DPP
DAILY PRACTICE PROBLEMS

CLASS : XIIth
DATE :

Solutio

SUBJECT : PHYSICS
DPP NO. : 3

Topic :-Atoms

1 **(a)**
Angular momentum $= \frac{nh}{2\pi} ie,$
$L \propto n \propto \sqrt{r} \quad (\because r \propto n^2)$

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
$$E = \frac{hc}{\lambda} = E_2 - E_1$$
$$\frac{1}{\lambda} = R\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$
For first line in Lyman series
$$\frac{1}{\lambda_L} = R\left(\frac{1}{1^2} - \frac{1}{2^2}\right) = \frac{3\,R}{4} \quad \text{...(i)}$$
For first line in Balmer series,
$$\frac{1}{\lambda_B} = R\left(\frac{1}{2^2} - \frac{1}{3^2}\right) = \frac{5\,R}{36} \quad \text{...(ii)}$$
From Eqs. (i) and (ii)
$$\therefore \quad \frac{\lambda_B}{\lambda_L} = \frac{3\,R}{4} \times \frac{36}{5R} = \frac{27}{5}$$
$$\therefore \quad \lambda_B = \frac{27}{5}\lambda \qquad (\because \lambda_L = \lambda)$$

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 $h/2\pi$.
$ie, \quad mvr = \frac{nh}{2\pi}$
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.

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

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

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

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

Given, λ_s=91.2 nm

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

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 = $10.2\times1.6\times10^{-19}$ J

So, $\frac{3}{2}\,kT=10.2\times1.6\times10^{-19}$ J

Or $T=\frac{2}{3}\times\frac{10.2\times1.6\times10^{-19}}{k}$

$=\frac{2}{3}\times\frac{10.2\times1.6\times10^{-19}}{1.38\times10^{-23}}=7.9\times10^4$ 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, $\lambda\propto\frac{1}{Z^2}$

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

$$\lambda_{\mathrm{Li}}=\frac{\lambda_{\mathrm{H}}}{9}=\frac{\lambda}{9}$$

11 **(b)**

$\Delta\lambda=706-656=50\text{ nm}=50\times10^{-9}\text{m}, v=?$

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

$$\therefore\ v=\frac{\Delta\lambda}{\lambda}\times c=\frac{50\times10^{-9}}{656\times10^{-9}}\times3\times10^8$$

$=2.2\times10^7\text{ms}^{-1}$

12 **(d)**

PE= 2 × 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,

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

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

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

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

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

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

14 **(b)**

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

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

$$= 108.8\ eV$$

15 **(b)**

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

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

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

16 **(d)**

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

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

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

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