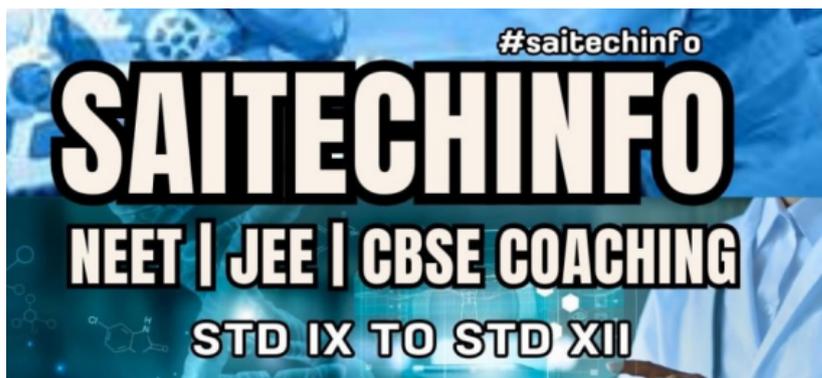# Atomic Structure

SYLLABUS : Structure of Atom

Max. Marks: 120
Marking Scheme: +4 for correct & (–1) for incorrect
Time: 60 min.
INSTRUCTIONS: This Daily Practice Problem Sheet contains 30 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.

1. Among the following groupings which represents the collection of isoelectronic species?

   - (a) NO^+, C_2^{2-}, O_2, CO
   - (b) N_2, C_2^{2-}, CO, NO
   - (c) CO, NO^+, CN^-, C_2^{2-}
   - (d) NO, CN^-, N_2, O_2^-

2. The compound in which cation is isoelectronic with anion is:

   - (a) NaCl
   - (b) CsF
   - (c) NaI
   - (d) K_2S

3. The de-Broglie wavelength of an electron in the ground state of hydrogen atom is: $[K.E. = 13.6\,\text{eV}; 1\,\text{eV} = 1.602 \times 10^{-19}\,\text{J}]$

   - (a) 33.28 nm
   - (b) 3.328 nm
   - (c) 0.3328 nm
   - (d) 0.0332 nm

4. The frequency of light emitted for the transition $n = 4$ to $n = 2$ of the He^+ is equal to the transition in H atom corresponding to which of the following?

   - (a) $n = 2$ to $n = 1$
   - (b) $n = 3$ to $n = 2$
   - (c) $n = 4$ to $n = 3$
   - (d) $n = 3$ to $n = 1$

5. The first emission line in the atomic spectrum of hydrogen in the Balmer series appears at:

- (a) $\frac{9R}{400}$ cm^{-1}
- (b) $\frac{7R}{144}$ cm^{-1}
- (c) $\frac{3R}{4}$ cm^{-1}
- (d) $\frac{5R}{36}$ cm^{-1}

6. In hydrogen atomic spectrum, a series limit is found at 12186.3 cm^{-1}. Then it belongs to:

- (a) Lyman series
- (b) Balmer series
- (c) Paschen series
- (d) Brackett series

7. Two fast moving particles X and Y are associated with de Broglie wavelengths 1 nm and 4 nm respectively. If mass of X is nine times the mass of Y, the ratio of kinetic energies of X and Y would be:

- (a) 3 : 1
- (b) 9 : 1
- (c) 5 : 12
- (d) 16 : 9

8. The ratio of magnetic moments of Fe(III) and Co(II) is:

- (a) 7 : 3
- (b) 3 : 7
- (c) $\sqrt{7} : \sqrt{3}$
- (d) $\sqrt{3} : \sqrt{7}$

9. The values 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 nanometres of a quantum of light with frequency of 8×10^{15} s^{-1}?

- (a) 5×10^{-18}
- (b) 4×10^{1}
- (c) 3×10^{7}
- (d) 2×10^{-25}

10. Li and a proton are accelerated by the same potential, their de Broglie wavelengths λ_{Li} and λ_p have the ratio (assume $m_{\mathrm{Li}} = 9m_p$):

- (a) 1 : 2
- (b) 1 : 4
- (c) 1 : 1
- (d) $1 : 3\sqrt{3}$

11. Energy levels A, B, C, of a certain atom correspond to increasing values of energy i.e., $E_A < E_B < E_C$. If $\lambda_1, \lambda_2, \lambda_3$ are the wavelengths of radiations corresponding to the transition from C to B, B to A and C to A respectively, which of the following statements is correct?

- (a) $\lambda_3 = \lambda_1 + \lambda_2$
- (b) $\lambda_3 = \frac{\lambda_1\lambda_2}{\lambda_1+\lambda_2}$
- (c) $\lambda_1 + \lambda_2 + \lambda_3 = 0$
- (d) $\lambda_3^2 = \lambda_1^2 + \lambda_2^2$

12. If uncertainty in position and momentum are equal, then uncertainty in velocity is:

- (a) $\frac{1}{2m}\sqrt{\frac{h}{\pi}}$
- (b) $\sqrt{\frac{h}{2\pi}}$
- (c) $\frac{1}{m}\sqrt{\frac{h}{\pi}}$
- (d) $\sqrt{\frac{h}{\pi}}$

13. The electrons, identified by quantum numbers n and l (i in $n = 4, l = 1$; ii in $n = 4, l = 0$; iii in $n = 3, l = 2$; iv in $n = 3, l = 1$; v in $n = 3, l = 0$) can be placed in order of increasing energy, from the lowest to highest, as:

- (a) $(i) < (ii) < (iii) < (iv)$
- (b) $(ii) < (iv) < (i) < (iii)$
- (c) $(i) < (iii) < (ii) < (iv)$
- (d) $(iii) < (i) < (iv) < (ii)$

14. Ionisation energy of He^+ is 19.6×10^{-18} J atom^{-1}. The energy of the first stationary state ($n = 1$) of Li^{2+} is:

- (a) 4.41×10^{-16} J atom^{-1}
- (b) -4.41×10^{-17} J atom^{-1}
- (c) -2.2×10^{-15} J atom^{-1}
- (d) 8.82×10^{-17} J atom^{-1}

15. The kinetic energy of an electron in the second Bohr orbit of a hydrogen atom is (a_0 is Bohr radius):

- (a) $\frac{h^2}{4\pi^2 ma_0^2}$
- (b) $\frac{h^2}{16\pi^2 ma_0^2}$
- (c) $\frac{h^2}{32\pi^2 ma_0^2}$
- (d) $\frac{h^2}{64\pi^2 ma_0^2}$