DPP
DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 7

Topic :- Dual nature of radiation and matter

1 **(a)**

$$\lambda = \frac{h}{mv} = \frac{6.6 \times 10^{-34}}{1 \times 2000} = 3.3 \times 10^{-37} m = 3.3 \times 10^{-27} Å$$

3 **(b)**

$$\text{KE} = \frac{\text{p}^2}{2m}$$

Momentum is same, so KE $\propto \frac{1}{m}$

Out of the given choices, mass of electron is minimum, so its KE will be maximum.

4 **(d)**

Cathode rays are beam of electrons

5 **(c)**

Due to 10.2 eV photon one photon of energy 10.2 eV will be detected.

Due to 15 eV photon the electron will come out of the atom with energy $(15 - 13.6)$

$= 1.4\ eV$

6 **(a)**

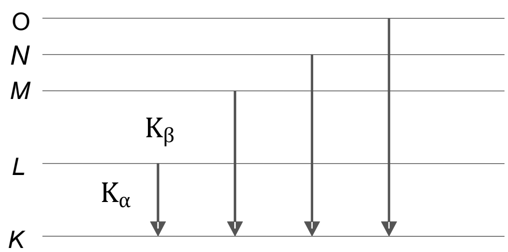
Photos move with velocity of light and have energy hv. Therefore, they also exert pressure

7 **(d)**

The maximum KE of the emitted photoelectrons is independent of the intensity of the incident light but depends upon the frequency of the incident light

8 **(a)**

When the colliding electron remove an electron from innermost k-shell (corresponding to n=1) of atom and electron from some higher shell jumps to k-shell to fill up this vacancy, characteristic X-ray of k- series are obtained



K- Series

$\therefore K_\propto$ and K_β X-rays are emitted when there is transition of electron between the levels n=2 to n=1 and n=3 to n=1 respectively.

9 **(d)**

$$\left.\begin{cases}\text{Photoelectric effect} \rightarrow \text{Particle nature} \\ \text{Diffraction} \rightarrow \text{Wave nature}\end{cases}\right\} \text{Dual nature}$$

10 **(c)**

$$p = \frac{E}{c} \Rightarrow E = p \times c = 2 \times 10^{-16} \times (3 \times 10^{10}) = 6 \times 10^{-6} erg$$

11 **(b)**

The momentum of the incident radiation is given as $p = \frac{h}{\lambda}$. When the light is totally reflected normal to the surface the direction of the ray is reversed. That means it reverses the direction of it's momentum without changing it's magnitude

$$\therefore \Delta p = 2p = \frac{2h}{\lambda} = \frac{2 \times 6.6 \times 10^{-34}}{6630 \times 10^{-10}} = 2 \times 10^{-27} kg - m/sec$$

12 **(b)**

Number of photons emitted is proportional to the intensity. Also $\frac{hc}{\lambda} = W_0 + E$

13 **(a)**

Since, de-Broglie wavelength is related to momentum by the relation

$\lambda = \frac{h}{P}$ (where h=plack's constant)

For electron $\lambda_e = \frac{h}{P_e}$

For neutron $\lambda_n = \frac{h}{p_n}$

$\therefore$ $\frac{\lambda_e}{\lambda_n} = \frac{P_n}{P_e}$ ...(i)

Case I since, $(\text{KE})_{\text{electron}} = (\text{KE})_{\text{neutron}}$

$$\Rightarrow \quad \frac{p_e^2}{2m_e} = \frac{p_n^2}{2m_n}$$

$\Rightarrow$ $\frac{p_n}{p_e} = \sqrt{\frac{m_n}{m_e}}$ ...(ii)

From Eqs. (i) and (ii),we get

$$\frac{\lambda_e}{\lambda_n} = \sqrt{\frac{m_n}{m_e}}$$

But $m_n > m_e$

$\therefore$ $\frac{m_n}{m_e} > 1$

$\Rightarrow$ $\frac{\lambda_e}{\lambda_n} \gg 1$

$$\lambda_e \gg \lambda_n$$

case II If momenta are equal, then

$$p_e = p_n$$

From Eq.(i)

$$\frac{\lambda_e}{\lambda_n} = 1$$

Case III If speeds are same

$$v_e = v_n$$

then $\frac{\lambda_e}{\lambda_n} = \frac{p_n}{p_e} = \frac{m_n v_n}{m_e v_e} = \frac{m_n}{m_e}$

Now, $m_n \gg m_e$

$\therefore$ $\frac{m_n}{m_e} \gg 1$

$\therefore$ $\frac{\lambda_e}{\lambda_n} \gg 1$

$$\lambda_e \gg \lambda_n$$

14 **(d)**

$$\frac{\lambda_p}{\lambda_\alpha} = \frac{\frac{h}{\sqrt{2em_p V}}}{\sqrt{2 \times 2e4\, m_p V}} = 2\sqrt{2}$$

15 **(b)**

$n\,e\,E = 6\pi\,\eta\,r\,v$ or $n = \frac{6\pi\,\eta\,r\,v}{e\,E}$

$$= \frac{6 \times 3.14 \times 1.6 \times 10^{-5} \times 5 \times 10^{-7} \times 0.01}{1.6 \times 10^{-19} \times 6.28 \times 10^{5}} = 15$$

136 **(a)**

Energy of the electron, when it comes out from the second plate

$$= 200\ eV - 100\ eV = 100\ eV$$

Hence accelerating potential difference $= 100\ V$

$$\lambda_{Electron} = \frac{12.27}{\sqrt{V}} = \frac{12.27}{\sqrt{100}} = 1.23\text{Å}$$

17 **(a)**

$$\lambda = \frac{h}{\sqrt{2mE}} \Rightarrow \lambda \propto \frac{1}{\sqrt{m}} \Rightarrow \frac{\lambda_p}{\lambda_\alpha} = \sqrt{\frac{m_\alpha}{m_p}} = \frac{2}{1}$$

18 **(b)**

Given $m_0c^2 = 0.51\ MeV$ and $v = 0.8\ c$

$K.E.$ of the electron $= mc^2 - m_0c^2$

But $m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{m_0}{\sqrt{1 - \left(\frac{0.8c}{c}\right)^2}} = \frac{m_0}{\sqrt{0.36}} = \frac{m_0}{0.6}$

Now, $mc^2 = \frac{0.51}{0.6} MeV = 0.85\ MeV$

$\therefore K.E. = (0.85 - 0.51) MeV = 0.34\ MeV$

19 **(b)**

Intensity of light source is

$$I \propto \frac{1}{d^2}$$

When distance is doubled, intensity becomes one-fourth.

As number of photoelectrons $\propto$ intensity, so number of photoelectrons is quarter of the initial number.

20 **(d)**

Given : $E = 13.2 keV$

$$\lambda(in\ \text{Å}) = \frac{hc}{E(eV)} = \frac{12400}{13.2 \times 10^3} = 0.939\text{Å} = 1\text{Å}$$

X-rays covers wavelengths ranging from about $10^{-8} m (10 nm)$ to $10^{-3} m (10^{-4} nm)$.

An electromagnetic radiation of energy 13.2 keV belongs to X-ray region of electromagnetic spectrum

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