JEE (2023)

Atomic Structure

DPP-02

1. A hydrogen atom and a Li^{2+} ion are both in the second excited state. If l_H and l_{Li} are their respective electronic angular momenta, and E_H and E_{Li} their respective energies, then

(1) $l_H > l_{Li}$ and $|E_H| > |E_{Li}|$

(2) $l_H = l_{Li}$ and $|E_H| < |E_{Li}|$

(3) $l_H = l_{Li}$ and $|E_H| > |E_{Li}|$

(4) $l_H < l_{Li}$ and $|E_H| > |E_{Li}|$

2. As an electron makes a transition from an excited state to the ground state of a hydrogen like atom/ion

(1) Kinetic energy, potential energy and total energy decrease

(2) Kinetic energy decreases, potential energy increases but total energy remains same

(3) Kinetic energy and total energy decrease but potential energy increases

(4) Its kinetic energy increases but potential energy and total energy decrease

3. As per Bohr model, the minimum energy (in eV) required to remove an electron from the ground state of doubly ionized Li atom ($Z = 3$) is

(1) 1.51 (2) 13.6

(3) 40.8 (4) 122.4

4. An electron in a hydrogen atom undergoes a transition from an orbit with quantum number n_i to another with quantum number n_f · v_i and v_f are respectively the initial and final potential energies of the electron. If $\frac{v_i}{v_f} = 6.25$, then the smallest possible n_f is

(1) 5 (2) 3

(3) 2 (4) 1

5. How many times does the electron go round the first Bohr orbit of hydrogen atoms in 1 s?

(1) 6.62×10^{15} Hz (2) 5.60×10^{5} Hz

(3) 3.31×10^{5} Hz (4) None

6. Find the ratio of ionization energy of Bohr's hydrogen atom and doubly ionized lithium ion (Li^{2+}).

(1) 1/9 (2) 1

(3) 1/3 (4) 1/6

7. A doubly ionized lithium atom is hydrogen-like with atomic number 3. Find the wavelength of the radiation required to excite the electron in Li^{++} from first to the third Bohr orbit. The ionization energy of the hydrogen atom is 13.6 eV. (in $Å$)

(1) 113.74 (2) 212.68

(3) 110.04 (4) 118.90

8. The first excitation potential of a hypothetical hydrogen-like atom is 15 V. Find the third excitation potential of the atom.

(1) 13/6 (2) 115/4

(3) 15/2 (4) 75/4

9. Hydrogen ($_1H^1$), deuterium ($_1H^2$), singly ionised helium $(_2He^4)^+$ and doubly ionised lithium $(_3Li^8)^{++}$ all have one electron around the nucleus. Consider an electron transition from $n = 2$ to $n = 1$. If the wavelengths of emitted radiation are λ_1, λ_2, λ_3, and λ_4 respectively for four elements, then approximately which one of the following is correct?

(1) $4\lambda_1 = 2\lambda_2 = 2\lambda_3 = \lambda_4$

(2) $\lambda_1 = 2\lambda_2 = 2\lambda_3 = \lambda_4$

(3) $\lambda_1 = \lambda_2 = 4\lambda_3 = 9\lambda_4$

(4) $\lambda_1 = 2\lambda_2 = 3\lambda_3 = 4\lambda_4$

10. In a hydrogen like atom electron makes transition from an energy level with quantum number n to another with quantum number $(n - 1)$. If $n >> 1$, the frequency of radiation emitted is proportional to

(1) $1/n$ (2) $1/n^2$

(3) $1/n^4$ (4) $1/n^3$

Answer Key

1.	**(2)**	**6.**	**(1)**
2.	**(4)**	**7.**	**(1)**
3.	**(4)**	**8.**	**(4)**
4.	**(1)**	**9.**	**(3)**
5.	**(1)**	**10.**	**(4)**