CHEMISTRY

FOR IIT JEE ASPIRANTS OF CLASS 11 FOR CHEMISTRY

ATOMIC STRUCTURE

C.U.Q

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 numbe 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. Possitive 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 $\left(S_2\right)$ 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 negatively charged particle

B. The mass of electron is equal to the mass of neutron

C. It is basic constituent of all atom

D. It is a constituent of cathode rays

Answer: B

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9. 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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10. 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 extermely high velocities.

Answer: D

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

A. Protons only

B. Protons and neutrons

C. Neutrons and electorns

D. Neutrons, electrons and protons

Answer: D

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12. The ratio between the neutrons present in nitrogen atom and silicon atoms with number 14 and 28 is :

A. $7:3$

B. $3:7$

C. $1:2$

D. $2:1$

Answer: B

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13. 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, electron and neutrons combine to give fractional masses

Answer: B

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14. 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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15. Set of iso electronic ions among the following is

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

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

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

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

Answer: C

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16. 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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17. 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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18. 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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19. 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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20. 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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21. 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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22. A metal surface ejects electrons when hit by green light but none when hit by yellow light. The electrons will be ejected when the surface is hit by

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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23. 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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24. 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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25. 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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26. 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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27. 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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28. 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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29. 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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30. 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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31. 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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32. 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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33. The equation corresponding to the wave number of spectral line in the Bracket series

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

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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34. 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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35. 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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36. 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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37. Wave properties are only important for particoles 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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38. Which of the following is responsible to rule out the existence of definite paths of 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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39. ψ^2 ,(psi) the wave function respereseents 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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40. In the Schrodinger's wave equation Ψ represents

A. Orbitals

B. Wave function

C. Amplitude function

D. Both 1 & 3

Answer: D

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

A. $50\ \%$

B. $95\ \%$

C. $33.33\ \%$

D. Zero

Answer: D

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42. 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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43. 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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44. The quantum number which determines the number of sub-energy levels in any main energy level is

A. n

B. 1

C. m

D. s

Answer: A

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45. 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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46. The angular momentum of an electron in an atom depends on

A. m

B. l

C. n

D. All

Answer: B

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47. 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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48. 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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49. The orbital with maximum number of possible orientations

A. s

B. p

C. d

D. f

Answer: D

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50. 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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51. Which is not an atomic orbital?

A. 2d

B. 5p

C. 3p

D. 4d

Answer: A

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52. 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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53. 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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54. According to $(n + l)$ rule after completing 'np' level the electron enters int

A. $(n - 1)d$

B. $(n + 1)s$

C. nd

D. $(n + 1)p$

Answer: B

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55. 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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56. Any p- orbital can accomedate upto:

A. Four electrons

B. Two electrons with parallel spins

C. Six electron

D. Two electrons with opposite spins

Answer: D

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57. Due to which of the following reasons the nitrogen shows thee unpaired electrons

A. Hund's rule

B. Aufbau principle

C. Pauli's principle

D. Heisenberg's principle

Answer: A

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

A. Configuration

B. Atoms

C. Ions

D. Molecules

Answer: A

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59. 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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60. 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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LEVEL-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 α - 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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4. The nitride ion in lithium nitride is composed of

A. 7 protons $+7$ electrons

B. 10 protons $+7$ electron

C. 7 protons $+10$ electrons

D. 10 protons $+10$ electrons

Answer: C

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5. The wrong statement among the following is

A. Nitrogen atom, nitride ion have same atomic number

B. Aluminium atoma 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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6. 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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7. 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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8. 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. $a > b > c > d$

B. $a < b < c < d$

C. $d < b < a < c$

D. $b < c < d < a$

Answer: C

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9. 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. $\lambda_3 = \dfrac{\lambda_1 \lambda_2}{\lambda_1 + \lambda_2}$

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

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

Answer: B

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10. 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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11. 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. $\frac{1}{hx}$

Answer: D

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12. 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. $5 \times 10^{23} Hz$

D. $4 \times 10^{12} Hz$

Answer: A

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13. In photo electric effect, the energy 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. $6.4 \times 10^{-19} J$

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

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

D. $6.4 \times 10^{-20} J$

Answer: C

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14. The kinetic energy of electrons ejected by using light having frequency equal to threshold frequency $\left(v_0\right)$ is:

A. hv_0

B. Almost zero

C. Very large

D. h / v_0

Answer: B

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15. Which of the following transitions are not allowed in the normal electronic emision 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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16. 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_{δ}-line

Answer: D

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17. 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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18. 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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19. 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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20. The following electonic transition corresponds to the shortest wave length (n= no. of orbit)

A. $n_5 \rightarrow n_1$

B. $n_5 \rightarrow n_3$

C. $n_5 \rightarrow n_2$

D. $n_5 \rightarrow n_4$

Answer: A

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

A. Remains unchanged

B. Becomes half

C. Becomed double

D. Becomes one fourth

Answer: B

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23. 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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24. 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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25. 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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26. 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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27. The IE_1 of H is $13.6eV$. It is exposed to electromagnetic waves of 1028Å and gives out induced radiation. Find out orbit of these induced radiation.

A. Longest wavelength of induced is $6568A^{\circ}$

B. Lowest wavelength of induced radiation in $102A^{\circ}$

C. Longest wavelength of induced radiation is $3252A^{\circ}$

D. Longest wavelength of induced is $1216A^{\circ}$

Answer: A

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28. Which ofthe following curves may represent the energy of electron in hydrogen atom as a function of principal quantum number n:

A. 

B.

C.

D.

Answer: A

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29. The difference in angular momentum associated with electron in two successive orbits of hydrogen atom is:

A. $h/2\pi$

B. h/π

C. $h/2$

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

Answer: A

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30. 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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31. 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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32. 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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33. 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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34. 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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35. 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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36. 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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37. 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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38. The number of radial nodes fo 3s and 2p orbitals are respectively:

A. 0,2

B. 2,0

C. 1,2

D. 2,1

Answer: B

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

A. Angular momentum of electron

B. Qantum numbers

C. Dual nature of electron

D. Black body radiation

Answer: C

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40. 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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41. 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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42. 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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43. 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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44. For an electron in a hydrogen atom , the wave function Φ is proparitional to exp -r/a_p where a_0 is the Bohr's radius What is the radio of the probability of finding the electron at the nucless at the nucless to the probability of finding id=f at a_p ?

A. e

B. e^2

C. $1/e^2$

D. zero

Answer: D

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45. The electron density between 1s and 2s is

A. High

B. Low

C. Zero

D. Abnormal

Answer: C

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46. 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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47. The quantum number l and the number of electrons (n) in the sub level are related by

A. $n = 2l + 1$

B. $l = 2n + 1$

C. $n = 4l + 2$

D. $n = 2l^2$

Answer: C

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

A. Describes and 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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49. 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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50. 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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51. 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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52. The total number of m values for $n = 4$ is

A. 8

B. 16

C. 12

D. 20

Answer: B

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53. Choose the incorrect statements:

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 an electron in an atomic orbital of multi-electron atom depends on principal quantum number

D. The number of degenerate atomic orbitals of one type depends on the value of azimuthal and magnetic quantum numbers

Answer: C

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54. Which of the following statements on quantum numbers is not correct?

A. Quantum numbers, n,l,m and s` are needed to describe an electron in an atom completely

B. Quantum numbers n,l,m and s are obtained by solving the Schrodinger wave equation.

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

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

Answer: B

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55. 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. $n = 3, l = 0, m = 0, s = +\frac{1}{2}$

Answer: B

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56. The electrons identified by quantum numbers n and l :-

(a) n=4, l=1 (b) n=4, l=0 (c) n=3, l=2 (d) n=3, l=1

Can be placed in order of increasing energy as

A. $ii < I < iv < ii$

B. $ii < iv < I < iii$

C. $i < iii < ii < iv$

D. $iv < ii < iii < i$

Answer: D

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57. The angular wave function depends upon quantum numbers.

A. n and l

B. l and m

C. l and s

D. m and s

Answer: B

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

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

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

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

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

Answer: B

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59. 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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60. 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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61. 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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62. During ionisation of copper atom, the quantum numbers of electron removed maybe

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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63. The rule that explains the reason for chromium to have $[Ar]3d^5 4s^1$ configuration instead of $[Ar]3d^4 4s^2$?

A. Pauli's exclusion principle

B. Aufbuat principle

C. Hund's rule

D. Heisenberg's principle

Answer: C

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

A.

B.

C.

D.

Answer: B

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65. The electronic configuration of gadolinium (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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66. How many 'd' electrons are present in Cr^{2+} ion?

A. 4

B. 5

C. 6

D. 3

Answer: A

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67. 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 IE 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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68. The ion that is most stable

A. Fe^{+}

B. Fe^{2+}

C. Fe^{3+}

D. Fe^{4+}

Answer: C

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69. 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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70. Which of the following statements are incorrect

(I) There are five unpaired electrons in $Fe^{+3}(z = 26)$

(II) Fe^{+3}, Mn^{+} and Cr all having24 electrons have same value of magnetic moment

(III) Copper (I) chloride is coloured salt

(IV) Every coloured ion is paramagnetic

A. I & II

B. II & III

C. III & IV

D. I & IV

Answer: B

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LEVEL-II(C.W)

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 enegry. 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 follwong nuclear reactiosn 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 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?

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

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

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

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

Answer: D

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

A. $3 \times 10^4 cm$

B. $3 \times 10^{-4} cm$

C. $6 \times 10^4 cm$

D. $6 \times 10^6 cm$

Answer: A

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

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

B. $7.95 \times 10^{-26} J$

C. $3.93 \times 10^{-26} J$

D. $3.93 \times 10^{-19} J$

Answer: A

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

A. $2.5 \times 10^{-20} erg$

B. $5.1 \times 10^{-23} erg$

C. $4.97 \times 10^{-21} erg$

D. $8.5 \times 10^{-2} erg$

Answer: C

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

A. $3.33 \times 10^{6} J$

B. $3.33 \times 10^{5} J$

C. $1.56 \times 10^{6} J$

D. $15.6 \times 10^{8} J$

Answer: A

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11. 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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12. Electromagnetic radiation of wavelength 242 nm is just sufficient to ionise the sodium atom . Calculate the ionisation energy of sodium in kJ mol^{-1}.

A. 494.5

B. 594.5

C. 694.5

D. 794.5

Answer: A

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13. When a metal is irradiated with light of frequency $4.0 \times 10^{16} s^{-1}$ the photo electrons emitted has six times the K.E as the K.E of photo electron emitted when the metal was irradiated with light of frequency $2.0 \times 10^{16} s^{-1}$. Calculate the critical frequency 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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14. In photo electric effect, if the energy required to over come the attractive forces on the electron (work function) of Li, Na and Rb are $2.41eV, 2.3eV$ and $2.09eV$ respectively, the work function of "K" could approximately by in eV

A. 2.52

B. 2.2

C. 2.35

D. 2.01

Answer: B

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15. 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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16. If the wave number of the first line in the Balmer series of hydrogen atom is $1500cm^{-1}$, the wave number of the first line of the Balmer series of Li^{2+} is

A. $1.35 \times 10^4 cm^{-1}$

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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17. 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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18. 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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19. The number of spectral lines obtain in Bohr spectrum of hydrogen atom when an electron is excited from ground level to 5th orbit is

A. 5

B. 10

C. 20

D. 1

Answer: B

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

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

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

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

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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21. Which is the correct relationship?

(a). E_1 of $H = 1/2E_2$ of $He^+ = 1/3E_3$of $Li^{2+} = 1/4E_4$of Be^{3+}

(b). $E_1(H) = E_2\left(He^+\right) = E_3\left(Li^{2+}\right) = E_4\left(Be^{3+}\right)$

(c). $E_1(H) = 2E_2\left(He^+\right) = 3E_3\left(Li^{2+}\right) = 4E_4\left(Be^{3+}\right)$

(d). No relation

A. E_1 of $H = \frac{1}{2}E_2$ of $He^+ = \frac{1}{3}E_3$ of $Li^{+2} = \frac{1}{4}$ of E_4 of Be^{+3}

B. E_1 of $H = E_2$ of $He^+ = E_3$ of $Li^{+2} = E_4$ of Be^{+3}

C. E_1 of $H = 2E_2$ of $He^+ = 3E_3$ of $Li^{+2} = 4E_4$ of Be^{+3}

D. E_1 of $H = \frac{2}{3}E_2$ of $He^+ = \frac{4}{3}E_3$ of $Li^{+2} = \frac{5}{4}E_4$ of Be^{+3}

Answer: B

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22. 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. 234nm

C. 476nm

D. 244nm

Answer: A

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23. Which of the transitions in hydrogen atom emits a photon of lowest frequecny ($n =$ quantum number)?

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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24. 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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25. 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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26. 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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27. The radius of first Bohr orbit is x, then de-Broglie wavelength of electron in 3rd orbit is nearly

A. $2px$

B. $6px$

C. $9x$

D. $x/3$

Answer: B

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

A. $8.72 \times 10^{-18} Ja \rightarrow m^{-1}$

B. $8.72 \times 10^{-19} Ja \rightarrow m^{-1}$

C. $4.35 \times 10^{-18} Ja \rightarrow m^{-1}$

D. $2.62 \times 10^{-19} Ja \rightarrow m^{-1}$

Answer: A

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30. If the diameter of a carbon atom is $0.15 nm$, calculate the number of carbon atom which can be placed side by side in a straight line length of scale of length $20 cm$ 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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31. 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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32. The wavelength of a spectral line emmited by hydrogen atom in the lyman series is $16/5R$ cm. what is the value of n_2

A. 2

B. 3

C. 4

D. 1

Answer: C

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33. 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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34. 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 $h = 6.63 \times 10^{-34} is \big)$:

A. $0.032 nm$

B. $2.5 nm$

C. $14.0 nm$

D. $0.4 nm$

Answer: D

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

A. $8.8 \times 10^{-12} m$

B. $8.8 \times 10^{-14} cm$

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

D. $4.4 \times 10^{-15} cm$

Answer: C

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36. 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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37. An electron of mass m and charge e is accelerated from rest through a potential difference V in vacuum. The final speed of the electron will be

A. $\sqrt{V/m}$

B. $\sqrt{eV/m}$

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

D. None of these

Answer: C

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38. 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. $1836 : 1$

Answer: D

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

A. $5J$

B. $5erg$

C. $5eV$

D. $8 \times 10^{-10} eV$

Answer: C

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41. 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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42. The spin magnetic momentum of electron in an ion is $4.84BM$. 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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43. 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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44. in a multi- electron atom ,which of the following orbitals described by the three quantum numbers, which of the following will have nearly same energy?

$(P)\quad n = 1, l = 0, m = 0 \quad (q)\quad n = 2, l = 0, m = 0$

$(r)\quad n = 2, l = 1, m = 1, \quad (S)\quad n = 3, l = 2, m = 1$

$(t)\quad n = 3, l = 2, m = 0$,,

A. a & c

B. b & c

C. c & d

D. d & e

Answer: D

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45. 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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46. Given $\begin{matrix} K & L & M & N \\ 2 & 8 & 11 & 2 \end{matrix}$

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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47. Sum of electronic spins of all electrons with the configuration $3d^7$ is

A. $+3/2$

B. $+5/2$

C. $+7/2$

D. $9/2$

Answer: A

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48. 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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49. 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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50. 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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51. 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. $X > YZ$

C. $Z > Y > X$

D. $Y > Z > X$

Answer: C

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52. 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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LEVEL -III

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

A. $2.47 \times 10^{-6} cm$

B. $2.47 \times 10^{-5} cm$

C. $24.7 \times 10^{-5} cm$

D. $24.7 \times 10^{-6} cm$

Answer: B

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

A. 594 nm

B. 640 nm

C. 700 nm

D. 494nm

Answer: D

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

A. $0.06m$

B. $6m$

C. $0.03m$

D. $0.3m$

Answer: A

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

A. $9 \times 10^7 m$

B. $9 \times 10^9 m$

C. $4.5 \times 10^9 m$

D. $7 \times 10^9 m$

Answer: B

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5. A quantum of light having energy E has wavelength equal to $7200 A^{\circ}$.

The frequency of light which corresponds to energy equal to 3E, is

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

B. $1.25 \times 10^{15} s^{-1}$

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

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

Answer: B

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6. 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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7. A certain dye absorbs $4530A^{\circ}$ and fluoresence at $5080A^{\circ}$ these being wavelength of maximum absorption that under given condition 47% of the absorbed energy is emitted. Calculate the ratio of the no of quanta emitted to the number absorbed.

A. 0.527

B. 1.5

C. 52.7

D. 3

Answer: A

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8. 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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9. 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. $8.282 \times 10^{10} J$

B. $4.141 \times 10^{-10} J$

C. $6.262 \times 10^{-9} J$

D. $8.282 \times 10^{-10} J$

Answer: D

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10. 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. $1.988 \times 10^{-17} J$

B. $1.988 \times 10^{19} J$

C. $3.988 \times 10^{-19} J$

D. $1.988 \times 10^{-19} J$

Answer: D

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11. 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 $240 kJmol^{-1}$)

A. $2.16 \times 10^{-20} J$

B. $4.1 \times 10^{-20} J$

C. $3.12 \times 10^{-14} J$

D. $2.16 \times 10^{-22} J$

Answer: B

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12. A photon of wavelength $4 \times 10^{-7}m$ strikes on metal surface, The work function of the metal is $2.13eV$. 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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13. When electromagnetic radiation of wavelength 300 nm falls on the surface of sodium, electrons are emitted with kinetic energy of $1.68 \times 10^{5}\text{Jml}^{-1}$. 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. $51.7nm$

B. $517 nm$

C. $427 nm$

D. $62 nm$

Answer: B

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14. Photoelectric emission is observed from a surface for frequencies $v_1 \text{and} v_2$ of the incident radiation $\left(v_1 > v_2\right)$. If maximum kinetic energies of the photo electrons in the two cases are in the ratio $1 : K$, then the threshold frequency is given by:

A. $\frac{v_2 - v_1}{K - 1}$

B. $\frac{K v_1 - v_2}{K - 1}$

C. $\frac{K v_2 - v_2}{K - 1}$

D. $\frac{v_2 - v_2}{K}$

Answer: B

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15. Light of wavelength λ shines on a metal surface with initail X and the metal emit Y electron per second of average Z what will happen to Y and Z if X is doubled ?

A. y will be doubled and z will become half

B. y will remains 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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16. 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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17. 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. $\left[\frac{2hc}{m}\left(\lambda_0 - \lambda\right)\right]^{1/2}$

C. $\left[\frac{2hc}{m}\left\{\frac{\lambda_0 - \lambda}{\lambda\lambda_0}\right\}\right]^{1/2}$

D. $\left[\frac{2hc}{m}\left\{(1)\left(\lambda_0\right) - \frac{1}{\lambda}\right\}\right]^{1/2}$

Answer: C

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18. 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. $4.48ev$

B. $3.35ev$

C. $44.8ev$

D. $22.4 ev$

Answer: A

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19. 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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20. Calculate the energy emitted when electron of $1.0g$ atom of hydrogen undergo transition giving the spectral line of lowest energy in the visible region of its atomic spectrum.

A. $n_2 = 3$ to $n_1 = 2, E = 182.8KJ$

B. $n_2 = 2$ to $n_1 = 1, E = 155.8KJ$

C. $n_2 = 3$ to $n_1 = 1, E = 180.8KJ$

D. $n_2 = 4$ to $n_1 = 2, E = 182.5KJ$

Answer: A

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21. In Bohr series of lines of hydrogen spectrum, third line from the red end corresponds to which one of the following inner orbit jumps of electron for Bohr orbit in atom in hydrogen :

A. $5 \rightarrow 2$

B. $4 \rightarrow 1$

C. $2 \rightarrow 5$

D. $3 \rightarrow 2$

Answer: A

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22. One energy difference between the states $n = 2$ and $n = 3$ is E eV, in hydrogen atom. The ionisation potential of H atom is -

A. $3.2E$

B. $7.2E$

C. $5.6E$

D. $13.2E$

Answer: B

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23. 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 $\left(\left(r_1 - r_2\right)\right.$ 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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24. Ionisation energy of He^+ is $19.6 \times 10^{-18} Jatom^{-1}$. The energy of the first stationary state $(n = 1)$ of Li^{2+} is.

A. $4.41 \times 10^{-16} Jatom^{-1}$

B. $-4.41 \times 10^{-17} Jatom^{-1}$

C. $-2.2 \times 10^{-15} J atom^{-1}$

D. $-8.83 \times 10^{-17} J atom^{-1}$

Answer: B

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25. If a hydrogen atom emit a photon of energy $12.1 eV$, its orbital angular momentum changes by $\Delta L. then$Delta L` equals

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

B. $\frac{3h}{2\pi}$

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

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

Answer: C

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26. 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

$\left(h = 6.62 \times 10^{-34} Js \text{ and } c = 3.0 \times 10^8 ms^{-1}\right)$.

A. $1.214 \times 10^{-7} m$

B. $2.816 \times 10^{-7} m$

C. $6.5 \times 10^{-7} m$

D. $8.5 \times 10^{-7} m$

Answer: A

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27. 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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28. In two H atoms A and B the electrons move around the nucleus in circular orbits of radius r and 4r respectively. The ratio of the times taken by them to complete one revolution is

A. $1:4$

B. $4:1$

C. $1:8$

D. $8:1$

Answer: A

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29. The ionization enthalpy of hydrogen atom is $1.312 \times 10^6 Jmol^{-1}$. The energy required to excite the electron in the atom from $n = 1$ to $n = 2$ is :

A. $8.51 \times 10^5 Jmol^{-1}$

B. $6.56 \times 10^5 Jmol^{-1}$

C. $7.56 \times 10^5 Jmol^{-1}$

D. $9.84 \times 10^5 Jmol^{-1}$

Answer: D

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30. In an atom, an electron is moving with a speed of $600 m/s$ with an accuracy of 0.005% certainity with which the positive of the electron can be located is $\left[h = 6.6 \times 10^{-34} Js, m = 9.1 \times 10^{-31} kg\right]$

A. $1.52 \times 10^{-4} m$

B. $5.1 \times 10^{-3} m$

C. $1.92 \times 10^{-3} m$

D. $3.84 \times 10^{-3} m$

Answer: C

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31. 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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32. Uncertainty in the position of an electron mass $\left(9.1 \times 10^{31} kg\right)$ moving with a velocity $300 ms^{-1}$ accurate uptp 0.001% will be :

A. $19.2 \times 10^{-2} m$

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

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

D. $3.83 \times 10^{-2} m$

Answer: C

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33. 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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34. In ψ_{321} the sum of angular momentum, spherical nodes and angular node is:

A. $\frac{\sqrt{6}h + 4\pi}{2\pi}$

B. $\frac{\sqrt{6h}}{2\pi} + 3$

C. $\frac{\sqrt{6h} + 2\pi}{2\pi}$

D. $\frac{\sqrt{6h} + 8\pi}{2\pi}$

Answer: A

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35. 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. $n = 4, l = 0, m = 0, \ = +1/2$

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

Answer: B

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36. The spin-only magnetic moment [in units of Bohr magneton, $\left(\mu_B \text{ of } Ni^{2+}\right)$ 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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LEVEL -IV

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

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

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

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

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

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

Answer: C

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2. Assertion (A) : Fe^{3+} (g) ion is more stable than $Fe^{2+}(g)$ ion.

Reason (R) : Fe^{3+} ion has more number of unpaired electrons than Fe^{2+} ion.

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

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

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

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

Answer: B

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3. Assertion(A): The kinetic of the photo electron ejected increases with increases in intensity of incident light.

Reason(R): Increase in intensity of incident light increases the rate of emission.

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

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

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

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

Answer: D

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4. Assertion(A): Threshold frequency is a characteristic for a metal

Reason(R): Threshold frequency is a maximum frequency required for the ejection of electron from the metal surface.

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

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

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

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

Answer: C

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5. Assertion(A): Line spectrum of Li^{+2} and He^{+} are identical

Reason(R): Isoelectronic species produce identical specturm

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

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

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

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

Answer: A

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6. Assertion (A) : Hydrogen has only one electron in its 1s orbital but it produces several spectral lines.

Reason (R) : There are many excited energy levels available in H atoms.

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

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

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

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

Answer: A

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7. Assertion: It is essential that all the lines available in the emission spectrum will also be available in the absorption spectrum.

Reason: The spectrum of hydrogen atom is only absorption spectrum.

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

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

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

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

Answer: C

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8. Assertion (A) : In an atom, the velocity of electron in the higher orbits keeps on decreasing

Reason (R) : Velocity of electron in inversely proportional to the radius of the orbit

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

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

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

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

Answer: A

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9. Assertion (A) : The radial probability of$1s$ electrons first increases,till it is maximum at 53Å and then decreases to zero

Reason (R) : Bohr's radius for the first is 53Å

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

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

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

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

Answer: B

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10. Assertion(A): Wavelength of limiting line of lyman series is less less than wavelength of limiting line of Balmer series.

Reason(R): Rydberg constant value is same for all elements

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

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

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

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

Answer: C

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11. Assertion(A): The faster a particle moves, the greater its momentum and the shorter is the wave length that is associated with it.

Reason(R): Because (λ) = hp^(-1) and p = mv`

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

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

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

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

Answer: A

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12. Assertion(A): An electron cannot exist in the nucleus

Reason(R): The deBroglie wavelength of an electron is much smaller than the diameter of the nucleus

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

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

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

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

Answer: C

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13. Assertion (A) : The position of electron can be determined with the help of an electronic microscope.

Reason (R) : The product of uncertainty in momentum and the uncertainty in the position of an electron cannot be less than a finite limit.

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

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

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

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

Answer: D

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14. Assertion(A): It is not possible to predict position and the velocity of an electron exactly and simultaneously

Reason(R): Electron moving with high speed possesses both the particle nature and the wave nature

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

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

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

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

Answer: A

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15. Assertion(A): deBroglie equation has significance for any microscopic or submicroscopic particles

Reason(R): Electron moving with high speed possesses both the particle nature and the wave nature

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

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

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

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

Answer: A

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16. Assertion (A) : There are two spherical nodes in $3s$ orbital

Reason (R) : There is no planar nodes in $3s$ orbital.

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

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

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

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

Answer: B

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17. Assertion (A) : A spectral line will be seen for $2p_x$-$2p_y$ transition

Reason (R) : Energy is raleased in the form of wave of light when the electron drops from $2p_x$, to $2p_y$ orbital.

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

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

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

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

Answer: D

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18. Assertion(A): The P_x orbital has maximum electron density along the x axis and its nodal plane is yz plane

Reason (R): For a given atom, for all values of n, the p-orbitals have the same shape, but the overall size increase as n increases

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

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

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

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

Answer: B

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19. Assertion(A): Electrons may be considered as particles and waves

Reason (R): An electron in an atom may be described as occupting at atomic orbital or by a wave function ψ, which is a solution to the schrodinger wave equation

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

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

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

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

Answer: B

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20. Assertion(A): ψ indicates the amplitude of electron-wave

ψ^2 denotes probability of finding an electron in the space around the nucleus

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

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

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

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

Answer: B

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21. STATEMENT-1: Half-filled and fully-filled degenerate orbitals are more stable.

STATEMEHNT-2: Extra stabillity is due to the symmetrical distribution of electrons and exchange energy.

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

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

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

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

Answer: A

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22. Assertion (A) : An orbital cannot have more than two electron

Reason (R) : The two electrons is an orbital create opposite magnetic field

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

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

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

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

Answer: C

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23. Assertion(A): P-orbital can accomadate 6 electrons

Reason (R): No two electrons in atom can have same set of four quantum numbers

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

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

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

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

Answer: D

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

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

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

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

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

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

Answer: A

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25. Following questions contains statements given in two columns. Which have to be matched. Statements (A,B,C,D) in column I have to be matched with statements (1,2,3,4,5) in column II

$List - 1$	$List - II$
(A)Velocity of light	(1)Energy particle
(B)Planck's constant	(2)Energy packet
(C)Wave numer	(3)$3 \times 10^8 m/\text{sec}$
(D)Photon	(4)$6.626 \times 10^{-34} J - \text{sec}$
	(5)cm^{-1}

The correct match is

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. $(A, B, C, D), (3, 4, 5, 1, 2)$

Answer: D

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26.

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

The correct match is

A. $\begin{matrix} I & II & III & IV \\ a & b & c & d \end{matrix}$

B. $\begin{matrix} I & II & III & IV \\ c & d & b & a \end{matrix}$

C. $\begin{matrix} I & II & III & IV \\ d & c & b & a \end{matrix}$

D. $\begin{matrix} I & II & III & IV \\ b & d & a & c \end{matrix}$

Answer: C

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27.

List - I	List - II
(I) Wave number	(a) ms^{-1}
(II) Frequency	(b) nm
(III) Wavelength	(c) s^{-}
(IV) Velcity	(d) m^{-1}

The correct match is

A. $\begin{matrix} I & II & III & IV \\ a & b & c & d \end{matrix}$

B. $\begin{matrix} I & II & III & IV \\ d & c & b & a \end{matrix}$

C. $\begin{matrix} I & II & III & IV \\ b & c & d & a \end{matrix}$

D. $\begin{matrix} I & II & III & IV \\ c & d & b & a \end{matrix}$

Answer: B

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28.

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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29.

List - I	*List - II*
(*I*)Radial probability distribution curve of 3s orbital	(*a*)1.1A°
(*II*)Distance of maximum probability of 1s electron	(*b*)1*s*orbital
(*III*)Radial node for a 2s electron	(*c*)3peaks, 2 radial nodes
(*IV*)No spherical nodes	(*d*)0.53A°

The correct match is

A. $\begin{matrix} I & II & III & IV \\ a & b & c & d \end{matrix}$

B. $\begin{matrix} I & II & III & IV \\ c & d & a & b \end{matrix}$

C. $\begin{matrix} I & II & III & IV \\ b & a & d & a \end{matrix}$

D. $\begin{matrix} I & II & III & IV \\ d & a & b & c \end{matrix}$

Answer: B

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30.

List - I	List - II
(A) nodal plane	(1) $\frac{Ze^2}{2r}$
(B) p-orbital	(2) $\lambda = \frac{h}{mv}$
(C) de Broglie	(3) Spherical
(D) Kinetic energy	(4) Probability of e^- is zero
	(5) Dumb bell

The correct match is

A.

A	B	C	D
4	5	2	1

B.

A	B	C	D
2	4	3	5

C.

A	B	C	D
1	5	3	2

D.

A	B	C	D
3	1	4	2

Answer: A

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31.

List - I	List - II
$(I)\psi^2$depends upon upon distance	(a)p-orbitals
$(II)\psi^2$depends upon distance and on one direction	(b)d-orbital
$(III)\psi^2$depends upon distance and on two directions	(c)f-orbital
$(IV)\psi^2$depends upon distance and on three directions	(d)s-orbitals

The correct match is

A.
I	II	III	IV
d	c	b	a

B.
I	II	III	IV
c	b	a	d

C.
I	II	III	IV
d	a	b	c

D.
I	II	III	IV
d	a	c	b

Answer: C

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32.

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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33.

List - I	*List - II*
(I)The electrons of same orbital differ in 's' value	(a)Hund's rule
(II)Order of orbitals is$2s.2p.3s.3p.4s$	(b)Stability of completely filled
$(III)E.\ CofNis1s^2 2s^2 2p_x^1 2p_y^1 2p_z^1$	(c)Pauli's principle
$(IV)E.\ CofCuis[Ar]4s^1 3d^{10}$	(d)Aufbau principle

The correct match is

A. $\begin{matrix} I & II & III & IV \\ a & b & c & d \end{matrix}$

B. $\begin{matrix} I & II & III & IV \\ d & c & b & a \end{matrix}$

C. $\begin{matrix} I & II & III & IV \\ c & d & a & b \end{matrix}$

	I	II	III	IV
D.	c	b	d	a

Answer: C

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34.

Column - I	Column - II
(A)7s	(P)Maximum energy
(B)4d	(Q)Maximum number of electrons
(C)5d	(R)3sub shells
(D)4p	(S)Minimum number of orbitals

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35.

Column - I	Column - II
(A)Radial function(R)	(P)n
(B)Angular function(θ)	(Q)l
(C)Angular function(ϕ)	(R)m
(D)Quantised angular momentum	(S)s

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36. Which of the following conclusions couldnot be derived from Rutehrford's a-paticle 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 nucleaus $10^{-15}m$

C. Electrons move in a circular path of fixed energy called orbits

D. Electrons and the nucleus are held together by electroststic forces of attraction

Answer: C

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37. Which of the following options does not represent ground state electronic configuration of an atom?

A. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^8 4s^2$

B. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9 4s^2$

C. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1$

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

Answer: B

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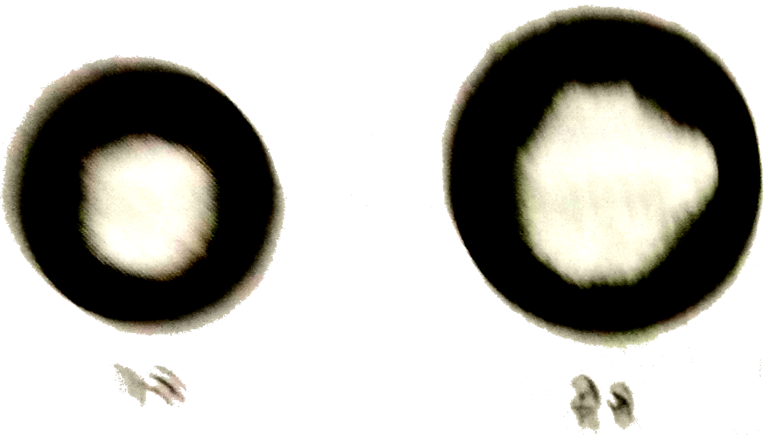
38. The probability density plots of 1 s and 2s orbitals are given in figure.



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. 1s and 2s orbitals are spectrical 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 orbital decreases uniformly as distance from the nucleus increases.

Answer: D

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39. 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. Charactersitics of cathode rays do not depend upon the material of electrods in carthode ray tube

D. Characterstics of cathode rays depend upon the nature of gas present in the cathode ray tube

Answer: D

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

A. It is negatively charged particle

B. The mass of electron is equal to the mass of neutron

C. It is basic constistuent of all atoms

D. It is a constitutent of cathode rays

Answer: B

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41. Which of the following properties of atom could be explained correctly by Thomson model of atom?

A. Overall neutrally of atom

B. Spectra of hydrogen atom

C. Position of electron, protons and neutrons in atom

D. Stability of atom

Answer: A

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42. 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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43. The number of radial nodes for 3p orbital is......

A. 3

B. 4

C. 2

D. 1

Answer: D

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44. Number of angular nodes for 4d orbtial is.........

A. 4

B. 3

C. 2

D. 1

Answer: C

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45. 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 uncertainity principle

C. Hund's rule of maximum multiplicity

D. Aufbau principle

Answer: B

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46. Total number of orbitals associated with thrid shell will be.....

A. 2

B. 4

C. 9

D. 3

Answer: C

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47. Orbital angular momentum depends on ....

A. l

B. n and l

C. n and m

D. m and s

Answer: A

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48. 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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49. For the electrons of oxygen atom, which of the following statemetns correct?

A. Z_{eff} for an electron in a 2s orbital is the same as Z_{eff} for an electron in a 2p

B. An electron in the 2s orbital has the same energy as an electron in the 2p orbital

C. Z_{eff} for an an electron in 1s orbital is the same as Z_{eff} for an electron in a 2s orbital

D. The two electrons present in the 2s orbital have spin quantum numbers m_s but if opposite sign

Answer: D

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50. It travelling at same speeds, whichof the following mater waves have the shortest wavelength?

A. Electron

B. Alpha particle $\left(He^{2+}\right)$

C. neutron

D. Proton

Answer: B

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51. Identify the paris which are not of isotopes?

A. $._6^{12}X, ._6^{13}Y$

B. $._{17}^{35}X, ._{17}^{37}Y$

C. $._6^{14}X, ._7^{14}Y$

D. $._4^8X, ._4^9Y$

Answer: D

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52. Out of the folowing paris of electorns, identify the pairs of electrons present in degenrate orbitals.

A. (a) $n = 3, l = 2, m_1 = -2, m_s = -\frac{1}{2}$

(b) $n = 3, l = 2, m_1 = -1, m_s = -\frac{1}{2}$

B. (a) $n = 3, l = 1, m_1 = 1, m_s = +\frac{1}{2}$

(b) $n = 3, l = 2, m_1 = 1, m_s = +\frac{1}{2}$

C. (a) $n = 4, l = 1, m_1 = 1, m_s = +\frac{1}{2}$

(b) $n = 3, l = 2, m_1 = 1, m_s = +\frac{1}{2}$

D. (a) $n = 3, l = 2, m_1 = +2, m_5 = -\frac{1}{2}$

(b) $n = 3, l = 1, m_1 = +2, m_5 = +\frac{1}{2}$

Answer: D

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53. Which of the following sets of quantum numbers are correct?

n l m n l m

A. $\begin{matrix} n & l & ml \\ 1 & 1 & +2 \end{matrix}$

B. $\begin{matrix} n & l & ml \\ 2 & 2 & -1 \end{matrix}$

C. $\begin{matrix} n & l & ml \\ 3 & 2 & -2 \end{matrix}$

D. $\begin{matrix} n & l & ml \\ 3 & 4 & -2 \end{matrix}$

Answer: C

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54. In which of the following pairs, the ions are iso electronic

A. Na^{+}, Mg^{2+}

B. Al^{3+}, O^{-}

C. Na^{+}, O^{-}

D. N^{3}, Cl^{-}

Answer: A

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55. Arrange S,P and d sub-shells of a shell in the decreasing order of effective nuclear charge (Zeff) experienced by the electron present in them

A. $S < P < d$

B. $S > P > d$

C. $S > d > P$

D. $P > S > d$

Answer: A

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56. Which of the following orbitals has the lowest energy?

A. 4d

B. 4f

C. 5S

D. 5P

Answer: C

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57. Which of the following will not show deflection from the path on passing through an electric field?

Proton,cathode rays, electron,neutron.

A. proton

B. cathode rays

C. electron

D. neutron

Answer: D

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58. Wavelengths of different radiations are given below:

(A) 300nm (B) $300\mu m$ (C) 3nm $(30A^{\circ}$

Arrange these radiations in the increasing order of their energies.

A. $B > A > C > D$

B. $B < A < C < D$

C. $B < A < C = D$

D. $B > A > C = D$

Answer: C

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59. Which are will have, a higher velocity to produce matter waves of the same wavelength?

A. proton

B. neutron

C. electron

D. None of these

Answer: C

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60. All isotopes of a given element show the same type of chemical behaviour:

A. The chemical properties of an atom are controlled by the number of electrons in the atoms

B. The chemical properties of an atom are controlled by the number of electrons in the atom

C. The chemical properties of an atom are controlled by the numeber of mass in the atom

D. none

Answer: A

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61. ψ^2 means.

A. radial probability density

B. probability density

C. always positive value

D. 2 & 3

Answer: D

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62. Which of the following exhibits both momentum and wavelength?

A. photon

B. electron

C. 1 & 2

D. none

Answer: C

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63. Line spectrum of Li^{+2} and He^{+} are identical due to

A. Both are cations

B. Both have same no of protons

C. Isoelectronic species produce identical spectrum

D. none

Answer: C

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C.W.Q.(H.W)

1. Which of the following is not a fundamental particle

A. Proton

B. Neutron

C. α-particle

D. Electron

Answer: C

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2. Magnitude of deflection of cathode rays in discharge tube is more when

A. Magnitude of charge of the particle is more

B. Greater interaction with the electric or magnteic field

C. Less mass of the particle

D. All the above

Answer: D

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3. The constancy of e/m ratio for electron shows that

A. Electrons mass is $\frac{1}{1837}th$ of mass of proton

B. Electrons are universal particles of all metter

C. Electrons are produced in discharge tube only

D. None of these

Answer: B

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4. The $\frac{e}{m}$ value of electron is

A. $1.76 \times 10^{-11} ckg^{-1}$

B. $1.76 \times 10^{11} ckg^{-1}$

C. $1.76 \times 10^{12} kg^{-1} c$

D. $1.76 \times 10^{13} kg^{-1} c$

Answer: B

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5. When the speed of the electron increases, the specific charge

A. Decreases

B. Increases

C. Remains same

D. None

Answer: A

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6. The nature of anode rays depends upon

A. Nature of gas filled in the discharge tube

B. Nature of electrode

C. Nature of metal

D. None of these

Answer: A

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7. The $\frac{e}{m}$ value of proton is

A. Less than $\frac{e}{m}$ value of electron

B. Equal to $\frac{e}{m}$ value of electron

C. Greater than $\frac{e}{m}$ value of electron

D. All the above

Answer: A

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8. In Rutherford's alpha-rays scattering experiment, the alpha particles are detected using a screen coated with

A. Carbon black

B. Platinum black

C. Zinc sulphide

D. Teflon

Answer: C

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9. Rutherford's experiment on the scattering of α particle showed for the first time that the atom has

A. Nucleus

B. Proton

C. Electron

D. Neutron

Answer: A

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10. When alpha particle are sent through a thin metal foil ,most of them go straight through the foil because

A. Alpha particles are much heavier than electron

B. Alpha particles are positively charged

C. Alpha particles move with high velocity

D. Most part of the atom is empty

Answer: D

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11. Atomic radius is to of the order of 10^{-8} cm and nuclear radius is to order of 10^{-13}cm. Calculate what fraction of atom is occupied by nucleus.

A. $10^{-13} \times$ atomic volume

B. $10^{-14} \times$ atomic volume

C. $10^{-15} \times$ atomic volume

D. $10^{-16} \times$ atomic volume

Answer: C

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12. The lightest radioactive isotope in periodic table is

A. Tritium

B. Deuterium

C. Protium

D. All the above

Answer: A

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13. Isotopes exhibits similar

A. Physical properties

B. Chemical properties

C. Physical and chemical

D. Neither physical nor chemical properties

Answer: B

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14. Among $._{10}A^{20}._{11}B^{21}._{11}C^{22}$ and $._{122}D^{22}$ the isobar combination is

A. A & B

B. B & C

C. C & D

D. A & D

Answer: C

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15. The hydride ion is isoelectronic with Electromagnetic Radiation

A. H^{+}

B. He^{+}

C. He

D. Be

Answer: C

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16. Which of the following statements is not correct regarding electromagnetic spectrum?

A. The velocity of X-rays is more than that of microwaves

B. Infra-red radiations have larger wavelength than cosmic rays

C. The frequency of microwaves is less than that of ultra-violet rays

D. X-rays have larger wave number the micro waves

Answer: A

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17. The radiation with highest wave number

A. Micro waves

B. X-rays

C. I.R. Radiations

D. Radiowaves

Answer: B

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18. The energy of photon is inversely proportional to its

A. Wavelength

B. Frequency

C. Wavenumber

D. valency

Answer: A

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19. The value of planck's constant is

A. $6.6256 \times 10^{-27} Js$

B. $6.6256 \times 10^{-34} Js$

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

D. $1.6 \times 10^{-19} Js$

Answer: B

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20. The ratio of energy of frequency electromagnetic radiation is called

A. Bohr's constant

B. Rydberg's constant

C. Planck's constant

D. Ritz constant

Answer: C

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21. The minimum energy required to eject an electron from an atom is called

A. Kinetic energy

B. Electrical energy

C. Chemical energy

D. Work function

Answer: D

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22. In photoelectric effect, the number of photoelectrons emitted is proportional to :

A. Intensity of incident beam

B. Frequency of incident beam

C. Wavelength of incident beam

D. All

Answer: A

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23. The kinetic energy of the ejected electrons in photoelectric effect is

A. Directly proportional to the frequency of the incident radiation

B. Inversely proportional to the frequency of the incident radiation

C. Not related to the frequency of the incident radiation

D. All the above

Answer: A

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24. Photo electric effect is not observed in case of

A. Potassium

B. Rubidium

C. Magnesium

D. Cesium

Answer: C

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25. The spectrum with all wavelengths may be

A. Absorption spectrum

B. Emission spectrum

C. Continuous spectrum

D. Discontinuous spectrum

Answer: C

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26. Line spectrum is characteristic of

A. Atoms

B. Molecules

C. Any substance in the solid state

D. Any substance in the liquid state

Answer: A

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27. Atoms can nto give

A. Absorption spectrum

B. Line spectrum

C. Band spectrum

D. Atomic spectrum

Answer: C

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28. The hydrogen line spectrum provides evidence for the

A. Heisenberg uncertainty principle

B. Wave-like properties of light

C. Diatomic nature of H_2

D. Quantized nature of atomic energy states

Answer: D

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29. If R_H is the Rydberg constant, then the energy of an electron in the ground state of Hydrogen atom is

A. R_H/C

B. $R_H h/C$

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

D. $R_H hc$

Answer: D

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30. According to Bohr's theory energy is ...when an electron moves from a lower to a higher orbit.

A. Adsorbed

B. Emitted

C. No change

D. Both 1 and 2

Answer: A

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31. The basic assumption of Bohrs Model of hydrogen atom is that

A. The energy of the electron is quantised

B. The angular momentum of the electron is quantised

C. The radial distance of the electron is quantised

D. The orbital velocity of the electron is quantised

Answer: C

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32. The radius of an orbit in hydrogen atom is equal to

A. $n^2h^2/4\pi^2mZe^2$

B. $2\pi Ze^2/nh$

C. $2\pi^2mZ^2e^4/n^2h^2$

D. $-2\pi^2mZ^2e^2/n^2h^2$

Answer: A

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33. The total energy of the electron in any orbit of one electron containing species is given by the expression

A. $-e^2/r^2$

B. $-n^2h^2/2\pi^2Z^2e^4m$

C. $-2\pi^2mZ^2e^4/n^2h^2$

D. $nh/2\pi$

Answer: C

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34. The total energy of the electron revolving round the nucleus is

A. zero

B. less than zero

C. More than zero

D. In some atoms less thanzero and in cerain atoms more than zero

Answer: B

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35. Bohr's model of atom can explain the spectrum of all except de-Broglie's And Heisenberg Uncertainity Principle

A. H

B. He^{+}

C. Li^{+2}

D. He

Answer: D

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36. The momentum of electron is

A. Directly proportional to wave length

B. Inversely proportional to wave number

C. Inversly propotional to wave length

D. Unable to be determined

Answer: C

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37. The de Broglie wavelength relates to applied voltage as:

A. $\lambda = \frac{12.3}{\sqrt{h}}\overset{0}{A}$

B. $\lambda = \frac{12.3}{\sqrt{V}}\overset{0}{A}$

C. $\lambda = \frac{12.3}{\sqrt{E}}\overset{0}{A}$

D. Both (2) and (3)

Answer: B

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38. According to de Broglie's concept, the circumference of an orbit which must be equal to

A. Diameter of a electron

B. The wave length of an electron

C. The integral no of electron wavelength

D. Planck's constant divided by 2

Answer: C

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39. The quantum number not obtained from the schrodinger's wave equation is

A. n

B. l

C. m

D. s

Answer: D

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40. Which of the following expression respresents the electron probability function (D)?

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

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

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

D. $4\pi r dr \psi$

Answer: C

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41. The probability of finding an electron in an orbital is approximately?

A. 95 %

B. 50 %

C. 60 %

D. 25 %

Answer: A

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42. Which one of the following atomic orbitals is not directed along the axis?

A. P_x

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

C. d_{xy}

D. d_{z^2}

Answer: C

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43. Total number of orbitals associated with thrid shell will be.....

A. 2

B. 4

C. 9

D. 3

Answer: C

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44. The azimuthal quantum number of a non-directional orbital is

A. 0

B. 1

C. -1

D. $+1/2$

Answer: A

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45. The shape of the orbital is determined by

A. Radial wave function

B. Angular wave function

C. Magnetic quantum number

D. Spin quantum number

Answer: B

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46. When the azimuthal quantum number l = 1, the shape of the orbital will be

A. Spherical

B. Dumb bell

C. Double dumb bell

D. Highly complicated

Answer: B

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47. The m value not possible for a double dumbell shaped orbital is

A. 0

B. -2

C. $+3$

D. -1

Answer: C

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48. The quantum number which determines the energy of a sublevel is

A. n

B. l

C. Both n and l

D. Neither n nor l

Answer: C

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49. The sub-energy level having minimum energy is

A. 3d

B. 5p

C. 4s

D. 4p

Answer: C

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50. The quantum number that was proposed to explain the Zeeman effect is

A. m

B. l

C. s

D. n

Answer: A

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51. Orbital angular momentum depends on ....

A. l

B. n and l

C. n and m

D. m and s

Answer: C

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52. The angular momentum of an electron due to its spin is given as ....

A. $\sqrt{s(s+1)}\frac{h}{2\pi}$

B. $s(s+1)\frac{h}{2\pi}$

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

D. $s(s+1)\frac{2\pi}{h}$

Answer: A

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53. According to aufbau principle the electron has a tendency to occupy that subshell which has.....energy.

A. Lowest

B. Highest

C. No energy

D. Both 1 and 2

Answer: A

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54. The statement "No two electrons in an atom can have all the four quantum numbers identical" is known as the....

A. Pauli's exclusion principle

B. Aufbau principle

C. Hund's rule

D. Heisenberg's principle

Answer: A

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55. The electronic configuration of an element is $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$ .This represents its

A. Excited state

B. Ground state

C. Cationic form

D. Gnionic form

Answer: B

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56. The orbital configuration of $._{24}Cr$ is $3d^5 4s^1$. The number of unpaired electrons in $Cr^{3+}(g)$ is

A. 1

B. 2

C. 3

D. 4

Answer: C

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LEVEL-I(H.W)

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

A. $+1$

B. -1

C. -2

D. None

Answer: B

Watch Video Solution

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

(a) $._{32}^{77}Ge$

(b).$_{33}^{77}As$

(c).$_{34}^{77}Se$

(d).$_{34}^{78}Se$

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

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

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

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

Answer: B

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6. The number of neutrons in deuterium is

A. 2

B. 3

C. 5

D. 1

Answer: D

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7. Identify the incorrectly matched set from the following

A. $\begin{array}{ll} listI & listII \\ \text{Wavelength} & \text{Naometers} \end{array}$

B. $\begin{array}{ll} listI & listII \\ \text{Frequency} & \text{Hertz} \end{array}$

C. $\begin{array}{ll} listI & listII \\ \text{Wavenumber} & m^{-1} \end{array}$

D. $\begin{matrix} list I & list II \\ \text{Velocity} & \text{ergs} \end{matrix}$

Answer: D

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8. 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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9. 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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10. 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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11. 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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12. 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

Watch Video Solution

13. 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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14. 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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15. 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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16. 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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17. 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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18. As the orbit number increase , the distance between two consecutive orbits in an atom or ion having single electron:

A. Increases

B. Decreases

C. Remains constant

D. First increases followed by a decreases

Answer: A

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19. 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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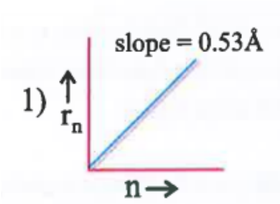
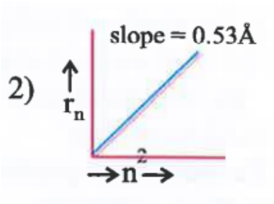
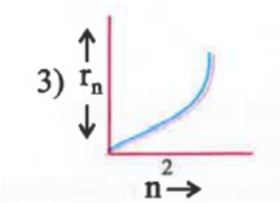
20. Which of the following curves may represent the radius of orbit (r_n) in H-atoms as a function of principal quantum number (n)

A. 

B. 

C. 

D. None of these

Answer: B

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21. 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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22. 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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23. 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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24. 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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25. Which of the following statements is not correct?

A. The wave function depicting the dependence on r involves two quantum numbers n and 1

B. The wave function depicting the angular dependence involves two quantum numbers 1 an 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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26. 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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27. 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 the these

Answer: D

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28. 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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29. 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 is a $90 - 95\%$ probability of finding all the electrons of an atom

D. An orbital is characterized by 3 quantum numbers n,1 andm

Answer: C

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30. 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 only

D. ψ is proportional to the probability of finding an electron

Answer: D

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31. 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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32. For the azimuthal quantum number 'I' 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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33. 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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34. 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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35. 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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36. 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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37. The orbital with lowest energy in which an electron with Azimuthal quantum no value 3 is

A. 4

B. 5

C. 7

D. 6

Answer: A

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38. 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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39. 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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40. 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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41. Which of the following arrangements of electron is mostly likely to the stable ?

A. ` `

B.

C.

D.

Answer: C

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42. 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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43. 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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44. The atomic number at which filling of a g-orbitals is likely to begin is:

A. 121

B. 116

C. 106

D. 124

Answer: A

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45. 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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46. 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. $3:5$

Answer: A

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47. 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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48. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$ is not the electron configuration of

A. Mn^{3+}

B. Fe^{3+}

C. Cr^{+}

D. Co^{4+}

Answer: A

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49. 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 mV/h

C. The principal quantum numeber (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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50. 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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51. 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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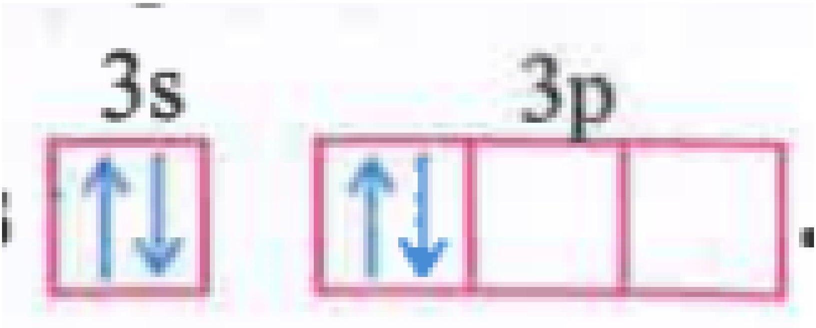
52. The electronic configuration in the valence shell of silicon is



. The rule violated is

A. Auf-bau principle

B. Pauli's rule

C. Hund's rule

D. All

Answer: C

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53. 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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LEVEL-II(H.W)

1. Which has highest specific charge?

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

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

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

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

Answer: D

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2. Alpha-particles are projectied towards the nuclei of 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. $Al(Z = 13)$

Answer: D

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3. The mass number of three isotopes of an element are $11, 12$ and 13 .Their percentage ohandances $80, 15$ and 5, respectively .What is the atomic weight of the element ?

A. 10.25

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. $1.99 \times 10^{-17} J$

C. $1.99 \times 10^{-17} ergs$

D. $1.99 \times 10^{-18} ergs$

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. $99.384 \times 10^{-30} J$

B. $993.84 \times 10^{-30} J$

C. $9.9384 \times 10^{-30} J$

D. $0.99384 \times 10^{-30} J$

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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11. In photo electric effect, the energy 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. $6.4 \times 10^{-19} J$

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

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

D. $6.4 \times 10^{-20} J$

Answer: C

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12. 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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13. 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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14. 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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15. 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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16. 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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17. 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. 91.2nm

Answer: D

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18. A gas of mono atomic hydrogen is excited by an energy of $12.75 eV/\text{atom}$. 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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19. 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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20. 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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21. If the diameter of carbon atom is $0.15 nm$, the number of carbon atoms which can be placed side by side is a straight line across length of $10.0 cm$ is

A. 66.66×10^7

B. 66.66×10^8

C. 6.2×10^9

D. 1.33×10^7

Answer: A

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22. 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. $-1.09 \times 10^{-18} J$

B. $-2.18 \times 10^{-18} J$

C. $-4.36 \times 10^{-18} J$

D. $-5.45 \times 10^{-19} J$

Answer: D

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23. 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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24. 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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25. 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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26. 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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27. 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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28. 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. $2.9 \times 10^{-2} cm$

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

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

Answer: B

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

A. $7.2 \times 10^{5} cm/\sec$

B. $72 \times 10^{5} cm/\sec$

C. $7.2 \times 10^{4} cm/\sec$

D. $3.6 \times 10^{5} cm/\sec$

Answer: A

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

A. $1/100 m$

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

C. $1.32 \times 10^{-35} m$

D. $6.6 \times 10^{-28} m$

Answer: C

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32. A microscope using suitable photons is employed to an electron in an atom within a distance of $0.1 Å$. What is the uncertainty involved in the measurment of its velocity? Mass of electron $= 9.11 \times 10^{-31} kg$ and $h = 6.626 \times 10^{-34} Js$

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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33. The mass of photon moving with the velocity of $3 \times 10^8 m/\sec$ with wave length $3.6A^\circ$ 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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34. 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. 0.332pm

B. 313pm

C. 3.32 pm

D. 3.13pm

Answer: A

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35. 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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36. An electron, a proton and an alpha particle have KE 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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37. 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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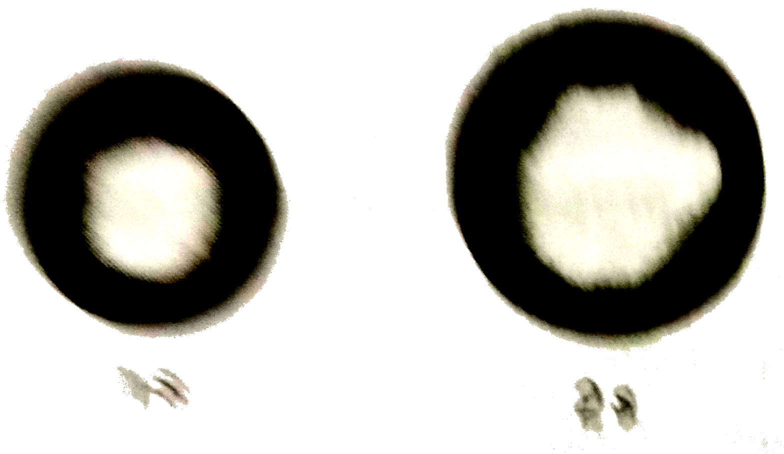
38. The probability density plots of 1 s and 2s orbitals are given in figure.



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. 1s and 2s orbitals are spherical in sjape

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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39. 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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40. Which of the following combinations of quantum numbers is possible for a $4p$ orbital?

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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41. 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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42. The quatum numbers $+\frac{1}{2}$ and $-\frac{1}{2}$ 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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43. The correct set of quantu numbers for the unpaired electron of Chlorine atom

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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44. The quantum number which explain the line spectra observed as doublets in case of hydrogen and alkali metals and doublets & triplets in case of alkaline earth metals is

A. Spin

B. Azimuthal

C. Magnetic

D. Principle

Answer: A

View Text Solution

45. 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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46. A compound of vanadium has a magnetic moment of $1.73BM$. Work out the electronic configuration of vanadium in the compound

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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47. 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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48. 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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LEVEL -V

1. Rutherfords experiments , which established the nuclear model of atom , used a beam of:-

A. β-particles, which impinged on a metal foil and got abosorbed

B. γ-rays, which impinged on a metal foil and ejected electrons

C. Helium atoms, which impinged on a metal foil and got scattered

D. Helium nuclei, which impinged on a metal foil and got scattered

Answer: D

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2. One quantum is absorbed per molecule of gaseous iodine for converting into iodine atoms. If light absorbed has wavelength of $5000A^{\circ}$, The energy required in $kJmol^{-1}$ is

A. 139

B. 239

C. 23.9

D. 60

Answer: B

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3. A near ultraviolet photon of 300 nm is absorbed by a gas and then reemitted as two photons. One photon is red with wavelength 760 nm. The wavelength of the second photon is (in nm)

A. 49.6

B. 496

C. 24.48

D. 99.2

Answer: B

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4. When the frequency of light incident an a metallic plate is doubled , the KE of the emitted photoelectrons will be :

A. Doubled

B. Halved

C. Increased out more than doubled of the previous KE

D. Remains unchanged

Answer: C

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5. If $10^{-17} J$ of energy from monochromatic light is needed by the interior of the human eye to see an object. How many photon of green light $\lambda = 550 nm$ are needed to generate this min amount of energy ?

A. 27

B. 28

C. 29

D. 30

Answer: B

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6. A 1-kW radio transmitter operates at a frequency of 880 Hz. How many photons per second does it emit?

A. 1.71×10^{21}

B. 1.71×10^{30}

C. 6.02×10^{23}

D. 1.71×10^{33}

Answer: D

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

A. Inference

B. $E = mc^2$

C. Diffraction

D. $E = hv$

Answer: D

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8. Electronmagnetic radiations having $\lambda = 310\text{Å}$are subjected to a metal sheet having work function $= 12.8eV$. What will be the velocity of photoelectrons with maximum Kinetic Energy....

A. 0, no emission will occur

B. $4.352 \times 10^6 m/s$

C. $3.09 \times 10^6 m/s$

D. $8.72 \times 10^6 m/s$

Answer: C

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9. The ratio of slopes of $K_{\max}$ vs. V and V_0 vs. v curves in the photoelectric effect gives (v= freqency. $K_{\max}$= maximum kinetic energy, V_0=stopping potential) :

A. Charge of electron

B. Planck's constant

C. Work function

D. The ratio of Planck's constant of electronic charge

Answer: A

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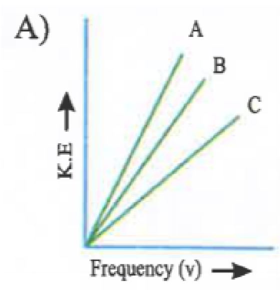
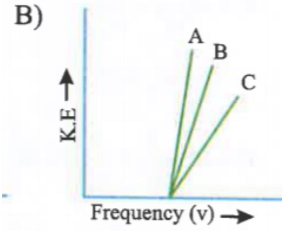
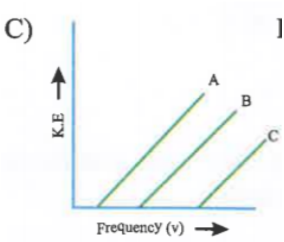
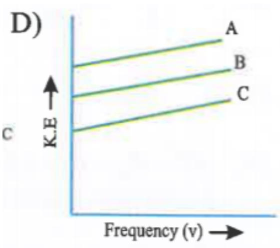
10. Photoelectron emission is observed for three different metals A,B and C. the kinetic energy of the fastest photoelectrons versus frequency 'v' is plotted for each metal. Which of the following graphs can be observed?

A. 

B. 

C. 

D. 

Answer: C

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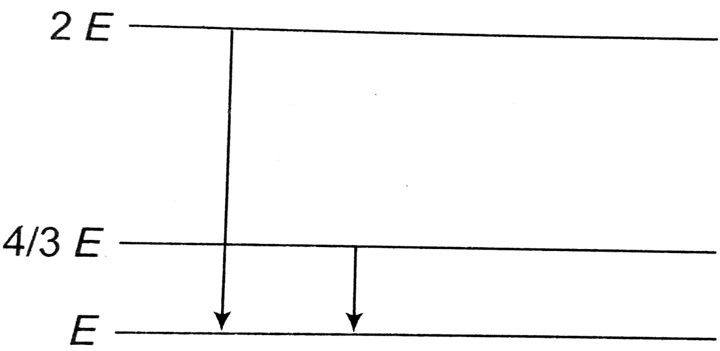
11. The follwing diagram indicates the energy levels of a certain atom when the system moves from $2E$ level to E, a photon of wavelength λ is emitted. The wavelength of photon produced during its transition from

$\frac{4E}{3}$ level to E is



A. $\frac{\lambda}{3}$

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

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

D. 3λ

Answer: D

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12. Which of the following postulates does not belong to Bohr's model of the atom?

A. Angular momentum of electron is an integral multiple of $\frac{h}{2\pi}$

B. The electron stationed in the orbit is stable

C. The path of an electron is circular

D. Mass of electron increases with increases velocity

Answer: D

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13. The mass of an electron is m, charge is e and it is accelerated from rest through a potential difference of V volts. The velocity acquired by electron will be

A. $\sqrt{\frac{2eV}{m}}$

B. $\sqrt{\frac{eV}{m}}$

C. $\sqrt{\frac{V}{m}}$

D. $\sqrt{\frac{eV}{2m}}$

Answer: A

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14. In two individual hydrogen atoms electrons move around the nucleus in circular orbits of radii R and 4R. The ratio of the time taken by them to complete one revolution is:

A. $1:4$

B. $4:1$

C. $1:8$

D. $8:7$

Answer: C

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15. The difference in angular momentum associated with electron in two successive orbits of hydrogen atom is:

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

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

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

D. $(n+1)\frac{h}{2\pi}$

Answer: B

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16. The ionization energy of a hydrogen atom in terms of Rydberg constant $\left(R_H\right)$ is given by the expression

A. $R_H hc$

B. $R_H c$

C. $2R_H hc$

D. $R_H hcN_A$

Answer: A

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17. If the wavelength of series limit of Lyman series for He^+ ions is $x\overset{0}{A}$, then what will be the wavelength of series limit of Balmer series for Li^{+2} ion?

A. $\frac{9x}{4}\overset{0}{A}$

B. $\frac{16x}{9}\overset{0}{A}$

C. $\frac{5x}{4}\overset{0}{A}$

D. $\frac{4x}{9}\overset{0}{A}$

Answer: B

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18. The potential energy of an electron in the hydrogen atom is -6.8 eV. Indicate in which excited state, the electron is present?

A. first

B. second

C. third

D. fourth

Answer: A

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19. What is the potential energy of an electron present in N - shell of the Be^{3+} ion ?

A. $-3.4eV$

B. $-6.8eV$

C. $-13.6eV$

D. $-27.2eV$

Answer: D

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20. The distance between $4th$ and $3rd$ Bohr orbits of He^{+} is :

A. $2.645 \times 10^{-10} m$

B. $1.322 \times 10^{-10} m$

C. $1.851 \times 10^{-10} m$

D. $6.8 \times 10^{-10} m$

Answer: C

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21. The ratio of velocity of the electron in the third and fifth orbit of Li^{2+} would be :

A. $3:5$

B. $5:3$

C. $25:9$

D. $9:25$

Answer: B

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22. If in Bohr's model, for unielectronic atom, time period of revolution is represented as $T_{n,z}$ where n represents shell no. and Z represents atomic number then the value of $T_{1,2}:T_{2,1}$, will be :

A. $8:1$

B. $1:8$

C. $1:1$

D. $1:32$

Answer: D

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23. The ionization potential for the electron in the ground state of the hydrogen atom is 13.6 eV atom^{-1}. What would be the inization potential for the electron in the first excited state of Li^{+} ?

A. $3.4eV$

B. $10.2eV$

C. $30.6eV$

D. $6.8eV$

Answer: C

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24. The mass of a proton is 1836 times more than the mass of an electron. It a sub-atomic of mass $(m)207$ times the mass of electron is captured by the nucleus, then the first ionization potential of H:

A. decreases

B. increases

C. remains same

D. may be decrease or increase

Answer: B

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25. The energy of an electron moving in n^{th} Bohr's orbit of an element is given by $E_n = \frac{-13.6}{n^2} Z^2$ eV/ atom (Z=atomic number). The graph of E vs. Z^2 (keeping "n" constant) will be :

A. 

B.

C.

D.

Answer: B

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26. Potential energy of electron present in He^+ is:

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

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

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

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

Answer: C

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27. The velocity of an e in excited state of H-atom is $1.093 \times 10^{6} m/s$, what is the circumference of this orbit?

A. $3.32 \times 10^{-10} m$

B. $6.64 \times 10^{-10} m$

C. $13.30 \times 10^{-10} m$

D. $13.28 \times 10^{-8} m$

Answer: C

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28. The energy of a I,II and III energy levels of a certain atom are $E, \frac{4E}{3}$ and 2E respectively. A photon of wavelength λ is emitted during a transition from III to I. what will be the wavelength of emission for II to I?

A. $\frac{\lambda}{2}$

B. λ

C. 2λ

D. 3λ

Answer: D

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29. The angular momentum of an electron in a hydrogen atom is proportional to

A. $\frac{1}{\sqrt{r}}$

B. $\frac{1}{r}$

C. r^2

D. $\sqrt{r}$

Answer: A

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30. The number of revolutions made by electron in Bohr's 2nd orbit of hydrogen atom is

A. 6.55×10^{-15}

B. 8.2×10^{14}

C. 1.64×10^{15}

D. 2.62×10^{16}

Answer: B

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31. Ratio of frequency of revolution of electron in the second state of $He^{\oplus}$ revolution of electron in the second state $He^{\ominus}$ and second state of hydrogen is

A. $\frac{32}{27}$

B. $\frac{27}{32}$

C. $\frac{1}{54}$

D. $\frac{27}{2}$

Answer: A

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32. Which of the following variant of hydrogen spectrum results from nuclear spin interaction with that of electron?

A. Fine spectrum

B. Stark effect

C. Zemann effect

D. Hyperfine spectrum

Answer: D

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33. If the 2nd excitation potential for a Hydrogen like atom in a simple is $108.9V$. Then the series limit of the paschen series for this atom is:

A. R_H

B. $\frac{R_H}{3^2}$

C. $\frac{3^2 R_H}{4^2}$

D. $3^2 R_H$

Answer: A

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34. Let v_1 be the frequency of series limit of Lyman series, v_2 the frequency of the first line of Lyman series and v_3 the frequency of series limit of Balmer series. Then which of the following is correct ?

A. $u_1 - u_2 = u_3$

B. $u_2 - u_1 = u_3$

C. $u_3 = \frac{1}{2}(u_1 - u_3)$

D. $u_1 + u_2 = u_3$

Answer: A

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

A. electron

B. proton

C. neutron

D. particle

Answer: A

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36. If λ_1 and λ_2 denote the de-Broglie wavelength of two particles with same masses but charges in the ratio of $1:2$ after they are accelerated from rest through the same potential difference, then

A. $\lambda_1 = \lambda_2$

B. $\lambda_1 < \lambda_2$

C. $\lambda_1 > \lambda_2$

D. $\lambda_1 < \sqrt{\lambda_2}$

Answer: C

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37. An electron, in a hydrogen like atom , is in excited state. It has a total energy of -3.4 eV, find the de-Broglie wavelength of the electron.

A. 66.5Å

B. 6.66Å

C. 60.6Å

D. 6.06Å

Answer: B

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38. The stationary Bohr's orbit can be readily explained on the basis of wave nature of electron if its is assumed that

A. Wave in any of the orbits is the stationary wave

B. The position of maxima and minima of wave does not change with time

C. The length of the circular orbit must be an integral multiple of the wavelength

D. wave in any of the orbit is not stationary wave

Answer: C

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39. Consider the following statements regarding Sommerfeld's model. Select the correct statement/s.

A. Around the nucleus, some of the paths are elliptical and others are circular

B. When an electron revolves around the nucleus in a circullar path, the angle of rotation is changed.

C. Both, angle of rotation and distance from the nucleus, are charged when an electron revolves in an ellptical path.

D. All are correct

Answer: D

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40. The mass of a particle is $10^{-10} g$ and its radius is $2 \times 10^{-4} cm$. If its velocity is $10^{-6} cm \sec^{-1}$ with 0.0001% uncertainty in measurement, the uncertainty in its position is :

A. $5.2 \times 10^{-8} m$

B. $5.2 \times 10^{-7} m$

C. $5.2 \times 10^{-6} m$

D. 5.2×10^{-9}

Answer: A

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41. Which of the following graphs correctly represents the variation of particle momentum with associated de Broglie wavelength?

A. 

B. 

C.

D.

Answer: D

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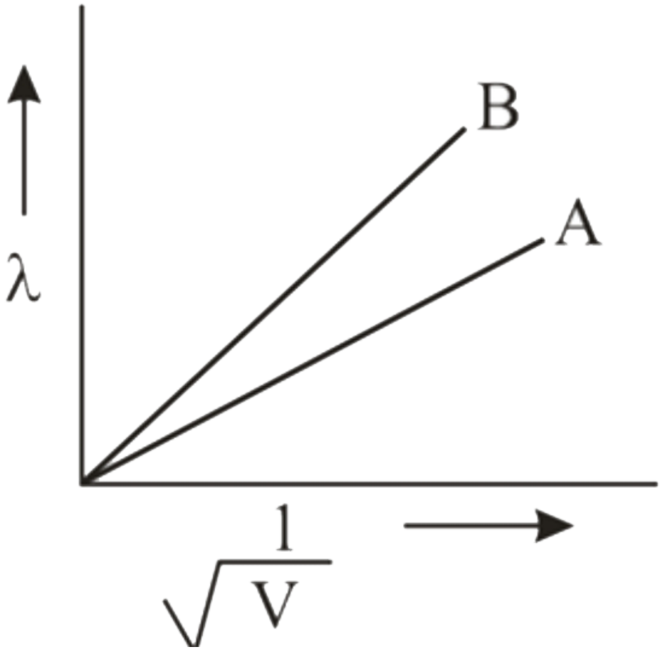
42. de Broglie wavelengths of two particles A and B are plotted against $\left(\frac{1}{\sqrt{V}}\right)$, where V is the potential on the particles. Which of the following relation is correct about the mass of the particles ?



A. $m_A = m_B$

B. $m_A > m_B$

C. $m_A < m_B$

D. $m_A \leq m_B$

Answer: B

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43. A proton and an alpha particle are accelerated through the same potential difference. The ratio of the wavelengths associated with the proton to that associated with the alpha particle is

A. 4

B. 2

C. $\sqrt{8}$

D. $\frac{1}{\sqrt{8}}$

Answer: C

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44. The ratio of orbital angular momentum and spin angular momentum of an electron in 'p' orbital is

A. $\frac{3}{2}$

B. $\sqrt{\frac{3}{2}}$

C. $\frac{2\sqrt{2}}{\sqrt{3}}$

D. $\sqrt{\frac{2}{3}}$

Answer: C

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45. Probability of finding the electron ψ^2 of 's' orbital does not depend upon

A. distance from the nucleus (r)

B. energy of 's' orbital

C. principal quantum number

D. azimuthal quantum number

Answer: C

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46. The orbital angular momentum of an electron in $2s$-orbital is

A. $\frac{h}{4\pi}$

B. zero

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

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

Answer: B

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47. The subshell that arises after f is called the g subshell.How many electrons may occupy the g subshell?

A. 9

B. 7

C. 5

D. 18

Answer: D

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48. The quantum numbers of most energetic electron in Ar atom when it is in first excited state is

A. $2, 1, 0, \pm 1/2$

B. $4, 1, 1, \pm ½$

C. $4, 0, 0, \pm 1/2$

D. $4, 1, 0, \pm 1/2$

Answer: C

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49. For a 'd' electron, the orbital angular momentum is $\left(\hbar = \frac{h}{2\pi}\right)$

A. $\sqrt{6}\hbar$

B. $\sqrt{2}\hbar$

C. h

D. 2h

Answer: A

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50. The quatum numbers $+\frac{1}{2}$ and $-\frac{1}{2}$ for the electron spin represent

A. Rotation of the electron in clockwise and anticlockwise direction respectively

B. Rotation of the electron in anticlockwise and clockwise direction respectively

C. Magnetic moment of the electron pointing up and down respectively

D. Two quantum mechanical spin states which have no classical analogue

Answer: D

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51. The Schrodinger wave equation for hydrogen atom is $\Psi_{2s} = \frac{1}{4\sqrt{2\pi}}\left(\frac{1}{a_0}\right)^{3/2}\left(2 - \frac{r}{a_0}\right)e^{-r/a_0}$, where a_0 is Bohr's radius . If the radial node in 2s be at r_0 , then r_0 would be equal to :

A. $\frac{a_0}{2}$

B. $2a_0$

C. $\sqrt{2}a_0$

D. $\frac{a_0}{2}$

Answer: B

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52. For a 'f' electron the orbital angular momentum is

A. $\sqrt{12}\frac{h}{\pi}$

B. $\sqrt{6}\frac{h}{\pi}$

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

D. $\sqrt{15}\frac{h}{\pi}$

Answer: C

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53. If $0.52\overset{0}{A}$ is Bohr's radius for the first orbit. It sugges in the light of the wave mechanical model that

A. the product of ψ^2 and $4\pi r^2 dr$ increase till it reaches at the distance of $0.53\overset{0}{A}$ for s-electron

B. only ψ^2 goes on increasing, $4\pi r^2 dr$ remains constant till it reaches at the distance of $0.53\overset{0}{A}$

C. ψ^2 goes on increasing, $4\pi r^2 dr$ goes on decreasing till it reached at the distance of $0.53\overset{0}{A}$

D. only $4\pi r^2 dr$ goes on increasing, ψ^2 remains constant till it reaches at the distance of $0.53\overset{0}{A}$

Answer: A

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54. Magnetic moments of $V(Z = 23), Cr(Z = 24), Mn(Z = 25)$ are x,y,z. HencE:

A. $x = y = z$

B. $x < y < z$

C. $x < z < y$

D. $z < y < x$

Answer: C

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55. The value of the magnetic moment of a particular ion is 2.83 Bohr magneton. The ion is :-

(a). Fe^{2+}

(b). Ni^{2+}

(c). Mn^{2+}

(d). Co^{3+}

A. Fe^{2+}

B. Ni^{2+}

C. Mn^{2+}

D. Co^{3+}

Answer: B

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56. If nitrogen atoms had el,ectonic configuration is ? It would have energy lower than that of the nornal ground state configuration $1s^2 2s^2 2p^3$ because the electrons would be clear to the nucleus yet $1s^2$ is not oberved because it violates ?

A. Heisenberg uncertainty principle

B. Hund's rule

C. Pauli exclusion principle

D. Bohr postulate of stationary orbits

Answer: C

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57. If the subsidiary quantum number of a subenergy level is 4, the maximum and minimum values of the spin multiplicities are:

A. 9,1

B. 10,1

C. 10,2

D. 4,-4

Answer: B

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58. The orbital diagram in which both Pauli's exclusion principle and Hund's rule are violated , is :

A.

B.

C.

D.

Answer: D

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59. When alpha particle are sent through a thin metal foil ,most of them go straight through the foil because

A. alpha particles are much heavier than electron

B. alpha particles are positively charged

C. most part of the atom is empty space

D. alpha particle move with high velocity

Answer: A::C

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60. Many elements have non-integral atomic masses because

A. they have isotopes

B. their isotopes have non-integral masses

C. their isotopes have different masses

D. the cosstituents, neutrons, protons and electron combine to give fractional masses

Answer: A::C

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61. Which statement about cathode rays is/are correct?

A. They travel in straight lines towards cathode

B. They produce fluorescent discharge through the walls of the tube

C. They produce heating effect

D. They can affect photographic plate

Answer: B::C::D

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62. Which of the following statement concerning Bohr's model is /are true ?

A. Predicts that probability of electron near nucleus is more

B. Angular momentum of electron is H-atom $= \frac{nh}{2\pi}$

C. Introduces the idea of stationary states

D. Explain line spectrum of hydrogen

Answer: B::C::D

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63. In Rutherford's gold foil experiment, the scattering of α-particles takes place. In this process:

A. coulombic force is involved

B. nuclear force is involved

C. path of α-particle is parabolic

D. path of α-particle is hyperbolic

Answer: A::D

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64. Choose the correct statement(s) regarding the photo-electric effect.

A. No electrons are ejected, regardless of the intensity of the radiation, unless the frequency exceeds a thershold value characteristic of the metal

B. The kinetic energy of the ejected electrons varies linearly with the frequency of the incident radiation and its intensity

C. Even at low intensities, electrons and ejected immediately if the frequency is above the threshold value

D. An intense and a weak beam of monochromatic radiations differ in having number of photons and not in the energy of photons

Answer: A::C::D

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65. The energy of an electron in the first Bohr orbit of H atom is $-13.6eV$ The potential energy value (s) of excited state(s) for the electron in the Bohr orbit of hydrogen is(are)

A. $-3.4eV$

B. $4.2eV$

C. $-6.8eV$

D. $+6.8eV$

Answer: A

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66. In which of the following conditions the de Broglie wavelength of particle A will be less than that of particle $B(m_A > m_B)$?

A. Linear momentum of these particles are same

B. Move with same speed

C. Move with same kinetic energy

D. have fallen through same height

Answer: B::D

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67. Which of the following quantum numbers is/are not allowed?

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

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

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

D. $n = 5, l = 2, m = -1$

Answer: B::C

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68. Which represent a possible arrangement?

A. $\begin{matrix} n & l & m & s \\ 3 & 2 & -2 & \pm 1/2 \end{matrix}$

B. $\begin{matrix} n & l & m & s \\ 4 & 0 & 0 & \pm 1/2 \end{matrix}$

C. $\begin{matrix} n & l & m & s \\ 3 & 2 & -3 & \pm 1/2 \end{matrix}$

D. $\begin{matrix} n & l & m & s \\ 5 & 3 & 0 & \pm 1/2 \end{matrix}$

Answer: A::B::D

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69. Which of the following statements is wrong? The probability of finding the electron in p_x orbital is

A. maximum on two opposite sides of the nucleus along x-axis

B. zero at the nucleus

C. same on all the sides around the nucleus

D. zero on the z-axis

Answer: A::B::D

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70. g' sublevel is possible if

A. $n = 5, l = 4$

B. It will have 18 electrons

C. Sublevel will have 9 orbitals

D. It will have 22 electrons

Answer: A::B::C

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71. Choose the correct statement(s):

A. For a particular orbital in hydrogen atom, the wave function may have negative value

B. Radial probability distribution function may have zero value but can never have negative value

C. $3d_{x^2-y^2}$ orbital has two angular nodes and one radial node.

D. yz and xz planes are nodal planes for d_{xy} orbital

Answer: A::B::D

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72. Choose the correct statement(s):

A. Heisenberg's principle is applicable to stationary e^-

B. Pauli's exclusion principle is not applicable to photons

C. For an e^-, the product of velocity and principal quantum number will be independent of principal quantum number

D. Quantum number l and m determine the value of angular wave function

Answer: B::C::D

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73. Select the correct statements about the wave function ψ.

A. ψ need not be real

B. ψ must be single valued, continuous

C. ψ has no physical significance

D. ψ^2 gives the probability density of finding the electrons

Answer: A::B::C::D

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74. Which of the following is/are correct energy order for H-atom?

A. $1s < 2s < 2p < 3s < 3p$

B. $1s < 2s = 2p < 3s = 3p$

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

D. $1s < 2s < 4s < 3d$

Answer: B::C

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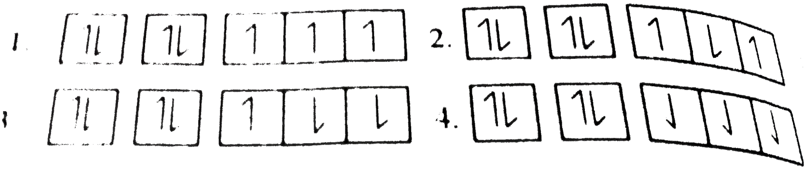
75. Ground state electronic configuration of nitrogen atom can be represented by:



A.

B.

C.

D.

Answer: A::D

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76. STATEMENT-1: The kinetic energy of photo-electrons increases with increase in frequency of incident light were $v > v_o$.

STATEMENT-2: Whenever intenksity of light is increased the number of photo-electron ejected always increases.

A. If both the statement are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1

B. If both the statements are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: B

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77. STATEMENT-1: Half-filled and fully-filled degenerate orbitals are more stable.

STATEMEHNT-2: Extra stabillity is due to the symmetrical distribution of electrons and exchange energy.

A. If both the statement are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-3

B. If both the statements are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-2

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: A

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78. Statement-I : The ground state configuration of Cr is $3d^5 4s^1$.

Because

Statement-II : A set of exactly half filled orbitals containing parallel spin arrangement provide extra stability.

A. If both the statement are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-4

B. If both the statements are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-3

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: A

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79. STATEMENT-1: For hydrogen orbital energy increases as $1s < 2s < 2p < 3s < 3p < 3d < 4s < 4p...$

STATEMENT-2: The orbital with lower $(n + l)$ value has lesser energy and hence filled up first.

A. If both the statement are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-5

B. If both the statements are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-4

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: D

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80. For a single electron atom or ion the wave number of radiation emitted during the transition of electron from a higher energy state $(n = n_2)$ to a lower energy state $(n = n_1)$ is given by the expression:

$$\bar{v} = \frac{1}{\lambda} = R_H \cdot z^2 \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right) \text{ ...(1)}$$

where $R_H = 2\frac{\pi^2 m k^2 e^4}{h^3 c}$ = Rydberg constant for H-atom

Where the terms have their usual meanings. Considering the nuclear motion, the most accurate expression would have been to replace mass of electron (m) by the reduced mass (μ) in the above expression, defined as

$\mu = \frac{m' . m}{m' + m}$ where m' = mass of nucleus

For Lyman series: $n_1 = 1$ (fixed for all the lines)

while $n_2 = 2, 3, 4...$ for successive lines i.e. $1^{st}, 2^{nd}, 3^{rd}...$ lines, respectively.

For Balmer series: $n_1 = 2$ (fixed for all the lines) while $n_2 = 3, 4, 5...$ for successive lines.

The ratio of the wave numbers for the highest energy transition of e^- in Lyman and Balmer series of H-atom is:

A. $4:1$

B. $6:1$

C. $9:1$

D. $3:1$

Answer: A

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81. For a single electron atom or ion the wave number of radiation emitted during the transition of electron from a higher energy state $(n = n_2)$ to a lower energy state $(n = n_1)$ is given by the expression:

$$\bar{\nu} = \frac{1}{\lambda} = R_H . z^2 \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right) \quad ...(1)$$

where $R_H = 2\frac{\pi^2 mk^2 e^4}{h^3 c}$ = Rydberg constant for H-atom

Where the terms have their usual meanings. Considering the nuclear motion, the most accurate expression would have been to replace mass of electron (m) by the reduced mass (μ) in the above expression, defined as

$\mu = \frac{m' . m}{m' + m}$ where m' = mass of nucleus

For Lyman series: $n_1 = 1$ (fixed for all the lines)

while $n_2 = 2, 3, 4...$ for successive lines i.e. $1^{st}, 2^{nd}, 3^{rd}$... lines, respectively.

For Balmer series: $n_1 = 2$ (fixed for all the lines) while $n_2 = 3, 4, 5...$ for successive lines.

If proton in H-nucleus be replaced by positron having the same mass as that of electron but same charge as that of proton, then considering the nuclear motion, the wavenumber of the lowest energy transition of He^+ ion in Lyman series will be equal to

A. $2R_H$

B. $3R_H$

C. $4R_H$

D. R_H

Answer: B

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82. A german physicist gae a principle about the uncertainties in simultaneous measurement of position and momentum of small particles. According to that physicist. It is impossible to measure simultaneously the position and momentum of small particle with absolute accuracy or certainty. if an attempt is made to measure any one of these two quantities with higher accuracy, the other becomes less accurate. The produce of the uncertainty in position (Δx) and uncertainty momentum (Δp) is always constant and is equal to or greater than $h/4\pi$, where h is Planck's constant i.e. $(\Delta x)(\Delta p) \geq \frac{h}{4\pi}$

If uncertainty in position is twice the uncertainty in momentum, then uncertainty in velocity is

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

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

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

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

Answer: D

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83. The uncertainty in the position of an electron $\left(mass = 9.1 \times 10^{-28}g\right)$ moving with a velocity of $3.0 \times 10^4 cms^{-1}$ accurate up to 0.001% will be (Use $\frac{h}{4\pi}$ in the uncertainty expression, where $h = 6.626 \times 10^{-27} erg - s$)

A. $3.84cm$

B. $1.92cm$

C. $7.68cm$

D. $5.76cm$

Answer: B

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84. A german physicist gae a principle about the uncertainties in simultaneous measurement of position and momentum of small particles. According to that physicist. It is impossible to measure simultaneously the position and momentum of small particle with absolute accuracy or certainty. if an attempt is made to measure any one of these two quantities with higher accuracy, the other becomes less accurate. The produce of the uncertainty in position (Δx) and uncertainty momentum (Δp) is always constant and is equal to or greater than $h/4\pi$, where h is Planck's constant i.e. $(\Delta x)(\Delta p) \geq \frac{h}{4\pi}$

If uncertainty in the position of an electron is zero, the uncertainty in its momentum would be

A. zero

B. $< h/4\pi$

C. $> h/4\pi$

D. Infinite

Answer: D

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85. A german physicist gae a principle about the uncertainties in simultaneous measurement of position and momentum of small particles. According to that physicist. It is impossible to measure simultaneously the position and momentum of small particle with absolute accuracy or certainty. if an attempt is made to measure any one of these two quantities with higher accuracy, the other becomes less accurate. The produce of the uncertainty in position (Δx) and uncertainty momentum (Δp) is always constant and is equal to or greater than $h/4\pi$, where h is Planck's constant i.e. $(\Delta x)(\Delta p) \geq \frac{h}{4\pi}$

If uncertainty in momentum is twice the uncertainty in position of an electron then uncertainty in velocity is: $\left[\bar{h} = \frac{h}{2\pi}\right]$

A. $\frac{1}{2m}\sqrt{h}$

B. $\frac{h}{4\pi m}$

C. $\frac{1}{4m}\sqrt{h}$

D. $\frac{1}{m}\sqrt{h}$

Answer: D

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86. In the Rutherford's experiment, a particles were bombarded towards the copper atoms so as to arrives a distance of 10^{-13} metre from the nucleus of copper and then getting either deflected or traversing back. The a-particles did not move further closer

The velocity of the a-particles must be

A. $8.32 \times 10^8 cm/\sec$

B. $6.32 \times 10^8 cm/\sec$

C. $6.32 \times 10^8 m/\sec$

D. $6.32 \times 10^{8} km / \sec$

Answer: B

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87. In the Rutherford's experiment, a particles were bombarded towards the copper atoms so as to arrives a distance of 10^{-13} metre from the nucleus of copper and then getting either deflected or traversing back. The a-particles did not move further closer

The velocity of the a-particles must be

A. $N \alpha \sin\left(+ \frac{\theta}{2}\right)$

B. $N \frac{d\sigma}{d\Omega} \alpha \frac{1}{\sin^{4}\theta}$

C. $N \frac{d\sigma}{d\Omega} \alpha \frac{1}{\sin^{4}(\theta / 2)}$

D. $N = \sin . \frac{\theta}{2}$

Answer: C

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88. In the Rutherford's experiment, a particles were bombarded towards the copper atoms so as to arrives a distance of 10^{-13} metre from the nucleus of copper and then getting either deflected or traversing back. The a-particles did not move further closer

It can also be concluded that the electrostatic potential energy is equal to

A. $\frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r}$

B. $\frac{1}{4\pi\varepsilon_0}\frac{5Ze^2}{mv^2}$

C. $\frac{Ze^2}{r}$

D. mv^2

Answer: A

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89. $L = \sqrt{l(l+1)}\frac{h}{2\pi}$

On the other hand, m determines Z-component of orbital angular momentum as $L_z = m\left(\frac{h}{2\pi}\right)$

Hund's rule states that in degenerate orbitals electron s do not pair up unless and until each such orbital has got an electron with parallel spins.

Besides orbital motion, an electron also possess spin-motion. spin may be clockwise and anti-clockwise. Both thes spin motions are called two spin states of electron characterised by spin. $s = +\frac{1}{2}$ and $s = -\frac{1}{2}$, respectively.

The orbital angular momentum of electron ($l = 1$) makes an angle of $45°$ from Z-axis. The L_z of electron will be

A. $2\left(\frac{h}{2\pi}\right)$

B. $0\left(\frac{h}{2\pi}\right)$

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

D. $3\left(\frac{h}{2\pi}\right)$

Answer: C

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90. It is tempting to think that all possible transition are permissible and that an atomic spectrum arises from the transition of an electron from any initial orbital to any other orbital .However this is not so because a photon a photon has as intrinsic spin angular momentum of $\sqrt{2}h/2\pi$ corresponding to $S = 1$ although it has no charge and no rest mass

On the other hand , an electron has got two type of angular momentum: orbital angular momentum

$L = \left[\sqrt{l(l+1)}\right]h/2\pi$,and spin angular momentum $L_1 = \sqrt{s(s+1)}h/2\pi$ arising from orbital motion and spin motion of the electron during any electronic transition must compensate for the angular momentum carried away by the photon .To satisfy this condition the different between the azimuthal quantum number of the orbital within which the transition take place must differ by 1.thus, an electron in a d-orbital $(l = 2)$ cannot make a transition into as s-orbital $(l = 0)$because the photon cannot carry away enough angular momentum

The maximum orbital angular momentum of an electron with $n = 5$ is

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

B. $\sqrt{6}\frac{h}{2\pi}$

C. $\sqrt{12}\frac{h}{2\pi}$

D. $\sqrt{20}\left(\frac{h}{2\pi}\right)$

Answer: C

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91. The sum of spins of all the electron is the total spins(S) and $(2S + 1)$ is called spin multiplicity of the electronic configuration. Hund's rule defines the ground state configuration of electrons in degenerate orbitals i.e., orbitals within the same sub-shell which have the same values of n and l, states thta in degenerate orbitals pairing of electrons does not occur unless and until all such orbitals are filled singly with their parallel spin. A spinning electron behaves as though it were a tiny bar magnet with poles lying on the axis of spin. The magnetic moment of any atom, ion or molecule due to spin called spin-only magnetic moment (m_s) is given by the formula.

$\mu_s = \sqrt{n(n+2)}B.M$

where $n =$ number of unpaired electron(s)

The spin-only magnetic moment of Cr^{3+}?

A. $\sqrt{3}B.M$

B. $\sqrt{8}B.M$

C. $\sqrt{15}B.M$

D. Zero

Answer: C

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92. The sum of spins of all the electron is the total spins(S) and $(2S+1)$ is called spin multiplicity of the electronic configuration. Hund's rule defines the ground state configuration of electrons in degenerate orbitals i.e., orbitals within the same sub-shell which have the same values of n and l, states thta in degenerate orbitals pairing of electrons does not occur unless and until all such orbitals are filled singly with their parallel spin. A spinning electron behaves as though it were a tiny bar magnet with poles lying on the axis of spin. The magnetic moment of any atom, ion or molecule due to spin called spin-only magnetic moment $\left(m_s\right)$ is given by the formula.

$\mu_s = \sqrt{n(n+2)}B.M$

where $n =$ number of unpaired electron(s)

The spin-multiplicity of $Fe^{3+}\left[Ec = [Ar]3d^5\right)$ in its ground state

A. 6

B. 2

C. 3

D. 4

Answer: A

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93. Spin multiplicity of Nitrogen atom is

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94. The work function (ϕ) of some metals is listed below . The number of metals which will show photoelectric effect when light of 300 nm wavelength falls on the metal is :

Metal	Li	Na	K	Mg	Cu	Ag	Fe	Pt	W
ϕ (eV)	2.4	2.3	2.2	3.7	4.8	4.3	4.7	6.3	4.75

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95. Difference between n^{th} and $(n + 1)^{th}$ Bohr's radius of H atom is equal to it's $(n - 1)^{th}$ Bohr's radius. The value of n is

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96. A single electron system has ionisation energy $11180 KJ \text{mole}^{-1}$. The number of protons in the nucleus of the system is.......

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97. The number of spectral lines produced when an electron jumps from 5^{th} orbit to 2^{nd} orbit in the hydrogen atom is.

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98. 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 :

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99. In a single isolated atom an electron make transition from 5th excited state to 2nd state then maximum number of different types of photons observed is

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100. The number of waves made by a Bohr electron in Hydrogen atom in one complete revolution in the 3^{rd} orbit is.

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101. The minimum number of waves made by an electron moving in an orbit having maximum magnetic quantum number $+3$ is.

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102. The wave function of an orbital is represented as $\psi_{4,2,0}$. The azimuthal quantum number of that orbital is

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103. The radial distribution curve of the-orbital with double dumbbell shape in the 4^{th} principle shell consists of 'n' nodes, n is

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104. A compound of vanadium possesses a magnetic moment of $1.73BM$. The oxidation state of vanadium in this compounds is:

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105. Magnetic moment of M^{x+} is $\sqrt{24}BM$. The number of unpaired electrons in M^{x+} is.

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106. How many d-electrons in $Cu^{+}(At. No = 29)$ can have the spin quantum $\left(-\frac{1}{2}\right)$?

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107. The maximum number of electrons can have pricipal quantum number $n = 3$ and spin quantum number $Mz = -\frac{1}{2}$ is (2011)

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108. $1mol$ of photons each of frequency $250s^{-1}$ would have approximately a total enegry of

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109.

Column I	Column II
$(A)\psi_{310}$	$(p)5f$
$(B)\psi_{120}$	$(q)3p_x$ or $3p_y$
$(C)\psi_{530}$	$(r)3p_z$
$(D)\psi_{311}$	(S)impossible

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110.

	Column I		Column II
(A)	Thomson model of atom	(P)	Electrons are present in extra nu
(B)	Rutherford model of atom	(Q)	Electron in the atom is describe
(C)	Bohr model of atom	(R)	Positive charge is accumulated i
(D)	Schrodinger model of hydrogen atom	(S)	Uniform sphere of positive char

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111.

Column I	Column II
(A)Radial function $\psi_{(r)}$	(p)Principle $Q.\ No.$
(B)Angular function $\psi_{(\theta)}$	(q)Azimuthal $Q.\ No.$
(C)Angular function $\psi_{(\phi)}$	(r)Magnetic $Q.\ No$
(D)Quantized angular momentum	(s)Spin $Q.\ No$
	(t)Shape of orbital

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112.

Column I	*Column II*
(*A*)Radius of n^{th} orbit	(*p*)Inversely proportional to Z
(*B*)Energy of n^{th} orbit	(*q*)Integral multiple of $\frac{h}{2\pi}$
(*C*)Velocity of electron in n^{th} orbit	(*r*)Proportional to n^(2)
(*D*)Angular momentum	(*s*)Inversely proportional to n
	(*t*)Inversely proportional to n^2

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113.

Column I	*Column II*
(Phenomenon related electron)	(Character of the electron).
(*A*)Working of electron microscope	(*p*)Wave nature
(*B*)Photoelectric effect	(*q*)Particle nature
(*C*)Diffraction	(*r*)Particle nature dominates the wave nature
(*D*)Scintillation	(*s*)Wave nature dominates the particle nature

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114.

Column I	Column II
(A) 2p orbital	(p) Number of spherical nodes =0
(B) 3d orbital	(q) Number of nodal plane=0
(C) 2s orbital	(r) Orbital angular momentum number =0
(D) 4s orbital	(s) Azimuthal quantum number =0

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115.

	Column I		Column II
(A)	Orbital angular momentum of an electron	(P)	$\sqrt{s(s+1)}\frac{h}{2\pi}$
(B)	Angular momentum of an electron in an orbit	(Q)	$\sqrt{(n(n+2))}$
(C)	Spin angular momentum of an electron	(R)	$\frac{nh}{2\pi}$
(D)	Magnetic moment of atom	(S)	$\sqrt{\left(l(l+1)\frac{h}{2\pi}\right)}$

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LEVEL -VI

1. α - particles of $6MeV$ energy is scattered back form a silver foil. Calculate the maximum volume in which the entire positive charge fo the atom is supposed to be concentrated. (Z for silver $= 47$)

A. $3.6 \times 10^{-28} m^3$

B. $5.97 \times 10^{-42} m^3$

C. $6.55 \times 10^{-71} m^3$

D. $48 \times 10^{-42} m^3$

Answer: D

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2. An α particle of momentum p is bombarded on the nucleus, the distance of the closest approach is r, if the momentum of α-particle is made to 6p, then the distance of the closest approach becomes

A. $4r$

B. $2r$

C. $16r$

D. $\frac{r}{36}$

Answer: D

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3. When a certain metal was irradiated with a light of $8.1 \times 10^{16} Hz$ frequency, the photoelectron emitted had 1.5 times the kinetic energy as the photoelectrons emitted when the same metal was irradiated with light $5.8 \times 10^{16} Hz$ frequency. If the same metal is irradiated with light of $3.846 nm$ wave length, what will be the energy of the photoelectron emitted?

A. $1.8 \times 10^{2} eV$

B. $3.65 \times 10^{-17} J$

C. $2.28 \times 10^{2} eV$

D. $4.37 \times 10^{-17} J$

Answer: D

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4. 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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5. A light source of wavelength λ illuminates a metal and ejects photo-electrons with $(K.E.)_{\max} = 1.eV$ Another light source of wavelength $\frac{\lambda}{3}$, ejects photo-electrons from same metal with $(K.E.)_{\max} = 4eV$ Find the value of work function?

A. $1eV$

B. $2eV$

C. $0.5eV$

D. $1.5eV$

Answer: C

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6. Ground state energy of H-atom is $(-E_1)$,t he velocity of photoelectrons emitted when photon of energy E_2 strikes stationary Li^{2+} ion in ground state will be:

A. $v = \sqrt{\frac{2(E_p - E)}{m}}$

B. $v = \sqrt{\frac{2(E_p + 9E)}{m}}$

C. $v = \sqrt{\frac{2(E_p - 9E)}{m}}$

D. $v = \sqrt{\frac{2(E_p - 3E)}{m}}$

Answer: C

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7. In a photoelectric experiment , the stopping potential V_s is plotted against the frequency v of the incident light . The resulting curve is a straight line which makes an angle θ with the v - axis. Then $\tan\theta$ will be equal to (Here E_0 = work function of the surface_

A. h/e

B. e/h

C. - ϕ/e

D. eh/ϕ

Answer: A

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8. $4000\overset{0}{A}$ photons is used to break the iodine molecule, then the % of energy converted to the K.E of iodine atoms if bond dissociation energy of I_2 molecule is $246.5kJ/mol$

A. 8%

B. 12%

C. 17%

D. 25%

Answer: C

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9. One mole of $He^{\oplus}$ ions is excited. An anaylsis showed that 50% of ions are in the third energy level 25% are in the second energy level and the remaining are in the first energy level. Calculate the energy emitted in kilojoules when all the ions return to the ground state.

A. $232.88 \times 10^4 J$

B. $331.13 \times 10^4 J$

C. $58.22 \times 10^4 J$

D. $660 \times 10^4 J$

Answer: B

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10. The wave number of the first line in the Balmer series of hydrogen atom is $15200 cm^{-1}$. What is the wave number of the first line in the Balmer series of Be^{3+}?

A. $2.432 \times 10^5 cm^{-1}$

B. $15200 cm^{-1}$

C. $4 \times 15200 cm^{-1}$

D. $2 \times 15200 cm^{-1}$

Answer: A

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11. An electron in a Bohr orbit of hydrogen atom with quantum level n, has an angular momentum $4.2178 \times 10^{-34} kgm^2 s^{-1}$. If this electron drops from this level to the next level, find the wavelength of this spectral line.

A. $18.75 \times 10^{-7} m$

B. $1.87 \times 10^{-7} m$

C. $187.5 \times 10^{-7} m$

D. $0.187 \times 10^{-7} m$

Answer: A

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12. Select the incorrect graph for velocity of e^- in an orbit vs. Z, $\frac{1}{n}$ and n :

A.

B.

C.

D.

Answer: D

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13. What is the frequency of revolution of electron present in $2nd$ Bohr's orbit of H - atom ?

A. $1.016 \times 10^{16} s^{-1}$

B. $4.065 \times 10^{16} s^{-1}$

C. $1.626 \times 10^{15} s^{-1}$

D. $8.13 \times 10^{16} s^{-1}$

Answer: D

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14. According to Bohr's atomic theory, which of the following is correct ?

A. Potential energy of electron $\alpha \frac{Z^2}{n^2}$

B. The product of velocity of electron and principle quantum number $(n) \alpha Z^2$

C. Frequency of revolution of electron in an orbti $\alpha \frac{Z^2}{n^3}$

D. Coulombic force of attraction on the electron $\alpha \frac{Z^2}{n^2}$

Answer: C

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15. Find the value of wave number $\left(\bar{v}\right)$ in terms of Rydberg's constant, when transition of electron takes place between two lvels of He^{+} ion whose sum is 4 and difference is 2.

A. $\frac{8R_H}{9}$

B. $\frac{32R_H}{9}$

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

D. $\frac{6R_H}{9}$

Answer: B

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16. The hydrogen atom in the ground state is excited by mass of monochromatic radiations of wavelength

λÅ . The resulting spectrum consists of maximum 15 different lines . What is the value of λ ? $(R_H = 109737cm^{-1})$.

A. $937.3\overset{0}{A}$

B. $1025\overset{0}{A}$

C. $1236\overset{0}{A}$

D. $618\overset{0}{A}$

Answer: A

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17. What is the angular velocity (ω) of an electron occupying second orbit of Li^{2+} ion?

A. $\dfrac{8\pi^3 me^4}{h^3}K^2$

B. $\dfrac{8\pi^3 me^4}{9h^3}K^2$

C. $\dfrac{64}{9} \times \dfrac{8\pi^3 me^4}{9h^3}K^2$

D. $\frac{9\pi^3 me^4}{h^3}K^2$

Answer: D

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18. The angular momentum of an electron in a Bohr's orbit of He^+ is $3.1652 \times 10^{-34} kg - m^2/\text{sec}$. What is the wave number in terms of Rydberg constant (R) of the spectral line emitted when an electron falls this level to the first excited state.

$\left[\text{Use} h = 6.626 \times 10^{-34} Js\right]$.

A. $3R_H$

B. $\frac{5R_H}{9}$

C. $\frac{3R_H}{9}$

D. $\frac{8R_H}{9}$

Answer: B

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19. When an electron makes a transition from $(n+1)$ state of nth state, the frequency of emitted radistions is related to n according to $(n > > 1)$:

A. $v = \frac{2CZ^2R_H}{n^3}$

B. $v = \frac{CZ^2R_H}{n^4}$

C. $v = \frac{CZ^2R_H}{n^2}$

D. $v = \frac{2CZ^2R_H}{n^2}$

Answer: A

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20. Monochromatic radiation of wavelength λ is incident on a hydrogen sample in ground state. Hydrogen atoms absorb a fraction of light and subsequently emit radiations of six different wavelength . Find the wavelength λ.

A. $9.75nm$

B. $50nm$

C. $85.8nm$

D. $97.25nm$

Answer: D

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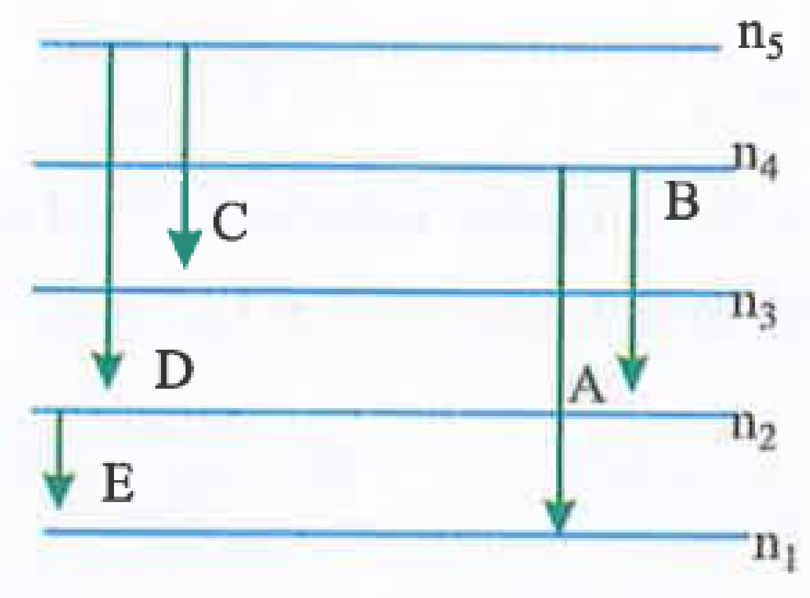
21. For a hypothetical H like atom which follows Bohr's model, some spectral lines were observed as shown. If it is known that line 'E' belongs to the visible region, then the lines possibly belonging to ultraviolet region will be $(n_1$ is not necessarily ground state). [Assume for this atom, no spectral series shows overlaps with other series in the emission spectrum



A. B and D

B. D only

C. C only

D. A only

Answer: D

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22. When an electron makes a transition from $(n+1)$ state to n state the frequency of emitted radiation is related to n according to $(n > > 1)$

A. $v \propto n^{-3}$

B. $v \propto n^2$

C. $v \propto n^3$

D. $v \propto n^{2/3}$

Answer: A

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23. Light from a discharge tube containing H-atoms in some excited state, falls on the metallic surface of metal Na.The KE of the fastest photo-electron was found to be fastest photo-electron was found to be $10.93eV$. If He^{+} ions were present in the same excited state, the KE of the fastest photo-electron would have been $49.18eV$. Determine the excited state orbit number and work function of Na.

A. $2, 18.2 ev$

B. $4, 1.82 ev$

C. $3, 16 ev$

D. $2, 1.6 ev$

Answer: B

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24. Be^{3+} and a proton are accelerated by the same potential, their de - Broglie wavelengths have the ratio (assume mass of proton $=$ mass of neutron):

A. $1:2$

B. $1:4$

C. $1:1$

D. $1:3\sqrt{3}$

Answer: D

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25. The mass of an electron is m, charge is e and it is accelerated form rest through a potential difference of V volts. The velocity acquired by electron will be :

A. $\sqrt{\frac{V}{m}}$

B. $\sqrt{\frac{eV}{m}}$

C. $\sqrt{\frac{2eV}{m}}$

D. zero

Answer: C

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26. An electron is continuously accelerated in a vacuum tube by applying potential differece. If the de-Broglie's wavelength is decreased by 10%, the change in the kinetic energy of the electron is nearly

A. decreased by 11%

B. increased by 23.4%

C. increased by 10%

D. increased by 11.1%

Answer: B

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27. An electron of mass m when accelerated through a potential difference V has de - Broglie wavelength λ. The de - Broglie wavelength associated with a proton of mass M accelerated through the same potential difference will be

A. $\lambda\frac{M}{m}$

B. $\lambda\frac{m}{M}$

C. $\lambda\sqrt{\frac{M}{m}}$

D. $\lambda\sqrt{\frac{m}{M}}$

Answer: D

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28. The ratio for the gap between successive orbits from the nucleous onwards is

A. $1:2:3:4$

B. $1:3:5:7$

C. $1:4:9:16$

D. $3:5:7:9$

Answer: D

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29. For a 3s - orbital, value of Φ is given by following realation:

$$\Psi(3s) = \frac{1}{9\sqrt{3}}\left(\frac{1}{a_0}\right)^{3/2}\left(6 - 6\sigma + \sigma^2\right)e^{-\sigma/2}, \text{ where } \sigma = \frac{2r.Z}{3a_0}$$

What is the maximum radial distance of node from nucleus?

A. $\frac{\left(3+\sqrt{3}\right)}{Z}a_0$

B. $\frac{a_0}{Z}$

C. $\frac{3}{2}\frac{\left(3+\sqrt{3}\right)}{Z}a_0$

D. $\frac{2a_0}{Z}$

Answer: C

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30. Energy required to ionise 2 mole of gaseous He^{+} ion present in its ground state is :

A. $54.4eV$

B. $108.8N_{A}eV$

C. $54.4N_{A}eV$

D. $108.8eV$

Answer: B

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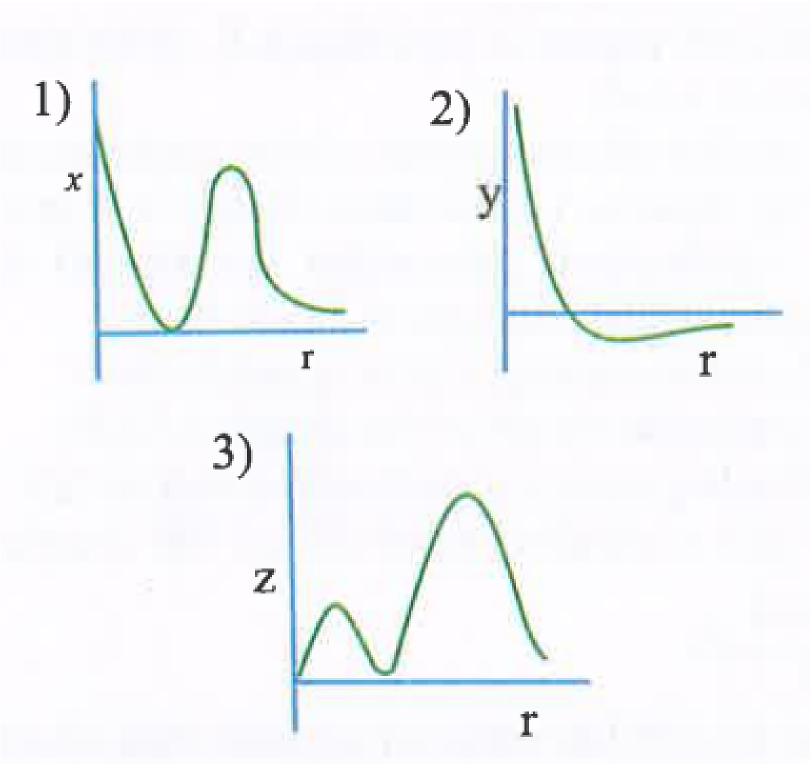
31. Condider the following plots for 2s-orbital:



x,y and z are respectively.

A. ψ, ψ^2 and $4\pi r^2\psi^2$

B. ψ^2, ψ and $4\pi r^2\psi^2$

C. $4\pi r^2\psi^2$ and ψ^2, ψ

D. ψ^2, $4\pi r^2\psi^2$ and ψ

Answer: B

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32. If n and l are respectively the principal and azimuthal quantum numbers , then the expression for calculating the total number of electrons in any energy level is :

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

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

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

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

Answer: D

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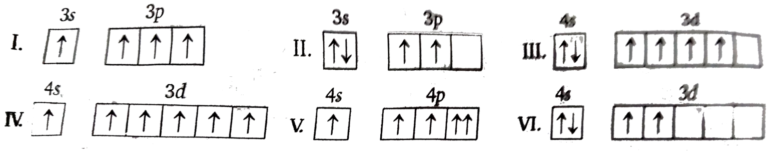
33. Consider the following six electronic configurations (remaining inner orbitals are completely filled) and mark the incorrect option.



A. Stability order: $II > I > IV > III$

B. Order of spin multiplicity: $IV > III = I > II$

C. V does not violate all the three rules of electronic configuration

D. If VI represents A and A^{+} when kept near a magnet, A^{+} acts as diamagnetic substance.

Answer: B

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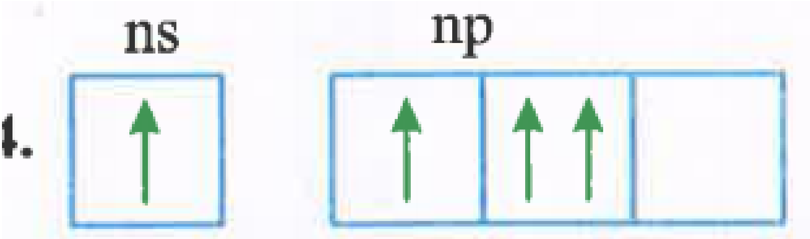
34. 

The above electronic configuration deviates from

(I) Hund's rule (II) Aufbau principle

(III) Pauli's rule

A. All of the above

B. Only I, II

C. Only I, III

D. Only II, III

Answer: A

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35. The ratio of magnetic moments of $Fe(III)$ and $Co(II)$ is:

A. $\sqrt{5}:\sqrt{7}$

B. $\sqrt{35}:\sqrt{15}$

C. $7:3$

D. $\sqrt{24}:\sqrt{15}$

Answer: B

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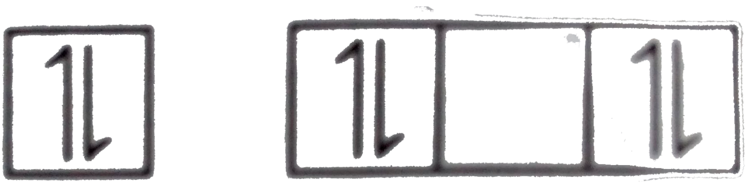
36. Give the correct order of initials T(true)F(false) for following satements. (I) If electron has zero quantum magnetic numbers, then it must be present in s-orbital

(II) In  orbital diagram, Pauli's exclusion principal is violated

(III) Bohr's model can explain spectrum of the hydrogen atom.

(IV) A d-orbital can accommodate maximum 10 electrons only.

A. T T F F

B. F F TF

C. TFTT

D. FFTT

Answer: D

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37. Which of the following statements is/are true in the correct of photoelectric effect?

A. The kinetic energy of ejected electron is independent of the intensity of radiation

B. It provident an evidence for quantum nature of light.

C. The number of photoelectrons ejected depends upon the intensity of the incident radiation

D. The kinetic energy of the emitted electrons depends on the frequency of the incident radiation.

Answer: A::B::C::D

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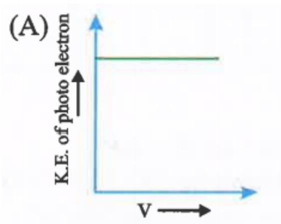
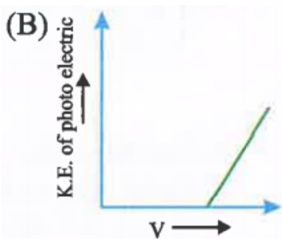
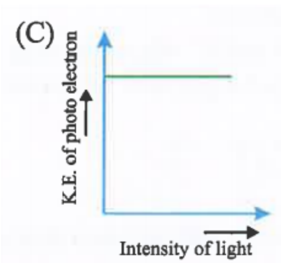
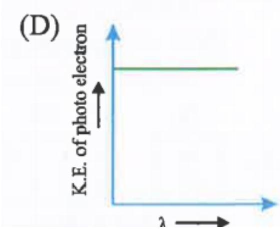
38. Which is correct graph for photoelectric effect.

A. 

B. 

C. 

D. 

Answer: B::C

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39. Which of the following is correct regarding Heisenberg's uncertainity principle

A. It is impossible to determine momentum and position of a small particle accurately and simultaneously

B. Uncertainty principle is applicable on all conjugate pair of two variables includes whose product has dimensions of action i.e. position and momentum or energy and time or angular momentum and time

C. Uncertainty principle loses its significance in case of larger objects

D. Mathematically uncertainity principle is represented as $\Delta p. \Delta x = \frac{4\pi}{nh}$

Answer: A::B::C

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40. In Bohr model of the hydrogen atom, let R,v and E represent the radius of the orbit, speed of the electron and the total energy respectively. Which of the following quantities are directly proportional to the quantum number n?

A. rE

B. vr

C. $\frac{v}{E}$

D. $\frac{r}{E}$

Answer: B::C

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41. In a hydrogen like sample, electron is in 2nd excied state. The Binding energy of 4th state of this sample is $13.6eV$, then

A. A 25 eV photon can set free the electron from the second excited state of this sample

B. 3 different types of photon will be observed if electrons make transition up to ground state from the second excited state

C. If 23 eV photon is used then K.E. of the ejected electron is $1eV$

D. 2nd line of Balmer series of this sample has same energy value as 1st excitation energy of H-atoms.

Answer: A::B

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42. 1st excitation potential for the H-like (hypothetical) sample is 24 V. Then:

A. Ionisation energy of the sample is $36eV$

B. Ionisation energy of the sample is $32eV$

C. Binding energy of 3rd excited state is $2eV$

D. 2nd excitation potential of the sample is $\frac{32 \times 8}{9}eV$

Answer: B::C::D

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43. A hydrogen like atom in ground state absorbs n photon having the same energy and its emits exacity $n`$ photon when electrons transition takes placed .Then the energy of the absorbed photon may be

A. $91.8eV$

B. $40.8eV$

C. $48.4eV$

D. $54.4eV$

Answer: A::B

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44. Which of the following is/are correct?

A. the energy of an electron depends only on the principal quantum number not on the other quantum numbers

B. the energy of an electron depends only on the principal quantum number in case of hydrogen and hydrogen like atoms

C. The different in potential energies of any two energy level is always more than the different in kinetic energies of these two levels

D. An electron in ground state can emit a photon

Answer: B::C

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45. Choose the correct statement(s):

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

B. The orientation of an atomic orbital depends upon the magnetic quantum number

C. The energy of an electron in an atomic orbital of multi-electron atom depends upon principal quantum number only

D. The number of degenerate atomic orbitals of one type depends upon the value of azimuthal quantum number.

Answer: A::B::D

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46. For radial probability curves. Which of the following is/are correct ?

A. The number opf maxima in 2s orbital are two

B. The number of spherical or radial nodes is equal to n-1-1

C. The number of angular nodes are 'l'

D. 3d has 3 angular nodes

Answer: A::B::C

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47. Select the correct statement(s):

A. Radial distribution function indicates that there is a higher probability of finding the 3s electron close to the nucleus than in case of 3p and 3d electrons

B. Energy of 3s orbital is less than for the 3p and 3d orbitals

C. At the node, the value of the radial function changes from positive to negative

D. The radial function depends upon the quantum numbers n and l

Answer: A::B::D

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48. Select the correct statement(s):

A. Radial function $[R(r)]$ a part of wave function is dependent on quantum number n only

B. Angular function depends only on the direction, and is independent to the distance from the nucleus

C. $\psi^2(r, \theta, \phi)$ is the probability density of finding the electron at a particular point in space

D. Radial distribution function $\left(4\pi r^2 R^2\right)$ gives the probability of the electron being present at a distance r from the nucleus

Answer: B::C::D

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49. An excited state of H atom emits a photon of wavelength λ and returns in the ground state. The principal quantum number of excited state is given by:

A. $\sqrt{\frac{(\lambda R - 1)}{\lambda R}}$

B. $\sqrt{\lambda R(\lambda R - 1)}$

C. $\sqrt{\frac{\lambda R}{(\lambda R - 1)}}$

D. $\sqrt{\lambda R(\lambda R + 1)}$

Answer: C

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50. The radial distribution functions $[P(r)]$ is used to determine the most probable radius, which is used to find the electron in a given orbital $\frac{dP(r)}{dr}$

for $1s$-orbital of hydrogen like atom having atomic number Z, is

$$\frac{dP}{dr} = \frac{4Z^3}{a_0^3}\left(2r - \frac{2Zr^2}{a_0}\right)e^{-2Zr/a_0}:$$

A. At the point of maximum value of radial distribution function $\frac{dP(r)}{dr} = 0$, one antinode is present

B. Most probable radius of Li^{2+} is $\frac{a_0}{3}$ ±

C. Most probable radius of He^{+} is $\frac{a_0}{2}$ ±

D. Most probable radius of hydrogen atom is a_0 ±

Answer: A::B::C::D

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51. Which of the following statement(s) is/are correct?

A. The electronic configuration of Cr is $[Ar]3d^5 4s^1$. (Atomic number of $Cr = 24$)

B. The magnetic quantum number may have a negative value

C. In silver atom, 23 electrons have a spin of one type and 24 of the opposite type. (Atomic number of $Ag = 47$)

D. Number of angular nodes for d_{z^2} is two

Answer: A::B::C::D

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52. Statement-1: Photon has definite momentum though it has no rest mass.

Statement-2: Momentum of photon is due to its energy and therefore it has equivalent mass.

A. If both the statement are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-1

B. If both the statements are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-1

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: A

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53. Statement-1: The orbital angular momentum of d-electron in orbitals is $\sqrt{6}\frac{h}{2\pi}$

Statement-2: Angular momentum of e^{-} in orbit is $mvr = \frac{nh}{2\pi}$

A. If both the statement are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-2

B. If both the statements are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-2

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: B

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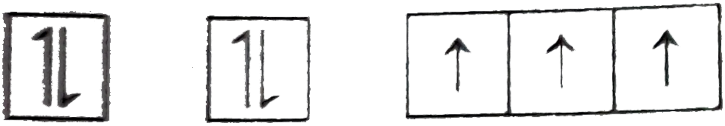
54. STATEMENT-1: The ground state electronic configuration of introgen is



STATEMENT-2:

Electronic are filled in orbitals as per aufbau principle, Hund's rule of maximum spin multiplicity and puli's principle.

A. If both the statement are TRUE and STATEMENT-2 is the correct explanation of STATEMENT-3

B. If both the statements are TRUE but STATEMENT-2 is NOT the correct explanation of STATEMENT-3

C. If STATEMENT-1 is TRUE and STATEMENT-2 is FALSE

D. If STATEMENT-1 is FALSE and STATEMENT-2 is TRUE

Answer: A

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55. When electron jumps from higher orbit to lower orbit, then energy is radiated in the form of electromagnetic radiation and these radiations are used to record the emission spectrum Energy of electron may be calculated as

$$E = -\frac{2\pi^2 m_e Z^2 e^4}{n^2 h^2}$$

Where, $m_e =$ rest mass of electron

$$\Delta E = \left(E_{n_2} - E_{n_1}\right) = 13.6 \times Z^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] eV \text{ per atom}$$

This equation was also used by Rydberg to calculate the wave number of a particular line in the spectrum

$$\bar{v} = \frac{1}{\lambda} = R_H Z^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] m^{-1}$$

Where $R_H = 1.1 \times 10^7 m^{-1}$ (Rydberg constant)

For Lyman, Balmer, Paschen, Brackett and Pfund series the value of

$n_1 = 1, 2, 3, 4, 5$ respectively and $n_2 = \infty$ for series limit. If an electron jumps from higher orbit n to ground state, then number of spectral line will be $.^nC_2$. Ritz modified the Rydberg equation by replacing the rest mass of electron with reduced mass (μ).

$$\frac{1}{\mu} = \frac{1}{m_N} + \frac{1}{m_e}$$

Here, $m_N =$ mass of nucleus $m_e =$ mass of electron Answer the following questions

The emission spectrum of He^+ involves transition of electron from $n_2 \rightarrow n_1$ such that $n_2 + n_1 = 8$ and $n_2 - n_1 = 4$. what whill be the total number of lines in the spectrum?

A. 10

B. 15

C. 20

D. 21

Answer: A

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$$\frac{1}{\mu} = \frac{1}{m_N} + \frac{1}{m_e}$$

Here, $m_N =$ mass of nucleus $m_e =$ mass of electron Answer the following questions

In which of the following region the spectrum of He^+ will be observed in above transition?

A. Ultraviolet

B. Visible

C. Infrared

D. far infrared

Answer: B

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$$\frac{1}{\mu} = \frac{1}{m_N} + \frac{1}{m_e}$$

Here, $m_N =$ mass of nucleus $m_e =$ mass of electron Answer the following questions

What will be the value of modified Rydberg's constant, if the nucleus having mass m_N and the electron having mass m_e revolve around the centre of the mass?

A. $R_H \times \frac{m_N}{m_e}$

B. $R_H \times \frac{m_e}{m_N}$

C. $R_H \times \frac{m_e}{m_N + m_e}$

D. $R_H \times \frac{m_N}{m_N + m_e}$

Answer: D

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58. When electron jumps from higher orbit to lower orbit, then energy is radiated in the form of electromagnetic radiation and these radiations are used to record the emission spectrum Energy of electron may be calculated as

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$$\frac{1}{\mu} = \frac{1}{m_N} + \frac{1}{m_e}$$

Here, $m_N =$ mass of nucleus $m_e =$ mass of electron Answer the following questions

The ratio of the wavelength of the first line to that of second line of Paschen series of H-atom is

A. $256 : 175$

B. $175 : 256$

C. $15 : 16$

D. $16 : 15$

Answer: A

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59. When electron jumps from higher orbit to lower orbit, then energy is radiated in the form of electromagnetic radiation and these radiations are used to record the emission spectrum Energy of electron may be calculated as

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$$\frac{1}{\mu} = \frac{1}{m_N} + \frac{1}{m_e}$$

Here, $m_N =$ mass of nucleus $m_e =$ mass of electron Answer the following questions

If the wavelength of series limit of Lyman's series of He^+ ions is "a" $\overset{0}{A}$, then what will be the wavelength of series limit of Lyman's series for Li^{2+} ion?

A. $\frac{9a}{4} \overset{0}{A}$

B. $\frac{4a}{9} \overset{0}{A}$

C. $\frac{16a}{9} \overset{0}{A}$

D. $\frac{4a}{7}\overset{0}{A}$

Answer: B

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60. Werner Heisenberg considered the limits of how precisely we can measure the properties of an electron or other microscopic particle. He determined that there is a fundamental limit to how closely we can measure both position and momentum. The more accurately we measure the momentum of a particle, the less accurately we can determine its position. The converse is also true. this is summed up in what we now call the Heisenberg uncertainty principal. The equation is $\Delta x. \Delta(mv) \geq \frac{h}{4\pi}$ The uncertainty is the position or in the momentum of a macroscopic object like a baseball is too small to observe. However, the mass of microscopic object such as an electron is small enough for the uncertainty to be relatively large and significant.

If the uncertainties in position and momentum are equal, the uncertainty in the velocity is:

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

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

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

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

Answer: C

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The uncertainty is the position or in the momentum of a macroscopic object like a baseball is too small to observe. However, the mass of microscopic object such as an electron is small enough for the uncertainty to be relatively large and significant.

If the uncertainty in velocity and position is same, then the uncertainty in momentum will be

A. $\sqrt{\frac{hm}{4\pi}}$

B. $m\sqrt{\frac{h}{4\pi}}$

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

D. $\frac{1}{m}\sqrt{\frac{h}{4\pi}}$

Answer: A

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62. Werner Heisenberg considered the limits of how precisely we can measure the properties of an electron or other microscopic particle. He determined that there is a fundamental limit to how closely we can measure both position and momentum. The more accurately we measure the momentum of a particle, the less accurately we can determine its position. The converse also true. This is summed up in what we now call the Heisenberg uncertainty principle.

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The uncertainty in the position or in the momentum of a marcroscopic object like a baseball is too small to observe. However, the mass of microscopic object such as an electon is small enough for the uncertainty to be relatively large and significant.

What would be the minimum uncetaintty in de-Broglie wavelength of a moving electron accelerated by potential difference of 6 volt and whose uncetainty in position is $\frac{7}{22}$ nm?

A. $6.25\overset{0}{A}$

B. $6\overset{0}{A}$

C. $0.625\overset{0}{A}$

D. $0.3125\overset{0}{A}$

Answer: C

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63. The French physicist Louis de Brogie in 1924 postulated that matter, like radiation, should exhibit a dual behaviour. He proposed the following relationship between the wavelength λ of a material particle, its linear momentum p and planck constant h.

$$\lambda = \frac{h}{p} = \frac{h}{mv}$$

The de Broglie relation implies that the wavelength of a particle should decrease as its velocity increase. its also implies that for a given velocity heavier particles should have shorter wavelength than lighter particles. The waves associated with particles in motion are called matter waves or de Broglie waves. These waves differe from the electromagnetic waves as they

(i) have lower velocites

(ii) have no electrcal and magnetic fields, and

(iii) are not emitted by the particle under consideration. The experimental confirmation of the de Brgolie's relation was obtained when Davisson and Germer, in 1927, observed that a beam of electron is diffracted by a nickel crystal. As diffraction is a characterstic property of waves hence the beam of electron behaves as a wave, as proposed by de Broglie

If proton, electron and α-particle are moving with same kinetic energy then the order of their de-Broglie's wavelength.

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

B. $\lambda_\alpha > \lambda_P > \lambda_e$

C. $\lambda_\alpha < \lambda_P < \lambda_e$

D. $\lambda_e = \lambda_P < \lambda_\alpha$

Answer: C

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64. The French physicist Louis de Broglie in 1924 postulated that matter like radiation , should exhibit a dual behaviour. He proposed the following relationship between the wavelength .λ of a material particle,its linear momentum P and Planck constant h.

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Werner Heisenberg considered the limits of how precisely we can measure properties of an electron or other microscopic particle like electron . He determined that there is a fundamental limit of how closely we can measure both position and momentum. The more accurately we can determine its position. The converse is also true. This is summed up in what we now call the "Heisenberg uncertainty principle" : It is impossible to determine simultaneously and precisely both the momentum and position of a particle. The product of uncertainty in the position, Δx and the uncertainty in the momentum $\Delta(mv)$ must be greater than or equal to $\frac{h}{4\pi}, i.e.,$

$$\Delta x \Delta(mv) \geq \frac{h}{4\pi}$$

The transition so that the de Broglie wavelength of electron becomes 3 times of its initial value in He^{+} ion will be :

A. $2 \rightarrow 6$

B. $2 \rightarrow 4$

C. $1 \rightarrow 4$

D. $1 \rightarrow 6$

Answer: A

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65. The French physicist Louis de Brogie in 1924 postulated that matter, like radiation, should exhibit a dual behaviour. He proposed the following relationship between the wavelength λ of a material particle, its linear momentum p and planck constant h.

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An electron is accelerated from rest and it has wavelength of $1.414A^{\circ}$ be how much amount potential should be dropped so that wavelength associated with electron becomes $1.73A^{\circ}$

A. $25V$

B. $50V$

C. $75V$

D. $12.5V$

Answer: A

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66. It is tempting to think that all possible transitions are permissible, and that an atomic spectrum arises from the transition of an electron from nay initial orbital to any other orbital. However, this is no so, because a photon has an intrinsic spin angular momentum of $\sqrt{2}\frac{h}{2\pi}$ corresponding to $S = 1$ although it has no charge and no rest mass. on the otherhand, an electron has got two types of angular momentum: Orbital angular momentum, $L = = \sqrt{l(l+1)}\frac{h}{2\pi}$ and spin angular momentum, $L_s\left(= \sqrt{s(s+1)}\frac{h}{2\pi}\right)$ arising from orbital motion and spin motion of electron respectively. The change in angular momentum of the electron during any electronic transition must compensate for the angular momentum carried away by the photon. To satisfy this condition the difference between the azimuthal quantum numbers of the orbitals within which transition takes place must differ by one. Thus, an electron in a d-orbital ($l = 2$) cannot make a transition into an s-orbital ($l = 0$) because the photon cannot carry away enough angular momentum. An electron, possess four quantum numbers, n l, m and s. Out of these four l determines the magnitude of orbital angular momentum (mentioned above) while m determines its Z-component as $m\left(\frac{h}{2\pi}\right)$. The permissible values of only integers right from $-l$ to $+l$. While those for l are also integers starting from 0 to $(n - 1)$. The values of l denotes the sub-shell. For $l = 0, 1, 2, 3, 4...$ the sub-shells are denoted by the symbols s,p,d,f,g....respectively.

The maximum orbital angular momentum of an electron with $n = 4$ is

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

B. $\sqrt{12}\frac{h}{2\pi}$

C. $\sqrt{42}\frac{h}{2\pi}$

D. $\sqrt{20}\frac{h}{2\pi}$

Answer: B

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67. It is tempting to think that all possible transitions are permissible, and that an atomic spectrum arises from the transition of an electron from nay initial orbital to any other orbital. However, this is no so, because a photon has an intrinsic spin angular momentum of $\sqrt{2}\frac{h}{2\pi}$ corresponding to $S = 1$ although it has no charge and no rest mass. on the otherhand, an electron has got two types of angular momentum: Orbital angular momentum, $L = = \sqrt{l(l+1)}\frac{h}{2\pi}$ and spin angular momentum, $L_s\left(= \sqrt{s(s+1)}\frac{h}{2\pi}\right)$ arising from orbital motion and spin motion of electron respectively. The change in angular momentum of the electron during any electronic transition must compensate for the angular momentum carried away by the photon. To satisfy this condition the difference between the azimuthal quantum numbers of the orbitals within which transition takes place must differ by one. Thus, an electron in a d-orbital $(l = 2)$ cannot make a transition into an s-orbital $(l = 0)$

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The orbital angular momentum of an electron in p-orbital makes an angle of $45°$ from Z-axis. Hence Z-component of orbital angular momentum of electron is:

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

B. $\left(\frac{h}{2\pi}\right)$

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

D. $-\left(\frac{h}{2\pi}\right)$

Answer: B

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68. It is tempting to think that all possible transitions are permissible, and that an atomic spectrum arises from the transition of an electron from nay initial orbital to any other orbital. However, this is no so, because a photon has an intrinsic spin angular momentum of $\sqrt{2}\frac{h}{2\pi}$ corresponding to $S = 1$ although it has no charge and no rest mass. on the otherhand, an electron has got two types of angular momentum: Orbital angular momentum, $L = = \sqrt{l(l+1)}\frac{h}{2\pi}$ and spin angular momentum, $L_s\left(= \sqrt{s(s+1)}\frac{h}{2\pi}\right)$ arising from orbital motion and spin motion of electron respectively. The change in angular momentum of the electron during any electronic transition must compensate for the angular momentum carried away by the photon. To satisfy this condition the difference between the azimuthal quantum numbers of the orbitals within which transition takes place must differ by one. Thus, an electron in a d-orbital $(l = 2)$ cannot make a transition into an s-orbital $(l = 0)$ because the photon cannot carry away enough angular momentum. An electron, possess four quantum numbers, n l, m and s. Out of these four l determines the magnitude of orbital angular momentum (mentioned above) while m determines its Z-component as $m\left(\frac{h}{2\pi}\right)$. The permissible values of only integers right from $-l$ to $+l$. While those for l are also integers starting from 0 to $(n - 1)$. The values of l denotes the sub-shell. For $l = 0, 1, 2, 3, 4...$ the sub-shells are denoted by the symbols s,p,d,f,g....respectively.

The spin-only magnetic moment of a free ion is $\sqrt{8}B.M.$ The spin angular momentum of electron will be

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

B. $\sqrt{8}\frac{h}{2\pi}$

C. $\sqrt{6}\frac{h}{2\pi}$

D. $\sqrt{\frac{3}{4}}\frac{h}{2\pi}$

Answer: A

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69. The Schrodinger wave equation for H-atom is

$$\nabla^2\Psi = \frac{8\pi^2 m}{h^2}(E - V)\Psi = 0$$

Where $\nabla^2 = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2}$

E = Total energy and V=potential energy wave function

$$\Psi_{(r\ \theta\ \phi)} R_{(r)} \Theta_{(\theta)} \Phi_{(\phi)}$$

R is radial wave function which is function of "r" only, where r is the distance from nucleus. Θ and Φ are angular wave function. R^2 is known as radial probability density and $4\pi r^2 R^2 dr$ is known as radial probability function i.e., the probability of finding the electron is spherical shell of thickness dr.

Number of radial node =n -l - 1

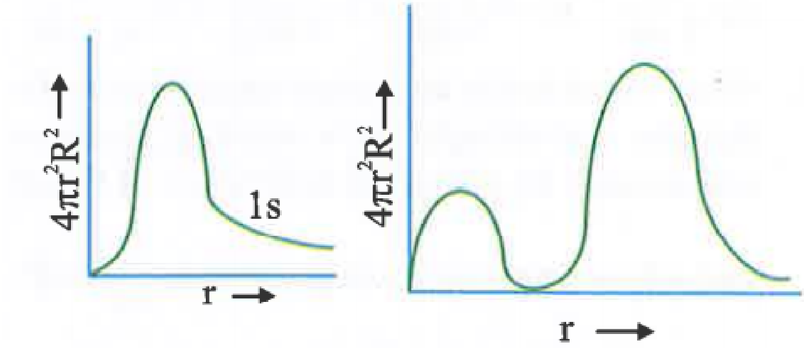
Number of angular node = l

For hydrogen atom, wave function for 1s and 2s-orbitals are:

$$\Psi_{1s} = \sqrt{\frac{1}{\pi a_0^a}} e^{-Z_r/a_0}$$

$$\Psi_{2s} = \left(\frac{Z}{2a_0}\right)^{½}\left(1 - \frac{Zr}{a_0}\right)e^{-\frac{Zr}{a_0}}$$

The plot of radial probability function $4\pi r^2 R^2$ aganist r will be:



Answer the following questions:

The value of radius 'r' for 2s atomic orbital of H-atom at which the radial node will exist may be given as:

A. $r = 2a_0$

B. $r = \frac{a_0}{4}$

C. $r = a_0$

D. $r = \frac{a_0}{5}$

Answer: C

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70. The Schrodinger wave equation for H-atom is

$$\nabla^2\Psi = \frac{8\pi^2 m}{h^2}(E - V)\Psi = 0$$

Where $\nabla^2 = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2}$

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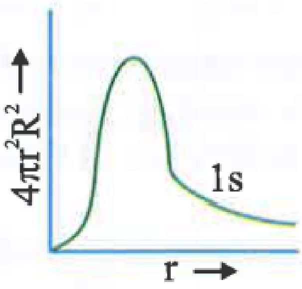
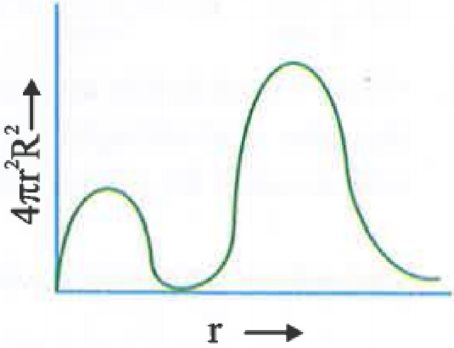
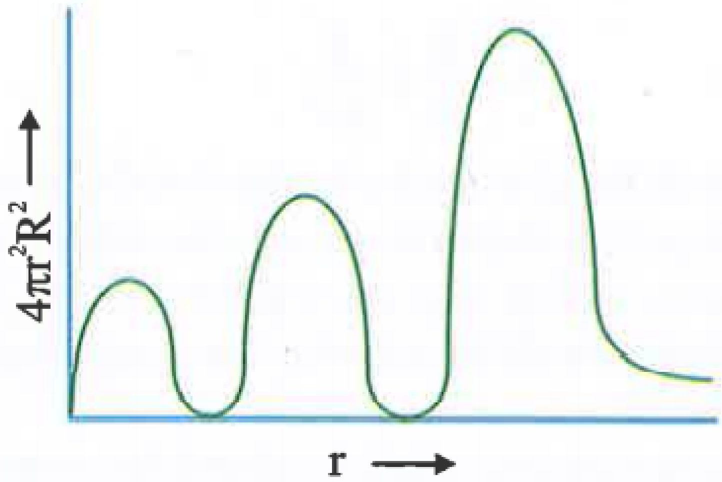




Answer the following questions:

The following graph is plotted for ns-orbitals



The value of 'n' will be:

A. 1

B. 2

C. 3

D. 4

Answer: C

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71. The Schrodinger wave equation for H-atom is

$$\nabla^2\Psi = \frac{8\pi^2 m}{h^2}(E - V)\Psi = 0$$

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$\Psi_{(r\ \theta\ \phi)} R_{(r)} \Theta_{(\theta)} \Phi_{(\phi)}$

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Number of radial node =n -l - 1

Number of angular node = l

For hydrogen atom, wave function for 1s and 2s-orbitals are:

$$\Psi_{1s} = \sqrt{\frac{1}{\pi a_0^a}} e^{-z_r/a_0}$$

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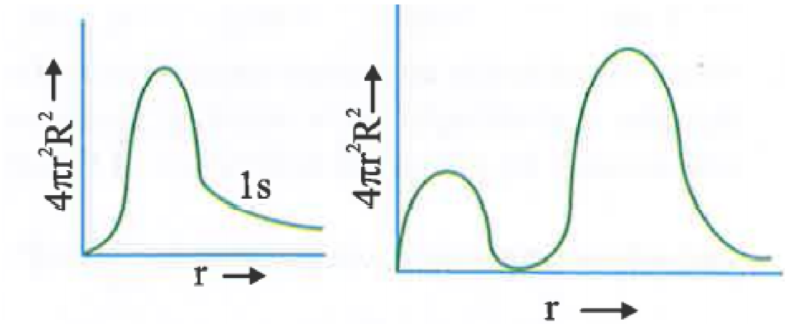
The plot of radial probability function $4\pi r^2 R^2$ aganist r will be:



Answer the following questions:

What will be number of angular nodes and spherical nodes for 4f atomic orbitals respectively.

A. 0,0

B. 1,3

C. 3,0

D. 0,3

Answer: C

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72. The hydrogen -like species Li^{2+} is in a spherically symmetric state S_1 with one node. Upon absorbing light , the ion undergoes transition to a state S_2. The state S_2 has one radial node and its energy is equal is to the ground state energy of the hydrogen atom.

The sate S_1 is

A. 1s

B. 2s

C. $2p$

D. 3s

Answer: B

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The sate S_1 is

A. 0.75

B. 1.50

C. 2.25

D. 4.50

Answer: C

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74. The hydrogen -like species Li^{2+} is in a spherically symmetric state S_1 with one node. Upon absorbing light , the ion undergoes transition to a state S_2. The state S_2 has one radial node and its energy is equal is to the ground state energy of the hydrogen atom.

The orbital angular momentum quantum number of the state S_2 is

A. 0

B. 1

C. 2

D. 3

Answer: B

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75. In a hydrogen like ion, nucleus has a positive charge Ze, Bohr's quantization rule is, the angular momentum of an electron about the nucleus $l = \frac{nh}{2\pi}$, where 'n' is a positive integer.

If electron goes from ground state to 1st excited state then change in energy of the hydrogen like ion is

A. $\frac{3}{32} \frac{m_e z^2 e^4}{\in_0^2 h^2}$

B. $\frac{1}{32}\frac{m_e ze^4}{\epsilon_0^2 h^2}$

C. $\frac{3}{32}\frac{m_e ze^2}{\epsilon_0^2 h^2}$

D. $\frac{1}{32}\frac{m_e ze^2}{\epsilon_0^2 h^2}$

Answer: A

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76. In a hydrogen like ion, nucleus has a positive charge Ze, Bohr's quantization rule is, the angular momentum of an electron about the nucleus $l = \frac{nh}{2\pi}$, where 'n' is a positive integer.

Change in K.E of electron when it goes from ground state to 1st excited state

A. $\frac{3}{32}\frac{m_e ze^4}{\epsilon_0^2 h^2}$

B. $\frac{-3}{32}\frac{m_e ze^4}{\epsilon_0^2 h^2}$

C. $\dfrac{1}{32}\dfrac{m_e z e^2}{\epsilon_0^2 h^2}$

D. $\dfrac{-1}{32}\dfrac{m_e z e^2}{\epsilon_0^2 h^2}$

Answer: B

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77. In a hydrogen like ion, nucleus has a positive charge Ze, Bohr's quantization rule is, the angular momentum of an electron about the nucleus $l = \dfrac{nh}{2\pi}$, where 'n' is a positive integer.

If electron is in ground state the magnetic field produced at the site of nucleus due to circular motion of the electron

A. $\dfrac{\mu_0 Z^3}{8\pi}\dfrac{e^7 m^2}{\epsilon_0^3 h^5}$

B. $\dfrac{\mu_0 Z^2}{8\pi}\dfrac{e^7 m^2}{\epsilon_0^3 h^5}$

C. $\dfrac{\mu_0 \pi Z^3}{8}\dfrac{e^7 m^2}{\epsilon_0^3 h^5}$

D. $\frac{\mu_0 \pi Z^2}{8} \frac{e^7 m^2}{\in_0^3 h^5}$

Answer: C

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78. The value of 'n' of the highest excited state that an electron of hydrogen atom in the ground state can reach when $12.09eV$ energy is given to the hydrogen atom is.

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79. A hydrogen like species (atomic number Z) is present in a higher excited state of quantum number n. This excited atom can make a transitionn to the first excited state by successive emission of two photons of energies 10.20 eV and 17.0 eV respectively. Altetnatively, the atom from the same excited state can make a transition to the second excited state by successive of two photons of energy 4.25 eV and 5.95 eVv respectively. Determine the value of Z.

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80. If the lowest energy X-rays have $\lambda = 3.055 \times 10^{-8}$ m, estimate the minimum difference in energy between two Bohr's orbits such that an electronic transition would correspond to the emission of an X-ray. Assuming that the electrons in other shells exert no influence, at what Z (minimum) would a transition form the second level to the first result in the emission of an X-ray?

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81. Electron in a sample of H - atoms make transitions from state $n = x$ to some lower excited state. The emission spectrum from the sample is found to contain only the lines belonging to a particular series. If one of the photons had an energy of $0.6375 eV$. Then find the value of x. $\left[\text{Take } 0.6375 eV = \frac{3}{4} \times 0.85 eV\right]$.

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82. Aphoton of energy 4.5 eV strikes on a metal surface of work function $3.0 eV$. If uncertainty in position is $\frac{25}{4\pi}$Å, find the uncertainty in measurment of deBroglie wavelength (inÅ).

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83. Suppose a particle has four quantum numbers such that the permited values are those as given below: n,1,2,3... $l:(n-1),(n-3),(n-5)$...but no negative number $J:\left(l+\frac{1}{2}\right)$ or $\left(l-\frac{1}{2}\right)$ if the latter is not negative. m : J in integral steps to +J Thus, how many particles could be fitted into that $n=2$ shell?

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84. Not considering the electronic spin, the degeneracy of the second excited state $(n = 3)$ of H-atom is 9, while the degeneracy of the second excited state of H^- is

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85. In Bohr's model, $r_{n,z} =$ radius of n^{th} orbit with atomic number Z

$u_{n,z} = P.E$ of electron in n^{th} orbit with atomic number Z

$K_{n,z} = K.E$ of electron in n^{th} orbit with atomic number Z

$V_{n,z} =$ velocity of electron in n^{th} orbit with atomic number Z

$T_{n,z} =$ time period of revolution in n^{th} orbit with atomic number Z

$(ColumnI, ColumnII), \left((A)U_{1.2}, K_{1.1}, (p)1:8\right), \left((B)r_{2.1}, r_{1.2}, (q)-8:1\right), \left((C)V_{1.3},\right.$

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	Column I	Column II
	$(A) H$	(p) Radius of 4^{th} orbit $0.53 \times 4\overset{0}{A}$
86.	$(B) He^{+}$	(q) Energy of 2^{nd} orbit $= -13.6 eV$
	$(C) Be^{3+}$	(r) Radius of 2^{nd} orbit $= 0.53 \times 4\overset{0}{A}$
	$(D) Li^{2+}$	(s) Velocity of electron in the 3rd orbit $= 2.18 X 10^{8} cm/\sec$

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87. Match the entries in Column I with the correctly related quantum number (s) in Column II.

Column I	C
(A) Orbital angular momentum of the electron in a hydrogen-like atomic orbital	(P
(B) A hydrogen-like one-electron wave function obeying Pauli principle	(Q
(C) Shape size and orientation of hydrogen-like atomic orbitals	(R
(D) Probability density at the nucleus in hydrogen like-atom	(S

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		Column I		Column II
	(A)	The d-orbital which has two angular nodes	(P)	$3d_{x^2-y^2}$
88.	(B)	The d-orbitial with two nodal surfaced from conce	(Q)	$3d_{s^2}$
	(C)	The orbital without angular node	(R)	$4f$
	(D)	The orbital which has three angular nodes	(S)	$3s$

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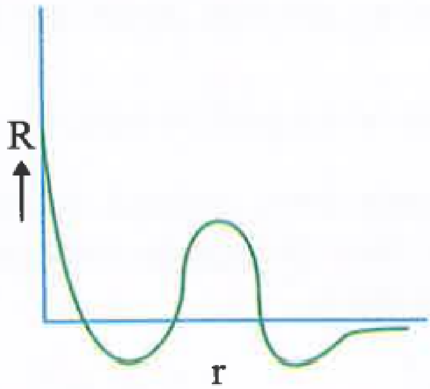
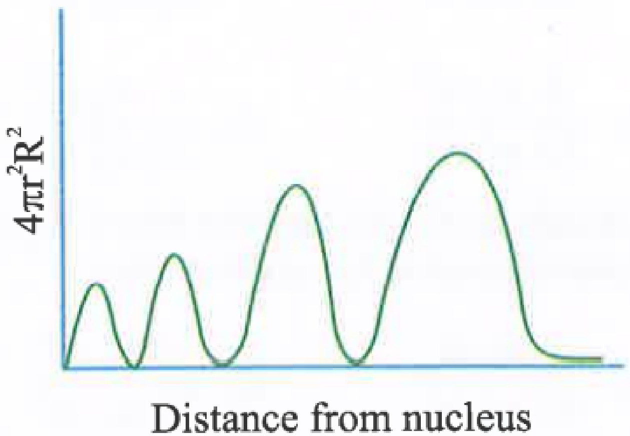
89. Match the following columns

Column I	Column II
A) 	p) 4s
B) 	q) $5p_y$
C) Angular probability is dependent of θ and ϕ	r) 3s
D) Atleast one angular node is present	s) $6d_{xy}$

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90.

	Column I		Column II
(A)	$\frac{K.E.}{P.E.}$	(P)	2
(B)	$P.E + 2K.E.$	(Q)	$-\frac{1}{2}$
(C)	$\frac{P.E.}{T.E.}$	(R)	1
(D)	$\frac{K.E.}{T.E.}$	(S)	0

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91.

Column I	*Column II*
$(A) 1s$	$(p) m_l = 0$
$(B) 2p_z$	(q) Nodal planes $= 2$
$(C) 3d_{xy}$	(r) Radial nodes $= 0$
$(D) 3d_{z^2}$	(s) Number of maxima $= 1$

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Others

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

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6. Calculate the no of protons, neutrons and electron in $._{36}^{80}Br$

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7. The number of electrons, protons and neutrons in a species are equal to 18, 16 and 16 respectively. Assign the proper symbol of the species.

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

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9. 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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10. 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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11. Naturally occurring boron consists of two isotopes whose atomic weight are 10.01 and 11.01. The atomic weight of the natural boron is 10.81. Calculate the percentage of each isotopes in natural boron.

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12. 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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13. 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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14. Calculate (a) Wavenumber and (b) frequency of yellow radiation having wavelength $5800A^{\circ}$.

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15. energy of one mol of photons whose frequency is $5 \times 10^{14} Hz$ is approximately equal to :

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16. A 100 watt buble emits monochromatic light of wavelength 400 nm. Then the number of photons emitted per seccond by the buble is nearly -

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17. When electromagnetic radiation of wavelength 300 nm falls on the surface of sodium, electrons are emitted with kinetic energy of $1.68 \times 10^5 J ml^{-1}$. 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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18. Calculate the energy of photons of radiation whose wavelength is $5000A^{\circ}$?

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

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

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21. Compare the energies of two radiations on with $l = 600nm$ and other with 30 nm.

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22. 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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23. 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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24. 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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25. 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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26. 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? $\left(h = 6.626 \times 10^{-34} J\text{sec}\right)$

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

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29. One of the lines in the emission spectrum of Li^{2+} has the same wavelength as that of the second line of Balmer series in hydrogen spectrum. The electronic transition correspnding to this line is.

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30. The number of spectral lines that are possible when electrons in 7th shell in different hydrogen atoms return to the 2nd shell is:

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

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

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33. Calculate the velocity of an electron present in third orbit of H atom. Also calculate number of revolutions per second round the nucleus.

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

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

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37. The mass of an electron is $9.1 \times 10^{-31} J$, if its K.E. is $3.0 \times 10^{-25} J$. Calculate its wavelength.

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

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

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40. 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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41. 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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42. 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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43. A microscope using suitable photons is employed to an electron in an atom within a distance of 0.1Å. What is the uncertainty involved in the measurment of its velocity? Mass of electron $= 9.11 \times 10^{-31}kg$ and $h = 6.626 \times 10^{-34}Js$

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

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46. what is the total number of orbitals associated with the principal quartum number n= 3?

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47. using s, p, d notations describe the orbital with the following quantum numbers .

(a) n = 2 l=1, (b) n = 4 , l = 0, (c) n= 5 , l=3 , (d) n = 3 , l = 2

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