DPP
DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 1

Topic :- Dual nature of radiation and matter

1 **(b)**

Energy $E = hv = h\frac{c}{\lambda}$ $\therefore \frac{E_1}{E_2} = \frac{\lambda_2}{\lambda_1} = \frac{5000}{1}$

2 **(c)**

$E = W_0 + K_{\max} \Rightarrow \frac{hc}{\lambda_1} = W_0 + E_1$ and $\frac{hc}{\lambda_2} = W_0 + E_2$

$\Rightarrow hc = W_0\lambda_1 + E_1\lambda_1$ and $hc = W_0\lambda_2 + E_2\lambda_2$

$\Rightarrow W_0\lambda_1 + E_1\lambda_1 = W_0\lambda_2 + E_2\lambda_2 \Rightarrow W_0 = \frac{E_1\lambda_1 - E_2\lambda_2}{(\lambda_2 - \lambda_1)}$

3 **(d)**

$\lambda_{\min} = \frac{hc}{eV}$

$\Rightarrow \quad \lambda \propto \frac{1}{V}$

$\because \quad \lambda_2 > \lambda_1$ (see graph)

$\Rightarrow \quad V_1 > V_2$

$\sqrt{v} = a(Z - b)$ Moseley's law

$v \propto (Z-1)^2$

$\Rightarrow \quad \lambda \propto \frac{1}{(Z-1)^2} \qquad (\because v \propto \frac{1}{\lambda})$

$\lambda_1 > \lambda_2$ (see graph for characteristic lines)

$\Rightarrow \quad Z_2 > Z_1$

4 **(b)**

Given, the linear momentum of particle (p)

$= 2.2 \times 10^4 kg - ms^{-1}$

$h = 6.6 \times 10^{-34}$ JS

The de-Broglie wavelength of particle

$\lambda = \frac{h}{p}$

$\lambda = \frac{6.6\times10^{-34}}{2.2\times10^4}$

Or $\lambda = 3 \times 10^{-38}$ m

Or $\lambda = 3 \times 10^{-29}$ mm

7 **(c)**

Specific charge $= \frac{q}{m}$; Ratio $= \frac{\left(\frac{q}{m}\right)_\alpha}{\left(\frac{q}{m}\right)_p} = \frac{q_\alpha}{q_p} \times \frac{m_p}{m_\alpha} = \frac{1}{2}$

8 **(a)**

$K_{\max} = hv - hv_0 = \frac{hc}{\lambda} - \frac{hc}{\lambda_0}$, *i.e.*, graph between $K_{\max}$ and $\frac{1}{\lambda}$ will be straight line having slope (hc) and intercept $\frac{hc}{\lambda_0}$ on $-KE$ axis

9 **(b)**

$K_A = \frac{hc}{\lambda_A} - \phi_0$ and $K_B = \frac{hc}{\lambda_B} - \phi_0$

$$\frac{K_A}{K_B} = \frac{\frac{hc}{2\lambda_B}}{\frac{hc}{\lambda_B}} < \frac{1}{2} \text{ or } K_A < K_B/2$$

11 **(c)**

Energy received from the sun

$$= 2 \text{ cal cm}^{-2}(\text{min })^{-1}$$
$$= 8.4 \text{ J cm}^{-2} (\text{min })^{-1}$$

Energy of 1 photon received from the sun

$$E = \frac{hc}{\lambda}$$
$$= \frac{6.6\times10^{-34}\times3\times10^{8}}{5500\times10^{-10}}$$
$$= 3.6\times 10^{-19} \text{ J}$$

∴ Number of photons reaching the earth per cm^2per minute will be

$$n = \frac{\text{energy received from sun}}{\text{energy of one photon}}$$
$$n = \frac{8.4}{3.6\times10^{-19}} = 2.3 \times 10^{19}$$

12 **(b)**

Wave nature of matter of de Broglie was proved when accelerated electrons showed diffraction by metal foil in the same manner as X-ray diffraction

13 **(c)**

In X-ray spectra, depending on the accelerating voltage and the target element, we may find sharp peaks super imposed on continuous spectrum. These are at different wavelengths for different elements. They form characteristic X-ray spectrum

14 **(b)**

$E = h\nu \Rightarrow 100 \times 1.6 \times 10^{-19} = 6.6 \times 10^{-34} \times \nu$

$\Rightarrow \nu = 2.42 \times 10^{16} Hz$

16 **(d)**

Planck's constant,

$h = E/\nu = [\text{ML}^2\text{T}^{-2}/\text{T}^{-1}] = [\text{ML}^2\text{T}^{-1}]$

Angular momentum, $L = I\omega = [\text{ML}^2\text{T}^{-1}]$

17 **(c)**

$$\lambda = \frac{h}{p} \Rightarrow \lambda \propto \frac{1}{p}$$

18 **(b)**

Momentum of incident light per second

$$p_1 = \frac{E}{c} = \frac{60}{3 \times 10^8} = 2 \times 10^{-7}$$

Momentum of reflected light per second

$$p_2 = \frac{60}{100} \times \frac{E}{c} = \frac{60}{3 \times 10^8} = 1.2 \times 10^{-7}$$

Force on the surface = change in momentum per second

$= p_2 - (-p_1) = p_2 + p_1 = (2 + 1.2) \times 10^{-7} = 3.2 \times 10^{-7}\text{N}$

20 **(d)**

From the symmetry of figure, the angle $\theta = 45°$. The path of moving proton in a normal magnetic field is circular. If r is the radius of the circular path, then from the figure,

$AC = 2\, r \cos 45° = 2r \times \frac{1}{\sqrt{2}} = \sqrt{2}r$ ...(i)

As $B\, q\, V = \frac{mv^2}{r}$ or $r = \frac{mv}{Bq}$

$$AC = \frac{\sqrt{2}\,mv}{B\,q} = \frac{\sqrt{2} \times 1.67 \times 10^{-27} \times 10^{7}}{1 \times 1.6 \times 10^{-19}} = 0.14 \text{ m}$$

ANSWER-KEY

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