DPP
DAILY PRACTICE PROBLEMS

CLASS : XIIth
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 3

Topic :-Atoms

1 **(a)**

Angular momentum $= \frac{n\text{h}}{2\pi} ie,$

$L \propto n \propto \sqrt{r} \quad (\because r \propto n^2)$

2 **(b)**

Number of spectral lines $= \frac{n(n-1)}{2} = \frac{4(4\ 3)}{2} = 6$

3 **(c)**

According to Bohr, the wavelength emitted when an electron jumps from n_1th to n_2th orbit is

$$E = \frac{\text{h}c}{\lambda} = E_2 - E_1$$

$$\frac{1}{\lambda} = R\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

For first line in Lyman series

$$\frac{1}{\lambda_L} = R\left(\frac{1}{1^2} - \frac{1}{2^2}\right) = \frac{3R}{4} \qquad \text{...(i)}$$

For first line in Balmer series,

$$\frac{1}{\lambda_B} = R\left(\frac{1}{2^2} - \frac{1}{3^2}\right) = \frac{5R}{36} \qquad \text{...(ii)}$$

From Eqs. (i) and (ii)

$$\therefore \quad \frac{\lambda_B}{\lambda_L} = \frac{3R}{4} \times \frac{36}{5R} = \frac{27}{5}$$

$$\therefore \quad \lambda_B = \frac{27}{5}\lambda \qquad (\because \lambda_L = \lambda)$$

4 **(b)**

When electric discharge is passed through mercury vapour lamp, eight to ten lines from red to violet are seen in its spectrum. In some line spectra there are only a few lines, while in many of them there are hundreds of them. Hence, mercury vapour lamp gives line spectra.

5 **(d)**

The moment of linear momentum is angular momentum

$$L = mvr = \frac{nh}{2\pi}$$

Here, n=2

$$\therefore \quad L = \frac{2h}{2\pi} = \frac{h}{\pi}$$

6 **(c)**

For an electron to remain orbiting around the nucleous, the angular momentum (L) should be an integral multiple of $h/2\pi$.

ie, $$mvr = \frac{nh}{2\pi}$$

where n = principle quantum number of electron,

and h= Planck's constant

7 **(a)**

The wavelength (λ) of lines is given by

$$\frac{1}{\lambda} = R\left(\frac{1}{1^2} - \frac{1}{n^2}\right)$$

For Lyman series, the shortest wavelength is for n=∞ and longest is for n=2.

$$\therefore \quad \frac{1}{\lambda_s} = R\left(\frac{1}{1^2}\right) \quad \text{...(i)}$$

$$\frac{1}{\lambda_L} = R\left(\frac{1}{1} - \frac{1}{2^2}\right) = \frac{3}{4}R \quad \text{...(ii)}$$

Dividing Eq.(ii) by Eq. (i) , we get

$$\frac{\lambda_L}{\lambda_s} = \frac{4}{3}$$

Given, λ_s=91.2 nm

$$\Rightarrow \quad \lambda_L = 91.2 \times \frac{4}{3} = 121.6\text{nm}$$

8 **(a)**

According to kinetic interpretation of temperature

$$Ek = \left(= \frac{1}{2}mv^2\right) = \frac{3}{2}\ kT$$

Given : E_i= 10.2 eV = 10.2 × 1.6 × 10^{-19} J

So, $\frac{3}{2}kT = 10.2 \times 1.6 \times 10^{-19}$ J

Or $$T = \frac{2}{3} \times \frac{10.2 \times 1.6 \times 10^{-19}}{k}$$

$$= \frac{2}{3} \times \frac{10.2 \times 1.6 \times 10^{-19}}{1.38 \times 10^{-23}} = 7.9 \times 10^4 \text{ K}$$

9 **(a)**

1st excited state corresponds to $n = 2$

2nd excited state corresponds to $n = 3$

$$\frac{E_1}{E_2} = \frac{n_3^2}{n_2^2} = \frac{3^2}{2^2} = \frac{9}{4}$$

10 **(c)**

For wavelength

$$\frac{1}{\lambda} = RZ^2\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

Here, transition is same

So, $\lambda \propto \frac{1}{Z^2}$

$$\frac{\lambda_H}{\lambda_{Li}} = \frac{(Z_{Li})^2}{(Z_H)^2} = \frac{(3)^1}{(1)^2} = 9$$

$$\lambda_{Li} = \frac{\lambda_H}{9} = \frac{\lambda}{9}$$

11 **(b)**

$\Delta\lambda = 706 - 656 = 50 \text{ nm} = 50 \times 10^{-9}\text{m}, v = ?$

As $\frac{\Delta\lambda}{\lambda} = \frac{v}{c}$

$$\therefore\ v = \frac{\Delta\lambda}{\lambda} \times c = \frac{50 \times 10^{-9}}{656 \times 10^{-9}} \times 3 \times 10^8$$

$$= 2.2 \times 10^7 \text{ms}^{-1}$$

12 **(d)**

$\text{PE} = 2 \times \text{total energy}$

$= 2(-1.5) \text{ eV} = -3.0 \text{ eV}$

13 **(b)**

The wavelength of series for n is given by

$$\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{n^2}\right)$$

were R is Rydberg's constant.

For Balmer series n=3 gives the first member of series and n=4 gives the second member of series. Hence,

$$\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{3^2}\right)$$

$$\frac{1}{\lambda_1} = R\left(\frac{5}{36}\right) \qquad \text{...(i)}$$

$\frac{1}{\lambda_2} = R\left(\frac{1}{2^2} - \frac{1}{4^2}\right)$

$= R\left(\frac{12}{16 \times 4}\right) = \frac{3R}{16}$ ...(ii)

$\Rightarrow \quad \frac{\lambda_2}{\lambda_1} = \frac{16}{3} \times \frac{5}{36} = \frac{20}{27}$

$\lambda_2 = \frac{20}{27}\lambda \qquad (\because \lambda_1 = \lambda)$

14 **(b)**

$\Delta E = 13.6Z^2\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$

$= 13.6\,(3)^2\left[\frac{1}{1^2} - \frac{1}{3^2}\right]$

$= 108.8\ e\text{V}$

15 **(b)**

Electric field E $= \frac{V}{d}$

$d = \frac{V}{E}$

$= \frac{10.39}{1.5 \times 10^6}$ m

16 **(d)**

$\frac{1}{\lambda} = R\left(\frac{1}{1^2} - \frac{1}{2^2}\right)$

$\Rightarrow \frac{1}{\lambda} = 1.097 \times 10^7 \times \frac{3}{4}$

$\therefore \lambda = 1.215 \times 10^{-7}\text{m} = 1215$ Å

18 **(d)**

The magnetic moment of the ground state of an atom is

$\mu = \sqrt{n(n+2)}\mu_B$

Where, μ_B is gyromagnetic moment. Here, open sub-shell is half-filled with 5 electrons. *ie*, n=5

$\therefore \quad \mu = \sqrt{5(5+2)}.\mu_B$

$= \mu_B\sqrt{35}$

20 **(d)**

Circumference of nth Bohr orbit $= n$

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	A	B	C	B	D	C	A	A	A	C
Q.	11	12	13	14	15	16	17	18	19	20
A.	B	D	B	B	B	D	C	D	C	D