Chapter 02

Atomic Structure

Practice Section-01

Q.1 If S_1 be the specific charge (e/m) of cathode rays and S_2 be that of positive rays, then which is true ?
(1) $S_1 = S_2$ (2) $S_1 < S_2$ (3) $S_1 > S_2$ (4) Either of these

Q.2 An increasing order (lowest first) for the values of e/m for electron (e), proton (p), neutron (n) and alpha (α) particle is :
(1) e, p, n, α (2) n, α, p, e (3) n, p, e, α (4) n, p, α, e

Q.3 Select iso electronic set :-
(a) Na^+, H_3O^+, NH_4^+ (b) CO_3^{-2}, NO_3^-, HCO_3^- (c) P^{-3}, HCl, C_2H_6, PH_3 (d) N^{-3}, O^{-2}, F
(1) a, b, d (2) b, c, d (3) a, b, c, d (4) a, b, c

Q.4 The ratio of specific charge of a proton and an α–particle is :–
(1) 2 : 1 (2) 1 : 2 (3) 1 : 4 (4) 1 : 1

Q.5 An isotone of $_{32}Ge^{76}$ is :-
(i) $_{32}Ge^{77}$ (ii) $_{33}As^{77}$ (iii) $_{34}Se^{77}$ (iv) $_{34}Se^{78}$
(1) (ii) & (iii) (2) (i) & (ii) (3) (ii) & (iv) (4) (ii) & (iii) & (iv)

Q.6 $^{13}_{6}C$ and $^{12}_{6}C$ differ from each in respect of number of
(1) electrons (2) protons (3) neutrons (4) none of these

Q.7 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.8 A strong argument for the particle nature of cathode rays is that they:
(1) Produce fluorescence (2) Get deflected by electric and magnetic fields
(3) Travel through vacuum (4) Cast shadow

Q.9 ^{18}O isotope of oxygen will have
(1) 18 protons (2) 9 protons and 9 neutrons
(3) 8 neutrons and 10 protons (4) 10 neutrons and 18 protons.

Q.10 Nuclides
(1) have same number of protons (2) have specific atomic numbers
(3) have specific atomic and mass numbers (4) are isotopes.

Practice Section-02

Q.1 If the radii of first orbits of H, He^+, Li^{+2} and Be^{+3} are r_1, r_2, r_3 and r_4 respectively, then their correct decreasing order will be:

(1) $r_1 > r_2 > r_3 > r_4$ (2) $r_3 < r_2 > r_4 < r_1$ (3) $r_1 < r_2 < r_3 > r_4$ (4) Radius of all are equal

Q.2 An electron in an atom jumps in such a way that its kinetic energy changes from x to $\frac{x}{4}$. The change in potential energy will be:

(1) $+\frac{3}{2}x$ (2) $-\frac{3}{8}x$ (3) $+\frac{3}{4}x$ (4) $-\frac{3}{4}x$

Q.3 The distance between 4th and 3rd Bohr orbits of He^+ is :

(1) 2.645×10^{-10}m (2) 1.322×10^{-10}m (3) 1.851×10^{-10} m (4) None

Q.4 What atomic number of an element "X" would have to become so that the 4th orbit around X would fit inside the 1st Bohr orbit of H atom?

(1) 3 (2) 4 (3) 16 (4) 25

Q.5 The energy levels for ${}_zA^{(+z-1)}$ can be given by :

(1) E_n for $A^{(+z-1)} = Z^2 \times E_n$ for H (2) E_n for $A^{(+z-1)} = Z \times E_n$ for H

(3) E_n for $A^{(+z-1)} = \frac{1}{z^2} \times E_n$ for H (4) E_n for $A^{(+z-1)} = \frac{1}{z} \times E_n$ for H

Q.6 The angular momentum of electron of H-atom is proportional to:

(1) r^2 (2) $\frac{1}{r}$ (3) $\sqrt{r}$ (4) $\frac{1}{\sqrt{r}}$

Q.7 The mass of an electron is m, its charge is e and it is accelerated from rest through a potential difference, V. The velocity of electron will be calculated by formula

(1) $\sqrt{\frac{V}{m}}$ (2) $\sqrt{\frac{eV}{m}}$ (3) $\sqrt{\left(\frac{2eV}{m}\right)}$ (4) None of these

Q.8 The minimum energy required 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 electron ejected out from Ag which is being exposed to *UV*–light of λ = 360 Å?

(1) 49.68×10^{-19} J (2) $4.9\ 68 \times 10^{-19}$ J (3) 27.29×10^{-19} J (4) 4.9×10^{-20} J

Q.9 The total number of atomic orbitals in fourth energy level of an atom is: –

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

Q.10 According to the Bohr Theory, which of the following transitions in the hydrogen atom will give rise to the least energetic photon?

(1) n = 5 to n = 3 (2) n = 6 to n = 1 (3) n = 5 to n = 4 (4) n = 6 to n = 5

Q.11 Which of the following is wrong for Bohr model

(1) It establishes stability of atom

(2) It is contradicted with Heisenberg uncertainty principle

(3) It explain the concept of spectral lines (4) e^- behaves as particle & wave

Practice Section-03

Q.1 What electronic transition in Li^{2+} produces the radiation of the same wavelength as the first line in the Lyman series of hydrogen?
(1) n = 4 to n = 2 (2) n = 9 to n = 6 (3) n= 9 to n = 3 (4) n = 6 to n = 3

Q.2 The first Lyman transition in the hydrogen spectrum has $\Delta E = 10.2$ eV. The same energy change is observed in the second Balmer transition of :
(1) Li^{2+} (2) Li^{+} (3) He^{+} (4) Be^{3+}

Q.3 A hydrogen atom in the ground state is excited by monochromatic radiation of wavelength λ Å. The resulting spectrum consists of maximum 15 different lines. What is the wavelength λ? ($R_H = 109737\ cm^{-1}$)
(1) 937.3 Å (2) 1025 Å (3) 1236 Å (4) None of these

Q.4 Line spectra is characteristic of :
(1) Molecules (2) atoms (3) radicals (4) none of these

Q.5 Splitting of spectral lines under the influence of magnetic field is called :
(1) Zeeman effect (2) Stark effect (3) Photoelectric effect (4) None of these

Q.6 Which statement relating to the spectrum of H atom is false?
(1) The lines can be defined by quantum number
(2) The lines of longest wavelength in the Balmer series corresponds to the transition between n = 3 and n = 2 levels
(3) The spectral lines are closer together at longer wavelength
(4) A quantum occurs at $n = \infty$

Q.7 Which of the following series of lines in the atomic emission spectrum of hydrogen is in the visible region?
(1) Lyman (2) Paschen (3) Balmer (4) Brackett

Q.8 If 'R_H' is the Rydberg constant, then the energy of an electron in the ground state of hydrogen atom is :
(1) $\frac{R_H c}{h}$ (2) $\frac{1}{R_H ch}$ (3) $\frac{hc}{R_H}$ (4) $-R_H hc$

Q.9 If uncertainty in position and momentum are equal, then uncertainty in velocity is ?
(1) $\sqrt{\frac{h}{\pi}}$ (2) $\frac{1}{2m}\sqrt{\frac{h}{\pi}}$ (3) $\sqrt{\frac{h}{2\pi}}$ (4) $\frac{1}{m}\sqrt{\frac{h}{\pi}}$

Q.10 The measurement of the electron position is associated with an uncertainty in momentum, which is equal to 1×10^{-18} g cm s^{-1}. The uncertainty in electron velocity is :
(mass of electron = 9×10^{-28}g)
(1) 1×10^{11} cm s^{-1} (2) 1×10^{9} cm s^{-1} (3) 1×10^{6} cm s^{-1} (4) 1×10^{5} cm s^{-1}

Q.11 A 0.66 kg ball is moving with a speed of 100 m/s. The associated wavelength will be
($h = 6.6 \times 10^{-34}$ Js) :-
(1) 6.6×10^{-34} m (2) 1.0×10^{-35} m (3) 1.0×10^{-32} m (4) 6.6×10^{-32} m

Q.12 Smallest wavelength occurs for
(1) Lyman series (2) Balmar series (3) Paschen series (4) Brackett series

Practice Section-04

Q.1 Which of the following set of quantum number is impossible for an electron ?

(1) n = 1, l = 0, m_l = 0, m_s = + $\frac{1}{2}$ (2) n = 9, l = 7, m_l = –6, m_s = – $\frac{1}{2}$

(3) n = 2, l = 1, m_l = 0, m_s = + $\frac{1}{2}$ (4) n = 3, l = 2, m_l = –3, m_s = + $\frac{1}{2}$

Q.2 Which of the following statements is correct for an electron having azimuthal quantum number l = 2?

(1) The electron may be in the lowest energy shell.

(2) The electron is in a spherical orbital.

(3) The electron must have spin m_s = + $\frac{1}{2}$

(4) The electron may have a magnetic quantum number = – 1

Q.3 Four electrons in an atom have the sets of quantum numbers as given below. Which electron in at the highest energy level?

(1) n = 4, l = 0, m_l = 0, m_s = +1/2 (2) n = 3, l = 1, m_l = 0, m_s = –1/2

(3) n = 3, l = 2, m_l = 0, m_s = +1/2 (4) n = 4, l = 1, m_l = –1, m_s = –1/2

Q.4 ψ^2 (psi) the wave function represents the probability of finding electron, Its values depends :

(1) inside the nucleus (2) far from the nucleus

(3) near the nucleus (4) upon the type of orbital

Q.5 Which set of quantum numbers is possible for the last electron of Mg^+ ion ?

(1) n = 3, l = 2, m = 0, s = +1/2 (2) n = 2, l = 3, m = 0, s = +1/2

(3) n = 1, l = 0, m = 0, s = +1/2 (4) n = 3, l = 0, m = 0, s = +1/2

Q.6 In any subshell, the maximum number of electrons having same value of spin quantum number is :

(1) $\sqrt{\ell(\ell+1)}$ (2) l + 2 (3) 2l + 1 (4) 4l + 2

Q.7 The electronic configuration of silver atom in ground state is :

(1) $[Ar]3d^{10}, 4s^1$ (2) $[Xr]4f^{14}, 5d^{10}, 6s^1$ (3) $[Kr]4d^{10}, 5s^1$ (4) $[Kr]4d^9, 5s^2$

Q.8 Which of the following statement is (are) correct ?

(1) The electronic configuration of Cr is $[Ar]3d^5, 4s^1$ (Atomic no. of Cr = 24)

(2) The magnetic quantum number may have a negative value

(3) In silver atom, 23 electrons have a spin of one type and 24 of the opposite type, (Atomic no. of Ag =47)

(4) All of the above

Q.9 Maximum number of electrons in a subshell of an atom is determined by the following :-

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

Q.10 Which of the following is not permissible arrangement of electrons in an atom ?

(1) n = 3, ℓ = 2, m = –2, s = –1/2 (2) n = 4, ℓ = 0, m = 0, s = –1/2

(3) n = 5, ℓ = 3, m = 0, s = +1/2 (4) n = 3, ℓ = 2, m = –3, s = –1/2

Q.11 If n = 6, the correct sequence for filling of electrons will be :

(1) ns → (n–2)f → (n–1)d → np (2) ns → (n–1)d → (n–2)f → np

(3) ns → (n–2)f → np → (n–1)d (4) ns → np (n–1)d → (n–2)f

ANSWER KEY

PRACTICE SECTION-01

Que.	1	2	3	4	5	6	7	8	9	10
Ans:	3	2	4	1	3	3	4	2	4	3

PRACTICE SECTION-02

Que.	1	2	3	4	5	6	7	8	9	10	11
Ans:	1	1	3	3	1	3	3	1	2	4	4

PRACTICE SECTION-03

Que.	1	2	3	4	5	6	7	8	9	10	11	12
Ans:	4	3	1	2	1	3	3	4	2	2	2	1

PRACTICE SECTION-04

Que.	1	2	3	4	5	6	7	8	9	10	11
Ans:	4	4	4	4	4	3	4	2	2	4	3