DPP 01

1. An electron jumps from the fourth orbit to the second orbit of hydrogen atom. Given: the Rydberg's constant $R = 10^5\ cm^{-1}$. The frequency, in Hz, of the emitted radiation IS $\frac{X}{16} \times 10^{15}$. Then find value of x is

2. Transitions between three energy levels in a particular atom give rise to three spectral lines of wavelengths, in increasing magnitudes, λ_1, λ_2, and λ_3. Equations correctly relates λ_1, λ_2, and λ_3 is as $\frac{1}{\lambda_1} = \frac{\alpha}{\lambda_2} + \frac{\beta}{\lambda_3}$. then the value of $\alpha + \beta$ *is*_____

3. A hydrogen-like atom emits radiations of frequency 2.7×10^{15} Hz when it makes a transition from $n = 2$ to $n = 1$. The frequency emitted in a transition from $n = 3$ to $n = 1$ is $3.2 \times 10^{\alpha+\beta}$ Hz then the value of $\alpha + \beta$ *is* ______.

4. The total energy of an electron in the ground state of hydrogen atom is -13.6eV. The potential energy of an electron in the ground state of Li^{2+} ion will be

(A) 122.4eV (B) -122.4eV (C) 244.8eV (D) -244.8eV

5. The force acting on the electron in a hydrogen atom depends on the principal quantum number as

(A) $F \propto n^2$ (B) $F \propto \frac{1}{n^2}$ (C) $F \propto n^4$ (D) $F \propto \frac{1}{n^4}$

6. If potential energy between a proton and an electron is given by $|U| = ke^2/2R^3$, where e is the charge of electron and R is the radius of atom, then radius of Bohr's orbit is given by (h = Planck's constant, k = constant)

(A) $\frac{ke^2m}{h^2}$ (B) $\frac{6\pi^2}{n^2}\frac{ke^2m}{h^2}$ (C) $\frac{2\pi}{n}\frac{ke^2m}{h^2}$ (D) $\frac{4\pi^2ke^2m}{n^2h^2}$

7. The wavelength of the first line of Balmer series is 6563Å. The Rydberg's constant is

(A) $1.09 \times 10^5\ m^{-1}$ (B) $1.09 \times 10^6\ m^{-1}$

(C) $1.097 \times 10^7\ m^{-1}$ (D) $1.09 \times 10^8\ m^{-1}$

8. A hydrogen atom and a Li^{++} 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

(A) $l_H < l_{Li}$ and $|E_H| > |E_{Li}|$ (B) $l_H = l_{Li}$ and $|E_H| < |E_{Li}|$

(C) $l_H = l_{Li}$ and $|E_H| > |E_{Li}|$ (D) $I_H < I_{Li}$ and $|E_H| < |E_{Li}|$

9. The electron in a hydrogen atom makes a transition $n_1 \to n_2$, where n_1 and n_2 are the principal quantum numbers of the two states. Assume the Bohr model as valid in this case. The frequency of the orbital motion of the electron in the initial state is 1/27 of that in the final state. The possible values of n_1 and n_2 are

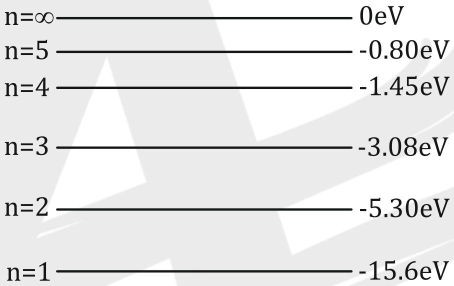
(A) $n_1 = 6, n_2 = 3$ (B) $n_1 = 4, n_2 = 2$ (C) $n_1 = 8, n_2 = 1$ (D) $n_1 = 3, n_2 = 1$

10. The ratio (in SI units) of magnetic dipole moment to that of the angular momentum of an electron of mass m kg and charge e coulomb in Bohr's orbit of hydrogen atom is

(A) $\frac{e}{2m}$ (B) $\frac{e}{m}$ (C) $\frac{2e}{m}$ (D) none of these

Paragraph for Q. No. 11 to 16

The energy levels of a hypothetical one electron atom are shown in figure.



11. Find the ionization potential of the atom.

(A) 11.2eV (B) 13.5eV (C) 15.6eV (D) 12.6eV

12. Find the short wavelength limit of the series terminating at $n = 2$.

(A) 3256Å (B) 2339Å (C) 2509Å (D) 3494Å

13. Find the excitation potential for the state $n = 3$.

(A) 14.64eV (B) 9.93eV (C) 12.52eV (D) 10.04eV

14. Find the wave number of the photon emitted for the transition $n = 3$ to $n = 1$

(A) $2.23 \times 10^7\ m^{-1}$ (B) $1.009 \times 10^7\ m^{-1}$

(C) $3.005 \times 10^6\ m^{-1}$ (D) $0.432 \times 10^6\ m^{-1}$

ANSWER KEY

1.	9	**2.**	2	**3.**	15	**4.**	(D)	**5.**	(D)	**6.**	(B)	**7.**	(C)
8.	(B)	**9.**	(D)	**10.**	(A)	**11.**	(C)	**12.**	(B)	**13.**	(C)	**14.**	(B)