & PHOTO ELECTRIC EFFECT

1. A gas absorbs a photon of $355 nm$ and emits at two wavelengths . If one of the emission is at 680 nm , the other is at :

A. 1035 nm

B. 325 nm

C. 743 nm

D. 518 nm

Answer: C

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2. the threashold frequency v_0 for a metal is $7 \times 10^{14} s^{-1}$. Calculate the kinetic energy of an electron emitted when radiation of fequency $v = 1.0 \times 10^{15} s^{-1}$ hits the metal .

A. 1.988×10^{-17} J

B. 1.988×10^{19} J

C. 3.988×10^{-19} J

D. 1.988×10^{-19} J

Answer: D

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3. An iodine molecule dissociates into atom after absorbing light of wavelength $4500Å$. If quantum of radiation is absorbed by each molecule calculate the kinetic energy of iodine (Bond energy of I_2 is $240 kJ mol^{-1}$)

A. 2.16×10^{-20} J

B. 4.1×10^{-20} J

C. $3.12 \times 10^{-14} J$

D. 2.16×10^{-22} J

Answer: B

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4. A photon of wavelength $4 \times 10^{-7} m$ strikes on metal surface, The work function of the metal is $2.13 eV$. The velocity of the photo electron is

A. $5.67 \times 10^{6} ms^{-1}$

B. $5.67 \times 10^{5} ms^{-1}$

C. $5.67 \times 10^{-5} ms^{-1}$

D. $5.67 \times 10^{-6} ms^{-1}$

Answer: B

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5. When electromagnetic radiation of wavelength 300 nm falls on the surface of sodium, electrons are emitted with kinetic energy of $1.68 \times 10^5 J\text{ml}^{-1}$. What is the minimum energy needed to remove an electron from sodium ? What is the maximum wavelength that will cause a photoelectron to be emitted.

A. 51.7 nm

B. 517 nm

C. 427 nm

D. 62 nm

Answer: B

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6. Photoelectric emission is observed from a surface for frequencies v_1 and v_2 of the incident radiation $(v_1 > v_2)$. If the maximum kinetic energies of the photoelectrons in two cases are in ratio $1 : K$ then the threshold frequency v_0 is given by.

A. $\frac{v_2 - v_1}{K - 1}$

B. $\frac{Kv_1 - v_2}{K - 1}$

C. $\frac{Kv_2 - v_2}{K - 1}$

D. $\frac{v_2 - v_2}{K}$

Answer: B

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7. Light of wavelength λ strikes a metal surface with intensity X and the metal emits Y electrons per second of average energy Z. What will happen to Y and Z if X is havled?

A. y will be doubled and z will become half

B. y will remain same and z will be doubled

C. Both y and z will be doubled

D. y will be doubled but z will remain same

Answer: D

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8. Threshold frequency of metal is f_0. When light of frequency $v = 2f_0$ is incident on the metal plate, velocity of electron emitted in V_1. When a plate frequency of incident radiation is $5f_0$, V_2 is velocity of emitted electron, then $V_1 : V_2$ is

A. $1:4$

B. $1:2$

C. $2:1$

D. $4:1$

Answer: B

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9. If I_0 is the threshold wavelength for photoelectric emission, 1 the wavelength of light falling on the surface of a metal and m is the mass of the electron, then the velocity of ejected electron is given by

A. $\left[\frac{2h}{m}(\lambda - \lambda)\right]^{1/2}$

B. $\left[\frac{2hc}{m}(\lambda_0 - \lambda)\right]^{1/2}$

C. $\left[\frac{2hc}{m}\left\{\frac{\lambda_0 - \lambda}{\lambda\lambda_0}\right\}\right]^{1/2}$

D. $\left[\frac{2hc}{m}\left\{\frac{1}{\lambda_0} - \frac{1}{\lambda}\right\}\right]^{1/2}$

Answer: C

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10. The ejection of the photoelectron from the silver metal in the photoelectric effect exeriment can be stopped by applying the voltage of $0.35V$ when the radiation $256.7nm$ is used. Calculate the work function for silver metal.

A. 4.48 ev

B. 3.35 ev

C. 44.8 ev

D. 22.4 ev

Answer: A

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EXERCISE - IV H-SPECTRUM

1. 1.8 gm of H-atom sample is excited by radiations. The study of spectra indicates that 27% of the atoms are in 3rd energy level, 15% of atoms

in 2nd energy level and test in ground state

A. Number of atoms in 2nd energy level is 1.626×10^{23} atoms

B. Number of atoms in 3rd energy level is 2.9268×10^{23} atoms

C. Number of atoms in Ground state is 6.2872×10^{23} atoms

D. All are correct

Answer: D

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2. Calculate the energy emitted when electron of 1.0 gm atom of Hydrogen undergo transition giving the spectrtal lines of lowest energy is visible region of its atomic spectra. Given that, R_H=$1.1 \times 10^7 m^{-1}$, $c = 3 \times 10^8 m/\sec$,$h = 6.625 \times 10^{-34} J \sec$.

A. $n_2 = 3$ to $n_1 = 3, E = 182.8$ KJ

B. $n_2 = 2$ to $n_1 = 1, E = 155.8$ KJ

C. $n_2 = 3$ to $n_1 = 1, E = 180.8$ KJ

D. $n_2 = 4$ to $n_1 = 2, E = 182.5$ KJ

Answer: A

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3. In Boh'r series of lines of hydrogen spectrum, the third line from the red corresponds to which one of the following inter orbit jumps of the electron for Boh'r orbit in an atom of hydrogen ?

A. $5 \rightarrow 2$

B. $4 \rightarrow 1$

C. $2 \rightarrow 5$

D. $3 \rightarrow 2$

Answer: A

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4. One energy difference between the states $n = 2$ and $n = 3$ is $\mathrm{E\,eV}$, in hydrogen atom. The ionisation potential of H atom is -

A. $3.2E$

B. 7.2 E

C. $5.6E$

D. $13.2E$

Answer: B

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5. In a certain electronic transition in the hydrogen atoms from an initial state (1) to a final state (2), the difference in the orbit radius $((r_1 - r_2)$ is 24 times the first Bohr radius. Identify the transition-

A. $5 \rightarrow 1$

B. $25 \rightarrow 1$

C. $8 \rightarrow 3$

D. $1 \rightarrow 5$

Answer: A

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6. Ionisation energy of He^{+} is $19.6 \times 10^{-18} J atom^{-1}$**. The energy of the first stationary state** $(n = 1)$ **of** Li^{2+} **is**

A. $4.41 \times 10^{-16} J atom^{-1}$

B. $-4.41 \times 10^{-17} J atom^{-1}$

C. $-2.2 \times 10^{-15} J atom^{-1}$

D. $-8.83 \times 10^{-17} J atom^{-1}$

Answer: B

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7. When a hydrogen atoms emits a photon of energy $12.1eV$, its orbital angular momentum changes by (where h os Planck's constant)

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

B. $\frac{3h}{2h}$

C. $\frac{h}{\pi}$

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

Answer: C

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EXERCISE - IV BOHR.S ATOMIC MODEL

1. Energy of an electron is givem by $E = -2.178 \times 10^{-18} J\left(\frac{Z^2}{n^2}\right)$. Wavelength of light required to excited an electron in an hydrogen atom from level $n = 1$ to $n = 2$ will be

$(h = 6.62 \times 10^{-34} Js$ and $c = 3.0 \times 10^8 ms^{-1})$.

A. 1.214×10^{-7} m

B. 2.816×10^{-7} m

C. 6.5×10^{-7} m

D. 8.5×10^{-7} m

Answer: A

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2. According to Bohr's theory, the angular momentum of electron in the fifth Bohr orbit is:

A. $\frac{25h}{\pi}$

B. $\frac{1.0h}{\pi}$

C. $\frac{10h}{\pi}$

D. $\frac{2.5h}{\pi}$

Answer: D

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3. In an atom, two electrons move around 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. $8:1$

Answer: C

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4. The ionisation energy of hydrogen atom is $1.312 \times 10^6 J\text{mol}^{-1}$. Calculate the energy required to excite an electron in a hydrogen atom from the ground state to the first excited state.

A. $8.51 \times 10^5 \text{J mol}^{-1}$

B. $6.56 \times 10^5 \text{J mol}^{-1}$

C. $7.56 \times 10^5 \text{J mol}^{-1}$

D. $9.84 \times 10^5 \text{J mol}^{-1}$

Answer: D

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EXERCISE - IV dE-BROGLIE.S AND HEISENBERG.S

1. In an atom, an electron is moving with a speed of $600m/s$ with an accuracy of 0.005% certainity with which the positive of the electron can be located is $[h = 6.6 \times 10^{-34} Js, m = 9.1 \times 10^{-31} kg]$

A. 1.52×10^{-4} m

B. 5.1×10^{-3} m

C. 1.92×10^{-3} m

D. 3.84×10^{-3} m

Answer: C

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2. The kinetic energy of electron is $3.0 \times 10^{-25} J$. The wave length of the electron is

A. $7965 A^0$

B. $4625 A^0$

C. $91 A^0$

D. $8967 A^0$

Answer: B

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3. Uncertainty in the position of an electron mass $(9.1 \times 10^{31} kg)$ moving with a velocity $300 ms^{-1}$ accurate uptp 0.001% will be :

A. $19.2 \times 10^{-2} m$

B. 5.76×10^{-2} m

C. 1.92×10^{-2} m

D. 3.83×10^{-2} m

Answer: C

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4. An electron of a velocity 'x' is found to have a certain wavelength. The velocity to be possessed by the neutron to have half the de Broglie wavelength possessed by electron is:

A. $x/1840$

B. $x/920$

C. $3680x$

D. $x/3680$

Answer: B

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EXERCISE - IV QUANTUM MECHANICAL MODEL OF ATOM

1. In ψ_{321} the sum of angular momentum, spherical nodes and angular node is:

A. $\dfrac{\sqrt{6}h + 4\pi}{2\pi}$

B. $\dfrac{\sqrt{6}h}{2\pi} + 3$

C. $\dfrac{\sqrt{6}h + 2\pi}{2\pi}$

D. $\dfrac{\sqrt{6}h + 8\pi}{2\pi}$

Answer: A

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2. Which of the following sets of quantum numbers represents the highest energy of an atom?

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

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

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

D. $n = 3, l = 0, m = 0, s = +1/2$

Answer: B

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3. The spin-only magnetic moment [in units of Bohr magneton, $(\mu_B$ of $Ni^{2+})$ in aqueous solution would be (atomic number of $Ni = 28)$

A. 2.84

B. 4.9

C. 0

D. 1.73

Answer: A

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EXERCISE - IV EXEMPLAR PROBLEMS

1. Which of the following conclusions couldnot be derived from Rutehrford's α-particle scattering experiment?

A. Most of the space in the atom is empty.

B. The radius of the atom is about 10^{-10} m while that of nucleus is 10^{-15} m.

C. Electrons move in a circular path of fixed energy called orbits.

D. Electrons and the nucleus are held together by electrostatic forces of attraction.

Answer: C

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2. Which of the following options does not represent ground state electronic configuration of an atom?

A. $1s^2 2s^2 2p^6 3p^6 3d^8 4s^2$

B. $1s^2 2s^1 2p^6 3s^2 3p^6 3d^9 4s^2$

C. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2$

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

Answer: B

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3. Which of the following statement is not correct about the characterstics of cathode rays

A. They start from the cathode and move towards the anode.

B. They travel in straight line in the absence of an external electrical or magnetic field.

C. Characteristics of cathode rays do not depend upon the material of electrodes in cathode ray tube.

D. Characteristics of cathode rays depend upon the nature of gas present in the cathode ray tube.

Answer: D

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4. Which of the following statements about the electron is incorrect?

A. It is a negatively charged particle.

B. The mass of electron is equal to the mass 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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5. Which of the following properties of atom could be explained correctly by Thomson model of atom?

A. Overall neutrality of atom.

B. Spectra of hydrogen atom.

C. Position of electrons, protons and neutrons in atom.

D. Stability of atom.

Answer: A

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6. Two atoms are said to be isobars is

A. they have same atomic number but different mass number.

B. they have same number of electrons but different number of neutrons.

C. they have same number of neutrons but different number of electrons.

D. sum of the number of protons and neutrons is same but the number of protons is different.

Answer: D

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7. The number of radial nodes for 3p orbital is......

A. 3

B. 4

C. 2

D. 1

Answer: D

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8. Number of angular nodes for 4d orbtial is.........

A. 4

B. 3

C. 2

D. 1

Answer: C

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9. 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's uncertainty principle.

C. Hund's rule of maximum multiplicity.

D. Aufbau principle.

Answer: B

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10. Total number of orbitals associated with thrid shell will be.....

A. 2

B. 4

C. 9

D. 3

Answer: C

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11. Orbital angular momentum depends on ....

A. l

B. $n \text{ and } l$

C. $n \text{ and } m$

D. $m \text{ and } s$

Answer: A

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12. Isodiapheres are the atoms of two elements having same values of:

A. ${}_{9}F^{19}, {}_{11}N^{23}$

B. ${}_{15}P^{31},{}_{16}S^{32}$

C. ${}_{17}Cl^{35},{}_{17}CI^{37}$

D. ${}_{18}Ar^{40},{}_{19}K^{40}$

Answer: C

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13. The pair of ions having same electronic configuration is________.

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

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

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

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

Answer: B

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14. For the electrons of oxygen atom, which of the following statemetns correct?

A. Zeff for an electron in a 2s orbital is the same as Zeff for an electron in a 2p orbital.

B. An electron in the 2s orbital has the same energy as an electron in the 2p orbital.

C. Zeff for an electron in ls orbital is the same as Zeff for an electron in a 2s orbital.

D. The two electrons present in the 2s orbital have spin quantum numbers ms but of opposite sign.

Answer: D

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15. It travelling at same speeds, whichof the following mater waves have the shortest wavelength?

A. Electron

B. Alpha particle (He^{2+})

C. Neutrons

D. Proton

Answer: B

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16. Identify the pairs which are not of isotopes?

(1) ${}_{6}^{12}X, {}_{3}^{16}$ (2) ${}_{17}^{35}X, {}_{17}^{37}$ (3) ${}_{6}^{14}X, {}_{7}^{14}$ (4) ${}_{4}^{8}X, {}_{5}^{8}Y$

A. $1\&2$

B. $2\&4$

C. $3\&4$

D. $1\&4$

Answer: C

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17. Match species given in Column I with the electronic configuration given in Column II.

	Column I		Column II
(a)	cr	(i)	$[Ar]3d^8 4s^0$
(b)	Fe^{2+}	(ii)	$[Ar]3d^{10} 4s^1$
(c)	Ni^{2+}	(iii)	$[Ar]3d^6 4s^0$
(d)	Cu	(iv)	$[Ar]3d^5 4s^1$
		(v)	$[Ar]3d^6 4s^2$

A. $\begin{matrix} i & ii & ii & iv \\ a & b & c & d \end{matrix}$

B. $\begin{matrix} i & ii & ii & iv \\ d & c & a & b \end{matrix}$

C. $\begin{matrix} i & ii & ii & iv \\ c & a & d & b \end{matrix}$

D. $\begin{matrix} i & ii & ii & iv \\ b & c & a & d \end{matrix}$

Answer: B

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18. State whether the following sets of quantum numbers can be allowed or not :

$n = 3, l = 2, m_1 = -1, s = +1/2$

A. 1&3

B. 2&3

C. 3&4

D. 1&4

Answer: B

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19. Which of the following pair would have larger size?

a.K or $K^{\oplus}$, b.Br or $Br^{\ominus}$

c.O^{2-} or $F^{\ominus}$, d.$Li^{\oplus}$ or $Na^{\oplus}$

e.P or As ,f.$Na^{\oplus}$ or Mg^{2+}

A. 1&2

B. 1&3

C. 2&3

D. 2&4

Answer: B

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20. The principal quantum number determines ....of the atom

A. 1&2

B. 1&4

C. 2&3

D. 2&4

Answer: B

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21. Match the following species with their corresponding ground state electronic configuration.

	Atom/Ion		Electronic configuration
(a)	Cu	(i)	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10}$
(b)	cu^{2+}	(ii)	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2$
(c)	Zn^{2+}	(iii)	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1$
(d)	cr^{3+}	(iv)	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^9$
		(v)	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^3$

A. $\begin{matrix} i & ii & iii & iv \\ c & d & a & e \end{matrix}$

B. $\begin{matrix} i & ii & iii & iv \\ d & a & e & c \end{matrix}$

C. $\begin{matrix} i & ii & iii & iv \\ a & b & c & d \end{matrix}$

D. $\begin{matrix} i & ii & iii & iv \\ c & b & d & e \end{matrix}$

Answer: A

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22. Match the quantum numbers with the information provided by these.

	Quantum number		Information provided
A.	Principal quantum number	1.	Orientation of the orbital
B.	Azimuthal quantum number	2.	Energy and size of orbital
C.	Magnetic quantum number	3.	Spin of electron
D.	Spin quantum number	4.	Shape of the orbital

A. $\begin{array}{cccc} i & ii & iii & iv \\ b & a & d & c \end{array}$

B. $\begin{array}{cccc} i & ii & iii & iv \\ b & d & a & c \end{array}$

C. $\begin{array}{cccc} i & ii & iii & iv \\ a & c & d & b \end{array}$

D. $\begin{array}{cccc} i & ii & iii & iv \\ a & b & c & d \end{array}$

Answer: B

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23. Match the following rules with their statement :

	Rules		Statements
(a)	Hund's Rule	(i)	No two electrons in an atom can hav
(b)	Aufbau Principle	(ii)	Half-filled and completely filled orb
(c)	Pauli Exclusion Principle	(iii)	Pairing of electrons in the orbitals b
(d)	Heisenberg's Uncertainty	(iv)	It is impossible to determine the exa
		(v)	In the ground state of atoms, orbita

A. $\begin{matrix} i & ii & iii & iv \\ c & e & d & a \end{matrix}$

B. $\begin{matrix} i & ii & iii & iv \\ e & c & d & a \end{matrix}$

C. $\begin{matrix} i & ii & iii & iv \\ c & e & a & d \end{matrix}$

D. $\begin{matrix} i & ii & iii & iv \\ e & d & a & b \end{matrix}$

Answer: C

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24. Match the following :

(a)	X-rays	(i)	$v = 10^0 - 10^4 Hz$
(b)	UV	(ii)	$v = 10^{10} Hz$
(c)	Long radio waves	(iii)	$v = 10^{16} Hz$
(d)	Microwave	(iv)	$v = 10^{18} Hz$

A. $\begin{matrix} i & ii & iii & iv \\ d & c & a & b \end{matrix}$

B. $\begin{matrix} i & ii & iii & iv \\ c & a & b & d \end{matrix}$

C. $\begin{matrix} i & ii & iii & iv \\ d & b & a & c \end{matrix}$

D. $\begin{matrix} i & ii & iii & iv \\ a & d & b & c \end{matrix}$

Answer: A

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