Chapter 02 Atomic Structure

TOPIC WISE QUESTIONS

ATOMIC NUMBER, MASS NUMBER AND IMPORTANT DEFINITIONS

Q.1 Which of the following is isoelectronic with N_2O:
(1) NO (2) N_2O_5 (3) CO_2 (4) CO

Q.2 Which one of the following pairs represents isobars -
(1) $_2He^3$ and $_2He^4$ (2) $_{12}Mg^{24}$ and $_{12}Mg^{25}$
(3) $_{19}K^{40}$ and $_{19}K^{39}$ (4) $_{19}K^{40}$ and $_{18}Ar^{40}$

Q.3 Cathode rays are made up of
(1) Positively charged particles
(2) Negatively charged particles
(3) Neutral particles
(4) None of these

Q.4 Which one of the following pairs is not correctly matched
(1) Rutherford-Proton
(2) J.J. Thomsom-Electron
(3) J.H. Chadwick-Neutron
(4) Bohr-Isotope

Q.5 The nature of anode rays depends upon
(1) Nature of electrode
(2) Nature of gas
(3) Nature of discharge tube
(4) All the above

Q.6 The ratio of the "e/m" (specific charge) values of a electron and an α-particle is -
(1) 2 : 1 (2) 1 : 1
(3) 1 : 2 (4) None of these

Q.7 When atoms are bombarded with alpha particles, only a few in million suffer deflection, others pass out undeflected. This is because
(1) The force of repulsion on the moving alpha particle is small
(2) The force of attraction on the alpha particle to the oppositely charged electrons is very small
(3) There is only one nucleus and large number of electrons
(4) The nucleus occupies much smaller volume compared to the volume of the atom

Q.8 Which one of the following constitutes a group of the isoelectronic species?
(1) C_2^{2-}, O_2^-, CO, NO (2) $NO^+, C_2^{2-}, CN^-, N_2$
(3) $CN^-, N_2, O_2^{2-}, C_2^{2-}$ (4) N_2, O_2^-, NO^+, CO

Q.9

Column-I	Column-II
(i) $_{26}Fe^{54}$, $_{26}Fe^{56}$, $_{26}Fe^{57}$, $_{26}Fe^{58}$	(a) Isotopes
(ii) $_1H^3$, $_2He^3$	(b) Isotones
(iii) $_{32}Ge^{76}$, $_{33}As^{77}$	(c) Isodiaphers
(iv) $_{92}U^{235}$, $_{90}Th^{231}$	(d) Isobars
(v) $_1H^1$, $_1D^2$, $_1T^3$	

Match the above correct terms:-
(1) [(i), - a], [(ii) - d], [(iii) - b], [(iv) - c],[(v)- a]
(2) [(i) - a] [(ii) - d], [(iii) - d] [(iv) - c] [v - a]
(3) [v -a] [(iv) - c]. [(iii) - d] [(ii) - b] [(i) - a]
(4) None of them

Q.10 The atom A, B, C have the configuration
A $\rightarrow$ [Z(90) + n(146)], B$\rightarrow$ [Z(92) + n(146)],
C $\rightarrow$ [Z(90) + n(148)] So that :-
(a) A and C – Isotones (b) A and C - Isotopes
(c) A and B – Isobars (d) B and C – Isobars
(e) B and C - Isotopes
The wrong statement's are:-
(1) a, b only (2) c, d, e only
(3) a, c, d only (4) a, c, e only

Q.11 In an atom $_{13}Al^{27}$. number of protons is (a) electron is (b) and neutron is (c). Hence ratio will be [in order c : b : a]
(1) 13 : 14 : 13 (2) 13 : 13 : 14
(3) 14 : 13 : 13 (4) 14 : 13 : 14

Q.12 The relative abundance of two rubidium isotopes of atomic weights 85 and 87 are 75%

and 25% respectively. The average atomic wt. of rubidium is:–
(1) 75.5 (2) 85.5 (3) 86.5 (4) 87.5

Q.13 Atomic weight of Ne is 20.2. Ne is mixture of Ne^{20} and Ne^{22}, Relative abundance of heavier isotope is :-
(1) 90 (2) 20 (3) 40 (4) 10

Q.14 Naturally occurring boron has two isotopes whose atomic weights are 10.00 (I) and 11.00 (II). Atomic weight of natural boron is 10.80. The percentage of isotopes (I) and (II) respectively is:-
(1) 20 and 80 (2) 10 and 20
(3) 15 and 75 (4) 30 and 70

Q.15 Let mass of electron is half, mass of proton is two times and mass of neutron is three fourth of original. The find out new atomic wt. of O^{16} atom:-
(1) increases by 37.5%
(2) Remain constant
(3) increases by 12.5%
(4) decreases by 25%

Q.16 In $_7N^{14}$ if mass attributed to electron were doubled & the mass attributed to protons were halved, the atomic mass would become approximately:-
(1) Halved (2) Doubled
(3) Reduced by 25% (4) Remain same

Q.17 A certain negative ion X^{-2} has in its nucleus 18 neutrons and 18 electrons in its extra nuclear structure. What is the mass number of the most abundant isotope of 'X' :-
(1) 35.46 (2) 32 (3) 36 (4) 39

Q.18 Isotopes of an element have
(1) similar chemical properties but different physical properties
(2) similar chemical and physical properties
(3) similar physical properties but different chemical properties.
(4) different chemical and physical properties.

Q.19 The charge to mass ratio of protons is
(1) 9.55×10^{-4} C/g (2) 9.55×10^{4} C/g
(3) 1.76×10^{8} C/g (4) 1.76×10^{-8} C/g

Q.20 The charge to mass ratio of α-particles is approximately ..... the charge to mass ratio of protons
(1) twice (2) half
(3) four times (4) Six times

Q.21 AIR service on Vividh Bharati is transmitted on 219 m band. What is its transmission frequency in Hertz?
(1) 1.3×10^{6} Hz (2) 1.9×10^{6} Hz
(3) 1×10^{6} Hz (4) 6.5×10^{6} Hz

Q.22 Photon of which light has maximum energy :
(1) red (2) blue
(3) violet (4) green

ELECTROMAGNETIC WAVES AND PLANCK'S QUANTUM THEORY

Q.23 The energy of a photon of radiation having wavelength 3000Å is nearly
(1) 6.63×10^{-19} J (2) 6.63×10^{-18} J
(3) 6.63×10^{-16} J (4) 6.63×10^{-49} J

Q.24 Energy of a photon having wave number 1.00 cm^{-1} is
(1) 6.62×10^{-34} J (2) 1.99×10^{-23} J
(3) 6.62×10^{-32} J (4) 6.62×10^{-36} J

Q.25 The frequency of wave is 6×10^{15} s^{-1}. Its wave number would be
(1) 10^{5} cm^{-1} (2) 2×10^{-5} cm^{-1}
(3) 2×10^{-7} cm (4) 2×10^{5} cm^{-1}

Q.26 The momentum of a photon of frequency 5×10^{17} s^{-1} is nearly:
(1) 1.1×10^{-24} kg ms^{-1}
(2) 3.33×10^{-43} kg ms^{-1}
(3) 2.27×10^{-40} kg ms^{-1}
(4) 2.27×10^{-38} kg ms^{-1}

Q.27 The number of photons of light having wavelength 100 nm which can provide 1.00 J energy is nearly
(1) 10^{7} photons (2) 5×10^{18} photons
(3) 5×10^{17} photons (4) 5×10^{7} photons

Q.28 How many times does light travel faster in vacuum than an electron in Bohr first orbit of hydrogen atom?
(1) 13.7 times (2) 67 times
(3) 137 times (4) 97 times

Q.29 The value of Planck's constant is 6.63×10^{-34} Js. The velocity of light is 3.0×10^{8} ms^{-1}, Which value is closest to the wavelength in nanometers of a quantum of light with frequency of 8×10^{15} s^{-1}?
(1) 5×10^{-18} (2) 4×10^{1}
(3) 3×10^{7} (4) 2×10^{-25}

Q.30 The ratio of the energy of a photon of 2000 Å wavelength radiation to that of 4000 Å radiation is
(1) 1/4 (2) 4 (3) 1/2 (4) 2

PHOTOELECTRIC EFFECT

Q.31 Light of wavelength λ falls on metal having work function hc/λ_0. Photoelectric effect will take place only if :
(1) $\lambda \geq \lambda_0$ (2) $\lambda \geq 2\lambda_0$
(3) $\lambda \leq \lambda_0$ (4) $\lambda \leq \lambda_0/2$

Q.32 Photoelectric effect is maximum in :
(1) Cs (2) Na (3) K (4) Li

Q.33 What is the work function (w_0) of the metal whose threshold frequency (ν_0) is 5.2×10^{14} S^{-1}?
(1) 3.44×10^{19} J (2) 3.44×10^{-19} J
(3) 1.44×10^{-17} J (4) 1.44×10^{17} J

Q.34 The work function (W_0) of some metals is listed below. Count the number of metals which will show photoelectric effect when light of 300 nm wave length falls on the metal.

Metal	Li	Na	K	Mg	Cu	Ag	Fe	Pt	W
W_0(ev)	2.4	2.3	2.2	3.7	4.8	4.3	4.7	6.3	4.75

(1) 2 (2) 3 (3) 4 (4) 1

BOHR'S ATOMIC MODEL

Q.35 The expression for calculation of velocity is
(1) $v = \left(\frac{KZe^2}{mr}\right)$ (2) $v = \frac{2\pi KZe^2}{nh}$
(3) $v = \frac{nh}{2\pi KZe^2}$ (4) Both (1) & (2)

Q.36 The ionization energy of He^+ is 19.6×10^{-18} J $atom^{-1}$. The energy of the first stationary state of Li^{+2} will be:
(1) 84.2×10^{-18} J/atom
(2) 44.10×10^{-18} J/atom
(3) 63.2×10^{-18} J/atom
(4) 21.2×10^{-18} J/atom

Q.37 Match the following

Column-I	Column-II
(A) Energy of ground state of He^+	(i) + 6.04 eV
(B) Potential energy of I orbit of H-atom	(ii) –27.2 eV
(C) Kinetic energy of II excited state of He^+	(iii) 54.4 V
(D) Ionisation potential of He^+	(iv) – 54.4 eV

(1) A – (i), B – (ii), C – (iii), D – (iv)
(2) A – (iv), B – (iii), C – (ii), D – (i)
(3) A – (iv), B – (ii), C – (i), D – (iii)
(4) A – (ii), B – (iii), C – (i), D – (iv)

Q.38 If r_1 is the radius of the first orbit of hydrogen atom, then the radii of second, third and fourth orbits in terms of r_1 are :
(1) r_1^2, r_1^3, r_1^4 (2) $8r_1, 27r_1, 64r_1$
(3) $4r_1, 9r_1 16r_1$ (4) $2r_1, 6r_1, 8r_1$

Q.39 The maximum energy is present in any electron at
(1) Nucleus
(2) Ground state
(3) First excited state
(4) Infinite distance from the nucleus

Q.40 If the velocities of first, second, third and fourth orbits of hydrogen atom are v_1, v_2, v_3 and v_4 respectively, then which of the following should be their increasing order?
(1) $v_1 > v_2 > v_3 > v_4$ (2) $v_4 < v_3 < v_1 < v_2$
(3) $v_1 > v_2 < v_3 > v_4$ (4) Equal for all

Q.41 If v_1, v_2, v_3 and v_4 are velocities of the electron present in the first orbit of H, He_+, Li^{+2} and Be^{+3}, then which of the following should be their increasing order?
(1) $v_1 < v_2 < v_3 < v_4$ (2) $v_4 = v_3 = v_2 = v_1$
(3) $v_1 < v_2 < v_3 > v_4$ (4) $v_1 > v_2 < v_3 > v_4$

Q.42 Which orbits of H, He^+ and Li^{+2} have identical energies?

(1) Second orbits of all the three
(2) First orbit of H, second orbit of He^+ and third orbit of Li^{+2}
(3) Third orbit of all the three
(4) Fourth orbit of H, First orbit of He^+ and Fifth orbit of Li^{+2}

Q.43 What should be the correct order of energies of the first orbits of H, He^+ and Li^{+2}, if these are represented as E_1, E_2 and E_3 respectively?
(1) $E_1 < E_2 < E_3$ (2) $E_3 < E_2 < E_1$
(3) $E_1 < E_2 > E_3$ (4) $E_1 = E_2 = E_3$

Q.44 What should be the ratio of energies of the fifth orbits of Li^{+2} and He^+?
(1) 4 : 9 (2) 9 : 4 (3) 12 : 16 (4) 7 : 2

Q.45 The diameter of the second orbit of hydrogen atom should be:
(1) 2.12 Å (2) 4.23 Å (3) 2.10 Å (4) 4.01 Å

Q.46 What should be the ratio of the radii of the orbits of electron in Na^{+10} and hydrogen atom?
(1) 11:1 (2) 1 : 11 (3) 1 : 1 (4) 1 : 2

Q.47 What should be the velocity of the electron present in the fourth orbit of hydrogen atom, if the velocity of the electron present in its first orbit is $2.188 \times 10^{+8}$ cm per second?
(1) 1.094×10^8 cm per second
(2) 5.47×10^7 cm per second
(3) 4.376×10^8 cm per second
(4) 2.188×10^6 cm per second

Q.48 What should be the velocity of the electrons present in the first, second and third orbits of H, He^+ and Li^{+2}, respectively?
(1) 2.188×10^8 cm per second
(2) 5.47×10^7 cm per second
(3) 4.376×10^8 cm per second
(4) 2.188×10^6 cm per second

Q.49 What should be the ratio of energies of the third and fifth orbits of He^+?
(1) 25 : 9 (2) 5 : 3
(3) 16 : 9 (4) None of these

Q.50 The ratio of the radii of first orbits of H, He^+ and Li^{+2} is :
(1) 1 : 2 : 3 (2) 6 : 3 : 1 (3) 9 : 4 : 1 (4) 6 : 3 : 2

Q.51 For the energy levels in an atom, which one of the fallowing statement is correct?
(1) There are seven principal electron energy levels
(2) the second principal energy level has four orbitals and contains a maximum of eight electrons
(3) The M energy level can have a maximum of 32 electrons
(4) The 4s sub-energy level has higher energy that 3d sub-energy level.

Q.52 The approximate quantum number of a circular orbit of diameter 20.6 nm of the hydrogen atom according to Bohr's theory is :
(1) 10 (2) 14 (3) 12 (4) 16

Q.53 The ratio of the radius of the atom to the radius of the nucleus is of the order of
(1) 10^5 (2) 10^6 (3) 10^{-5} (4) 10^{-8}

Q.54 The first use of quantum theory to explain the structure of atom was made by
(1) Heisenberg (2) Bohr
(3) Planck (4) Einstein

Q.55 Angular momentum for p-shell electron is :
(1) $\frac{3h}{\pi}$ (2) Zero (3) $\frac{\sqrt{2}h}{2\pi}$ (4) None

Q.56 Multiplication of electron velocity and radius for a orbit in an atom is :
(1) Proportional to mass of electron
(2) Proportional to square of mass of electron
(3) Inversely proportional to mass of electron
(4) Does not depend upon mass of electron

Q.57 The radius of a shell for H-atom is 4.761Å. The value of n is :
(1) 3 (2) 9
(3) 5 (4) 4

Q.58 The ratio of the radii of two Bohr orbits of H-atoms is 4 : 1, what would be their nomenclature:
(1) K & L (2) L & K
(3) N & L (4) 2 & 3 both

Q.59 The velocity of electron in third excited state of Be^{3+} ion will be :
(1) $\frac{3}{4}$ $(2.188 \times 10^8)ms^{-1}$
(2) $\frac{3}{4}$ $(2.188 \times 10^6)ms^{-1}$
(3) $(2.188 \times 10^6)\ Kms^{-1}$
(4) $(2.188 \times 10^3)\ Kms^{-1}$

Q.60 The energy of H-atom in n^{th} orbit is E_n then energy in n^{th} orbit of singly ionised helium atom will be :

(1) $4E_n$ (2) $E_n/4$ (3) $2E_n$ (4) $E_n/2$

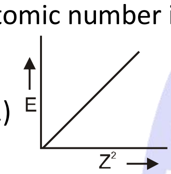
Q.61 The energy of second Bohr orbit of the hydrogen atom is – 328 kJ/mol. Hence the energy of fourth Bohr orbit should be :

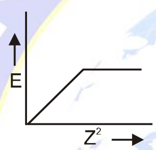
(1) – 41 KJ/mol (2) – 1312 KJ/mol
(3) – 164 KJ/mol (4) – 82 KJ/mol

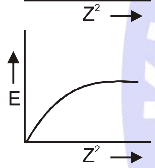
Q.62 Potential energy is – 27.2 eV in second orbit of He^+ then calculate, double of total energy in first excited state of hydrogen atom :

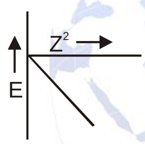
(1) – 13.6 eV (2) – 54.4 eV
(3) – 6.8 eV (4) – 27.2 eV

Q.63 The graphical representation of energy of e_- and atomic number is :

(1) 

(2) 

(3) 

(4) 

Q.64 Maximum frequency of emission is obtained for the transition :

(1) n = 2 to n = 1 (2) n = 6 to n = 2
(3) n = 1 to n = 2 (4) n = 2 to n = 6

Q.65 If the ionization energy of hydrogen is 313.8 K cal per mole, then the energy of the electron in 2^{nd} excited state will be :

(1) – 113.2 Kcal/mole
(2) – 78.45 Kcal/mole
(3) – 313.8 Kcal/mole
(4) – 35 Kcal/mole

Q.66 Which of the following electron transition will require the largest amount of energy in a hydrogen atom :

(1) From n = 1 to n = 2
(2) From n = 2 to n = 3
(3) From n = ∞ to n = 1
(4) From n = 3 to n = 5

Q.67 Which of the following is a correct relationship :

(1) E_1 of H = 1/2 E_2 of He^+ = 1/3m, E_3 of Li^{+2} = 1/4, E_4 of Be^{+3}
(2) $E_1(H) = E_2(He^+) = E_3(Li^{+2}) = E_4(Be^{+3})$
(3) $E_1(H) = 2E_2(He^+) = 3E_3(LI^{+2}) = 4E_4(Be^{+3})$
(4) No relation

Q.68 Energy required to remove an e^- from M shell of H-atom is 1.51 eV, then energy of first excited state will be :

(1) – 1.51 eV (2) +1.51 eV
(3) – 3.4 eV (4) – 13.6 eV

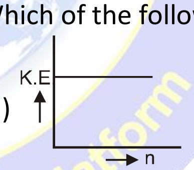
Q.69 The ionisation energy for excited hydrogen atom in eV will be :

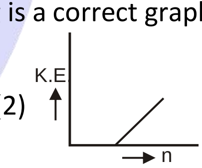
(1) 13.6 (2) Less than 13.6
(3) Greater than 13.6 (4) 3.4 or less

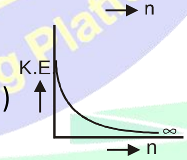
Q.70 The energy required to excite an electron of H-atom from first orbit to second orbit is :

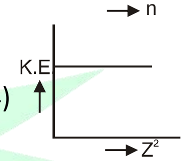
(1) $\frac{3}{4}$ of its ionisation energy
(2) $\frac{1}{2}$ of its ionisation energy
(3) $\frac{1}{4}$ of its ionisation energy
(4) None

Q.71 Which of the following is a correct graph :

(1) 

(2) 

(3) 

(4) 

Q.72 The energy of an electron in the first Bohr orbit of H atom is – 13.6 eV . The possible energy value(s) of the excited state(s) for electrons in Bohr orbits of hydrogen is/are :

(1) – 3.4 eV (2) – 4.2 eV
(3) – 6.8 eV (4) + 6.8 eV

Q.73 The radius of which of the following orbit is same as that of the first Bohr's orbit of hydrogen atom?

(1) He^+ (n = 2) (2) Li^{2+} (n = 2)
(3) Li^{2+} (n = 3) (4) Be^{3+} (n = 2)

SPECTRUM AND SPECTRUM LINE

Q.74 In Balmer series of hydrogen atom spectrum which electronic transition causes third line
(1) Fifth Bohr orbit to second one
(2) Fifth Bohr orbit to first one
(3) Fourth Bohr orbit to second one
(4) Fourth Bohr orbit to first one

Q.75 When an electron in an excited hydrogen atom jumps from an energy level for which n = 5 to a lower level for which n = 2, the spectral line is observed in the ....region and in ....series of the hydrogen spectrum.
(1) Visible, Balmer (2) Visible, lyman
(3) Infrared, lyman (4) Infrared, Balmer

Q.76 What should be the correct order of energies, if E_1, E_2, E_3 and E_4 are the energies of Lyman, Balmer, Paschen and Brackett series, respectively.
(1) $E_1 > E_2 > E_3 > E_4$ (2) $E_4 > E_3 > E_2 > E_1$
(3) $E_1 < E_3 < E_2 < E_4$ (4) $E_4 < E_2 < E_3 < E_1$

Q.77 In Bohr series of lines of hydrogen spectrum, the third line from the red end corresponds to which one of the following inner-orbit jumps of the electron for Bohr' orbits in an atom of hydrogen?
(1) $2 \rightarrow 5$ (2) $3 \rightarrow 2$
(3) $5 \rightarrow 2$ (4) $4 \rightarrow 1$

Q.78 The spectrum of He^+ is expected to be similar to that of
(1) Li^+ (2) H (3) Na (4) He

Q.79 Which of the following should be the expression for the last line of Paschen series?
(1) $\frac{1}{\lambda} = R\left(\frac{1}{9} - \frac{1}{\infty^2}\right)$ (2) $\frac{1}{\lambda} = R\left(\frac{1}{4} - \frac{1}{9}\right)$
(3) $\frac{1}{\lambda} = R\left(\frac{1}{9} - \frac{1}{16}\right)$ (4) $\frac{1}{\lambda} = R\left(\frac{1}{16} - \frac{1}{\infty}\right)$

Q.80 Which of the following should be the correct value of the wave number of first line in Balmer series of hydrogen atom?
(1) 5R/36 (2) 36/5R (3) R/9 (4) 9/R

Q.81 What should be the frequency of radiation of the emission spectrum when the electron present in hydrogen atom undergoes transition from n = 3 energy level to the ground state?
(1) 3×10^{15} second^{-1} (2) 3×10^{5} second^{-1}
(3) 3×10^{10} second^{-1} (4) 3×10^{8} second^{-1}

Q.82 What should be the quantum number of the highest energy state when an electron falls from the highest energy state to Lyman series and for this transition the wave number will be = 97492.2 cm^{-1}?
(1) 2 (2) 3 (3) 4 (4) 5

Q.83 The ratio of minimum frequency of Lyman & Balmer series will be :
(1) 1.25 (2) 0.25 (3) 5.4 (4) 10

Q.84 The wavelength of the radiation emitted, when in a hydrogen atom electron falls from infinity to stationary state 1 would be
(Rydberg constant = 1.097×10^7 m^{-1})
(1) 91 nm (2) 192 nm
(3) 406 nm (4) 9.1×10^{-8} nm

Q.85 The ratio of minimum wavelengths of Lyman & Balmer series will be :
(1) 1.25 (2) 0.25 (3) 5 (4) 10

Q.86 Which transition emits photon of maximum frequency :
(1) second spectral line of Balmer series
(2) second spectral line of Paschen series
(3) fifth spectral line of Humphery series
(4) first spectral line of Lyman series

Q.87 The wavelength of photon obtained by electron transition between two levels in H-atom and singly ionised He are λ_1 and λ_2 respectively, then:
(1) $\lambda_2 = \lambda_1$ (2) $\lambda_2 = 2\lambda_1$
(3) $\lambda_2 = \lambda_1/2$ (4) $\lambda_2 = \lambda_1/4$

Q.88 Find out ratio of following for photon
$(\nu_{max})_{Lyman} : (\nu_{max})_{Bracket}$
(1) 1 : 16 (2) 16 : 1 (3) 4 : 1 (4) 1 : 4

Q.89 The limiting line in Balmer series will have a frequency of :
(1) 3.65×10^{14} sec^{-1} (2) 3.29×10^{15}sec^{-1}
(3) 8.22×10^{14} sec^{-1} (4) -8.22×10^{14}sec^{-1}

Q.90 If H-atom is supplied with 12.1 eV energy and electron returns to the ground state after excitation the number of spectral lines in Balmer series would be :
(use energy of ground state of H-atom = – 13.6 eV)
(1) 1 (2) 2 (3) 3 (4) 4

Q.91 If the shortest wavelength of Lyman series of H atom is x, then the wave length of first line of Balmer series of H atom will be :

(1) $\frac{9x}{5}$ (2) $\frac{36x}{5}$ (3) $\frac{5x}{9}$ (4) $\frac{5x}{36}$

Q.92 What transition in He_+ will have the same λ as the I line in Lyman series of H - atom :

(1) $5 \rightarrow 3$ (2) $3 \rightarrow 2$ (3) $6 \rightarrow 4$ (4) $4 \rightarrow 2$

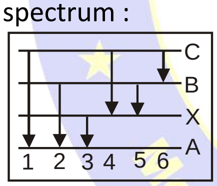
Q.93 In H-atom, electron transits from 6th orbit to 2nd orbit in multi step. Then total spectral lines (without Balmer series) will be :

(1) 6 (2) 10 (3) 4 (4) 0

Q.94 An atom has x energy level, then total number of lines in its spectrum are :

(1) 1 + 2 + 3 ..... (x + 1)
(2) 1 + 2 + 3 ... (x_2)
(3) 1 + 2 + 3 ....(x – 1)
(4) (x + 1)(x + 2)(x + 3)

Q.95 The figure indicates the energy level diagram for the origin of six spectral lines in emission spectrum(e.g line no. 5 arises from the transition from level B to X) which of the following spectral lines will not occur in the absorption spectrum :



(1) 1, 2, 3 (2) 3, 2 (3) 4, 5, 6 (4) 3, 2, 1

Q.96 A certain electronic transition from an excited state to ground state of the H-atom in one or more step gives rise to three lines in the ultra violet region of the spectrum. How many lines does this transition produce in the infrared region of the spectrum :

(1) 1 (2) 2 (3) 3 (4) 4

Q.97 Which electronic level would allow the hydrogen atom to absorb a photon but not to emit a photon

(1) 3s (2) 2p (3) 2s (4) 1s

Q.98 An electron in a hydrogen atom in its ground state absorbs energy equal to the ionisation energy of Li^{+2}. The wavelength of the emitted electron is:

(1) 3.32×10^{-10} m (2) 1.17 Å
(3) 2.32×10^{-9} nm (4) 3.33 pm

Q.99 The energy photon emitted corresponding to transition n = 3 to n = 1 is :
[$h = 6 \times 10^{-34}$ J-sec.]

(1) 1.76×10^{-18} J (2) 1.98×10^{-18} J
(3) 1.76×10^{-17} J (4) None of these

Q.100 The difference in the wavelength of the 1st line of Lyman series and 2nd line of Balmer series in a hydrogen atom is

(1) $\frac{9}{2R}$ (2) $\frac{4}{R}$ (3) $\frac{88}{15R}$ (4) None

Q.101 The wave number of electromagnetic radiation emitted during the transition of electron in between two levels of Li^{2+} ion whose principal quantum numbers sum is 4 and difference is 2 is

(1) 3.5 R (2) 4 R (3) 8 R (4) $\frac{8}{9}$ R

DE-BROGLIE CONCEPT

Q.102 An α-particle is accelerated through a potential difference of V volts from rest. The de-Broglie's wavelength associated with it is

(1) $\sqrt{\frac{150}{V}}$ Å (2) $\frac{0.286}{\sqrt{V}}$ Å
(3) $\frac{0.101}{\sqrt{V}}$ Å (4) $\frac{0.983}{\sqrt{V}}$ Å

Q.103 A helium molecule is moving with a velocity of 2.40×10^2 ms^{-1} at 300k. The de-Broglie wave length is about

(1) 0.416 nm (2) 0.83 nm
(3) 803 Å (4) 8000 Å

Q.104 A ball weight 25 g moves with a velocity of 6.6×10^4 cm/sec then find out the de Broglie wavelength.

(1) 0.4×10^{-33} cm (2) 0.4×10^{-31} cm
(3) 0.4×10^{-34} cm (4) 0.4×10^{20} cm

Q.105 No. of wave in fourth orbit :–

(1) 4 (2) 5 (3) 0 (4) 1

Q.106 (n + 1) is the principal quantum number of the energy state for an atom. What are the number of elliptical orbits associated with it :–

(1) (n – 1) (2) (n + 1)
(3) (n – 2) (4) n

Q.107 If the radius of first Bohr orbit of hydrogen atom is 'x' then de Broglie wavelength of electron in 3rd orbit is nearly:

(1) $2\pi x$ (2) $6\pi x$ (3) 9x (4) $\frac{x}{3}$

Q.108 What is the ratio of the De-Broglie wave lengths for electrons accelerated through 200 volts and 50 volts :-
(1) 1 : 2 (2) 2 : 1 (3) 3 : 10 (4) 10 : 3

Q.109 A particle X moving with a certain velocity has a debroglie wavelength of 1Å. If particle Y has a mass of 25% that of X and velocity 75% that of X, debroglies wavelength of Y will be :-
(1) 3Å (2) 5.33 Å
(3) 6.88 Å (4) 48Å

Q.110 The wavelength associated with a golf ball weighing 200 g and moving at a speed of 5 m/h is of the order
(1) 10^{-10}m (2) 10^{-20}m
(3) 10^{-30}m (4) 10^{-40} m

Q.111 The de-Broglie wavelength of a tennis ball of mass 60 g moving with a velocity of 10 metres per second is approximately
[Planck's constant, h = 6.63×10^{-34} Js]
(1) 10^{-25} metres (2) 10^{-33} metres
(3) 10^{-31} metres (4) 10^{-16} metre

Q.112 A ball of 100 g mass is thrown with a velocity of 100 ms^{-1}. The wavelength of the de Broglie wave associated with the ball is about
(1) 6.63×10^{-35} m (2) 6.63×10^{-30} m
(3) 6.63×10^{-35} cm (4) 6.63×10^{-33} m

Q.113 An electron has kinetic energy 2.8×10^{-23} J. de-Broglie wavelength will be nearly :
($m_e = 9.1 \times 10^{-31}$ kg)
(1) 9.28×10^{-24} m (2) 9.28×10^{-7} m
(3) 9.28×10^{-8} m (4) 9.28×10^{-10} m

Q.114 Which of the following has least de-Broglie λ?
(1) e^- (2) p (3) CO_2 (4) SO_2

HEISENBERG UNCERTAINITY PRINCIPLE

Q.115 The uncertainty in position and velocity of a particle are 10^{-10} m and 5.27×10^{-24} ms^{-1} respectively. Calculate the mass of the particle (h = 6.625×10^{-34} Joule sec.)
(1) 0.099 Kg (2) 0.089 Kg
(3) 0.99 Kg (4) Can not predict

Q.116 It the uncertainity in position of a moving particle is 0 then find out ΔP
(1) 0 (2) 1
(3) ∞ (4) Can not predict

Q.117 For the electron if the uncertainty in velocity is Δv, the uncertainty in its position (Δx) is given below:
(1) $\frac{h}{2}\pi m\Delta v$ (2) $\frac{2\pi}{hm\Delta v}$
(3) $\frac{h}{4\pi m\Delta v}$ (4) $\frac{2\pi m}{h\Delta v}$

Q.118 The uncertainty in momentum of moving particle is 1.0×10^{-15} kg m s^{-1}, the minimum uncertainty in its position would be
(1) 5.28×10^{-20} m (2) 5.28×10^{-49} m
(3) 6.63×10^{-49} m (4) 6.63×10^{-22} m

Q.119 Heisenberg Uncertainity principle is not valid for
(1) Moving electron
(2) Motor car
(3) Stationary particles
(4) 2 & 3 both

Q.120 The uncertainty in the position of an electron (mass 9.1×10^{-28} gm) moving with a velocity of 3×10^4 cm sec^{-1}, uncertainity in velocity is 0.011% will be:-
(1) 1.92 cm (2) 7.68 cm
(3) 0.175 cm (4) 3.84 cm

Q.121 The uncertainty in position of an electron & helium atom are same. If the uncertainity in momentum for the electron is 32×10^5, then the uncertainity in momentum of helium atom will be
(1) 32×10^5 (2) 16×10^5
(3) 8×10^5 (4) None

QUANTUM NUMBERS

Q.122 Which of the following set of quantum numbers is not permitted
(1) n = 3, *l* = 2, m = – 2, s = +1/2
(2) n = 3, *l* = 2, m = – 1, s = -1/2
(3) n = 2, *l* = 2, m = +1, s = – 1/2
(4) n = 4, *l* = 2, m = +1, s = – 1/2

Q.123 Which of the following principles/rules limits the maximum number of electrons in an orbital to two
(1) Aufbau principle
(2) Pauli's exclusion principle
(3) Hund's rule of maximum multiplicity
(4) Heisenberg's uncertainty principle

Q.124 In an atom, for how many electrons, the quantum numbers will be , n = 3, ***l*** = 2, m = + 2, s = + $\frac{1}{2}$:-

(1) 18 (2) 6 (3) 24 (4) 1

Q.125 For the azimuthal quantum number (***l***), the total number of magnetic quantum number is given by:-

(1) ***l*** = $\frac{(m+1)}{2}$ (2) ***l*** = $\frac{(m-1)}{2}$

(3) ***l*** = $\frac{(2m+1)}{2}$ (4) ***l*** = $\frac{(2m-1)}{2}$

Q.126 Spin angular momentum for electron :-

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

(3) $\sqrt{s(s+2)}\ \frac{h}{2\pi}$ (4) None

Q.127 If l = 3 then type and number of orbital is :–

(1) 3p, 3 (2) 4f, 14 (3) 5f, 7 (4) 3d, 5

Q.128 The total value of m for the electrons (n = 4) is -

(1) 4 (2) 8 (3) 16 (4) 32

Q.129 An electron has magnetic quantum number as -3, what is its principal quantum number :-

(1) 1 (2) 2 (3) 3 (4) 4

Q.130 The total spin resulting from a d^7 configuration is:-

(1) $\frac{1}{2}$ (2) 2 (3) 1 (4) $\frac{3}{2}$

Q.131 No. of all subshells of n + ℓ = 7 is:-

(1) 4 (2) 5 (3) 6 (4) 7

Q.132 The quantum number of 20th electron of Fe(Z = 26) ion would be :–

(1) 3, 2, – 2, – ½ (2) 3, 2, 0, ½

(3) 4, 0, 0, + ½ (4) 4, 1, – 1, + ½

Q.133 Which orbital has two angular nodal planes :-

(1) s (2) p (3) d (4) f

Q.134 In an atom having 2K, 8L, 8M and 2N electrons, the number of electrons with m = 0; S = $+\frac{1}{2}$ are

(1) 6 (2) 2 (3) 8 (4) 16

Q.135 Orbital angular momentum of a 3d electron is:-

(1) $\sqrt{2}\ \frac{h}{2\pi}$ (2) $\sqrt{6}\ \frac{h}{2\pi}$

(3) $\frac{h}{2\pi}$ (4) $\frac{h}{4\pi}$

Q.136 An orbital with ℓ = 0 is symmetrical about the:-

(1) x-axis only (2) y-axis only

(3) z-axis only (4) The nucleus

Q.137 In n & ℓ are principal and azimuthal quantum no. respectively then the expression for calculating the total no. of electron in any energy level is:-

(1) $\sum_{\ell=0}^{\ell=1} 2(2\ell+1)$ (2) $\sum_{\ell=1}^{\ell=n-1} 2(2\ell+1)$

(3) $\sum_{\ell=0}^{\ell=n+1} 2(2\ell+1)$ (4) $\sum_{\ell=0}^{\ell=n-1} 2(2\ell+1)$

Q.138 For azimuthal quantum number l = 3, the maximum number of electrons will be :

(1) 2 (2) 6 (3) zero (4) 14

Q.139 Which d - orbital has different shape from rest of all d – orbitals ?

(1) $d_{x^2-y^2}$ (2) d_{z^2} (3) d_{xy} (4) d_{xz}

Q.140 The total number of orbitals in a shell with principal quantum number 'n' is :

(1) 2 n (2) $2n^2$ (3) n^2 (4) n + 1

Q.141 What is the correct orbital designation for the electron with the quantum numbers , n = 4, l = 3 , m = – 2 , s = 1/2

(1)3 s (2)4 f (3)5 p (4)6 s

Q.142 The total number of electrons that can be accommodated in all the orbitals having principal quantum number 2 and azimuthal quantum number 1 is :

(1) 2 (2) 4 (3) 6 (4) 8

Q.143 Which atom has as many as s - electron as p – electron ?

(1) H (2) Mg (3) N (4) Na

Q.144 Correct set of four quantum number for valency (outermost) electron of rubidium (Z = 37) is :

(1) 5, 0 , 0 , + 1/2 (2) 5 , 1 , 0 , + 1/2

(3) 5, 1, 1, +1/2 (4) 6, 0, 0, +1/2

Q.145 The probability of finding an electron residing in a p_x orbital is not zero :
(1) In the yz plane
(2) In the xy plane
(3) In the y direction
(4) In the z direction

Q.146 The total spin resulting from a d^7 configuration is:
(1) $\pm 1/2$ (2) ± 2
(3) ± 1 (4) $\pm 3/2$

Q.147 The number of nodal planes in a p_x orbital is:
(1) 1 (2) 2 (3) 3 (4) zero

Q.148 The orbital angular momentum of an electron in p-orbital is:
(1) zero (2) $\frac{h}{\sqrt{2}\pi}$ (3) $\frac{h}{2\pi}$ (4) $\frac{1}{2}\frac{h}{2\pi}$

Q.149 The value of Azimuthal quantum number for all electrons present in 5p orbitals is
(1) 4 (2) 5 (3) 2 (4) 1

Q.150 Which of the following sets of quantum number is not possible?
(1) n = 3; l = 0 , ml = 0, m_s = + $\frac{1}{2}$
(2) n = 3; l = 0 , ml = 0, m_s = − $\frac{1}{2}$
(3) n = 3; l = 0, ml = −1, m_s = + $\frac{1}{2}$
(4) n = 3; l = 1, ml = 0, m_s = − $\frac{1}{2}$

Q.151 The 19th electron of chromium has which of the following sets of quantum numbers?

	n	l	m	s
(1)	3	0	0	$\frac{1}{2}$
(2)	3	2	−2	$\frac{1}{2}$
(3)	4	0	0	$\frac{1}{2}$
(4)	4	1	−1	$\frac{1}{2}$

Q.152 The orbital angular momentum for an electron revolving in an orbit is given by $\sqrt{l(l+1)} \cdot \frac{h}{2\pi}$. This momentum for an s-electron will be given by
(1) $\sqrt{2}.\frac{h}{2\pi}$ (2) $\frac{1}{2}.\frac{h}{2\pi}$
(3) zero (4) $\frac{h}{2\pi}$

Q.153 Which of the following sets of quantum numbers is correct for an electron in 4f-orbital?
(1) n = 4, l = 3, m = 4, s = + $\frac{1}{2}$
(2) n = 4, l = 4, m = −4, s = − $\frac{1}{2}$
(3) n = 4, l = 3, m = +1, s = + $\frac{1}{2}$
(4) n = 3, l = 2, m = −2, s = + $\frac{1}{2}$

Q.154 For principal quantum number n = 4, the total number of orbitals having l = 3 is
(1) 3 (2) 7 (3) 5 (4) 9

Q.155 Which of the following sets of quantum numbers represents the highest energy of an atom?
(1) n = 3, l = 1, m = 1, s = + $\frac{1}{2}$
(2) n = 3, l = 2 m = 1 s = + $\frac{1}{2}$
(3) n = 4, l = 0, m = 0, s = + $\frac{1}{2}$
(4) n = 3, l = 0, m = 0, s = + $\frac{1}{2}$

Q.156 The orbital angular momentum of an electron in 2s orbital is:
(1) $+\frac{1}{2}.\frac{h}{2\pi}$ (2) Zero
(2) $\frac{h}{2\pi}$ (4) $\sqrt{2}\frac{h}{2\pi}$

ELECTRONIC CONFIGURATION

Q.157 Magnetic moment of X^{n+} (Z = 26) is $\sqrt{24}$ B.M. Hence number of unpaired electrons and value of n respectively are :
(1) 4, 2 (2) 2, 4 (3) 3, 1 (4) 0, 2

Q.158 A transition metal 'X' has a configuration [Ar] $3d^5$ in its + 3 oxidation state. Its atomic number is:–
(1) 22 (2) 26 (3) 28 (4) 19

Q.159 $4s^2$ is the configuration of the outermost orbit of an element. Its atomic number would be :–
(1) 29 (2) 24 (3) 30 (4) 19

Q.160 A neutral atom of an element has 2K, 8L, 11 M and 2N electrons. The number of s-electron in the atom are
(1) 2 (2) 8 (3) 10 (4) 6

Q.161 The explanation for the presence of three unpaired electrons in the nitrogen atom can be given by:-
(1) Pauli's exclusion principle
(2) Hund's rule
(3) Aufbau's principle
(4) Uncertainty principle

Q.162 n and ℓ values of an orbital 'A' are 3 and 2, of another orbital 'B' are 5 and 0. The energy of
(1) B is more than A
(2) A is more than B
(3) A and B are of same energy
(4) None

Q.163 Sum of the paired electrons present in the orbital with ℓ = 2 in all the species Fe^{2+}, Co^{2+} and Ni^{+2} are:–
(1) 9 (2) 12 (3) 6 (4) 15

Q.164 The number of electrons in the M-shell of the element with atomic number 24 is :-
(1) 24 (2) 12 (3) 8 (4) 13

Q.165 An improbable configuration is :
(1) [Ar] $3d^4$, $4s^2$ (2) [Ar] $3d^5$, $4s^1$
(3) [Ar] $3d^6$, $4s^2$ (4) [Ar] $3d^{10}$, $4s^1$

Q.166 Krypton ($_{36}Kr$) has the electronic configuration ($_{18}Ar$) $4s^2$ $3d^{10}$ $4p^6$, the 37[th] electron will go into which of the following subshells .
(1) 4 f (2) 4 d (3) 3 p (4) 5 s

Q.167 The electronic configuration of the element which is just above the element with atomic number 43 in the same particle group is :
(1) $1s^2, 2s^2\,2p^6, 3s^2\,3p^6\,3d^{10}, 4s^1\,4p^6$
(2) $1s^2, 2s^2\,2p^6, 3s^2\,3p^6\,3d^5, 4s^2$
(3) $1s^2, 2s^2\,2p^6, 3s^2\,3p^6\,3d^6, 4s^1$
(4) $1s^2, 2s^2\,2p^6, 3s^2\,3p^6\,3d^{10}, 4s^2\,4p^5$

Q.168 The number of vacant d - orbitals in completely excited Cl atom is:
(1) 2 (2) 3 (3) 1 (4) 4

Q.169 Which among the following is correct of $_5B$ in normal state?
2s 2p
(1) [↑↑] [ ][↑][ ] : Against Hund's rule
(2) [↑] [↑][↑][ ] : Against Aufbau principle as well as Hund's rule
(3) [↑↑] [↑][ ][ ] : Violation of Pauli's exclusion principle and not Hund's rule
(4) [↑↓] [↑][ ][ ] : Against Aufbau principle

Q.170 The atomic orbitals are progressively filled in order of increasing energy. This principle is called.
(1) Hund's rule (2) Aufbau principle
(3) Exclusion principle (4) de- Broglie rule.

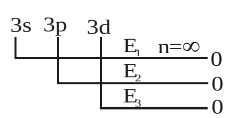
Q.171 For a given principal level n = 4, the energy of its subshells is in the order
(1) s < p < d < f (2) s > p > d > f
(3) s < p < f < d (4) f < p < d < s.

Q.172 The atomic number of an element is 17, the number of orbitals containing electron pairs in the valency shell is:-
(1) 8 (2) 2 (3) 3 (4) 6

Q.173 Which of the following transition neither shows absorption nor emission of energy in case of Hydrogen atom :–
(1) $3p_x \rightarrow 3s$ (2) $3d_{xy} \rightarrow 3d_{yz}$
(3) $3s \rightarrow 3d_{xy}$ (4) All the above

Q.174 In potassium the order of energy level for 19[th] electron is :
(1) 3 s > 3 d (2) 4 s < 3 d
(3) 4 s > 3 p (4) 4 s = 3 d

Q.175 Remaining part of atom except outer orbit is called:-
(1) Kernel (2) Core
(3) Empty space (4) None of these

Q.176 For H atom, the energy required for the removal of electron from various sub-shells is given as under:-


The order of the energies would be :-
(1) $E_1 > E_2 > E_3$ (2) $E_3 > E_2 > E_1$
(3) $E_1 = E_2 = E_3$ (4) None of these

Q.177 The maximum number of electrons in a sub-shell is given by the expression

(1) $4l - 2$ (2) $4l + 2$ (3) $2l + 1$ (4) $2n_2$

Q.178 Total number of nodal planes, angular and spherical nodes in 3s-subshell are respectively :

(1) zero, zero, 2 (2) 2, 2, 2
(3) zero, zero, zero (4) zero, 2, 2

Q.179 Consider the ground state of Cr atom (z = 24). The numbers of electrons with the azimuthal quantum numbers, $l = 1$ and 2 are, respectively.

(1) 12 and 4 (2) 12 and 5
(3) 16 and 4 (4) 16 and 5

Q.180 Which of the following statements in relation to the hydrogen atom is correct?

(1) 3s, 3p and 3d orbitals all have the same energy.
(2) 3s and 3p orbitals are of lower energy than 3d orbital.
(3) 3p orbital is lower in energy than 3d orbital.
(4) 3s orbital is lower is energy than 3p orbital.

ANSWER KEY

TOPIC WISE QUESTIONS

Que.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Ans.	3	4	2	4	2	4	4	2	1	4	3	2	4	1	1
Que.	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Ans.	3	2	1	2	2	1	3	1	2	4	1	3	3	2	4
Que.	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
Ans.	3	1	2	3	2	2	3	3	4	1	1	2	2	2	2
Que.	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
Ans.	2	2	1	1	4	2	2	1	2	1	3	1	4	4	1
Que.	**61**	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**
Ans.	4	3	4	1	4	1	2	3	4	1	3	1	4	1	1
Que.	**76**	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**
Ans.	1	3	2	1	1	1	2	3	1	2	4	4	2	3	1
Que.	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**100**	**101**	**102**	**103**	**104**	**105**
Ans.	2	4	1	3	3	1	4	2	1	2	3	3	1	1	1
Que.	**106**	**107**	**108**	**109**	**110**	**111**	**112**	**113**	**114**	**115**	**116**	**117**	**118**	**119**	**120**
Ans.	2	2	1	2	3	2	1	3	1	1	3	3	1	4	3
Que.	**121**	**122**	**123**	**124**	**125**	**126**	**127**	**128**	**129**	**130**	**131**	**132**	**133**	**134**	**135**
Ans.	1	3	2	4	2	1	3	3	4	4	1	3	3	1	2
Que.	**136**	**137**	**138**	**139**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**147**	**148**	**149**	**150**
Ans.	4	4	4	2	3	2	3	2	1	2	4	1	2	4	3
Que.	**151**	**152**	**153**	**154**	**155**	**156**	**157**	**158**	**159**	**160**	**161**	**162**	**163**	**164**	**165**
Ans.	3	3	3	2	2	2	1	2	3	2	2	1	2	4	1
Que.	**166**	**167**	**168**	**169**	**170**	**171**	**172**	**173**	**174**	**175**	**176**	**177**	**178**	**179**	**180**
Ans.	4	2	1	3	2	1	3	4	2	1	3	2	1	2	1