DPP
DAILY PRACTICE PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 10

Topic :- Dual nature of radiation and matter

1 **(c)**

Here, $E_1 = E_2$

$n_1 h v_1 = n_2 h v_2$

So, $\frac{n_1}{n_2} = \frac{v_2}{v_1}$

2 **(a)**

Energy of photon

$$E = \frac{hc}{\lambda}$$

Given, $\lambda = 5000\ \text{Å} = 5 \times 10^{-7} m$

$$\therefore \quad E = \frac{6.6 \times 10^{-34} \times 3 \times 10^{8}}{5 \times 10^{-7}}$$

$$= 3.96 \times 10^{-19} J$$

Energy received per second $= 10^{-8}$ Js^{-1}

$\therefore$ Number of photon's received per second

$$= \frac{\text{Energy received per second}}{\text{Energy of one photon}}$$

$$= \frac{10^{-8}}{3.96 \times 10^{-19}} = 2.5 \times 10^{10}$$

3 **(c)**

$$\frac{1}{2} m v_{\max}^2 = eV_0$$

$$\Rightarrow \quad v_{\max} = \sqrt{2\left(\frac{e}{m}\right)V_0}$$

$$= \sqrt{2 \times 1.8 \times 10^{11} \times 9}$$

$$= 18 \times 10^{5}\ ms^{-1}$$

$$= 1.8 \times 10^{6}\ ms^{-1}$$

4 **(c)**

$QE = mg \Rightarrow Q = \dfrac{mg}{E} \Rightarrow n = \dfrac{mgd}{Ve}$

$\Rightarrow n = \dfrac{1.8 \times 10^{-14} \times 10 \times 0.9 \times 10^{-2}}{2 \times 10^3 \times 1.6 \times 10^{-19}} = 5$

5 **(d)**

X-rays are electromagnetic in nature so they remains unaffected in electric and magnetic field

6 **(a)**

$\lambda_{\min} = \dfrac{12375}{V} \text{Å} \Rightarrow V = \dfrac{12375}{0.4125} = 30\ kV$

7 **(a)**

$$E = \frac{hc}{\lambda} \Rightarrow E \propto \frac{1}{\lambda}$$

$\Rightarrow$ $\frac{E'}{E} = \frac{400}{300} = 1.33$

But $E = eV_s$, V_s being stopping potential. Thus, stopping potential for photoelectrons from a surface becomes approximately 1.0 V greater.

8 **(b)**

Energy possessed by a photon is given by

$$E = hv = \frac{hc}{\lambda}$$

If power of each photon is P then energy given out in t second is equal to Pt. Let the number of photons be n, then

$$n = \frac{Pt}{E} = \frac{Pt}{(hc/\lambda)} = \frac{Pt\lambda}{hc}$$

For red light, $n_R = \frac{Pt\lambda_R}{hc}$

For violet light, $n_V = \frac{Pt\lambda_V}{hc}$

$\therefore$ $\dfrac{n_R}{n_V} = \dfrac{\lambda_R}{\lambda_V}$

As $\lambda_R > \lambda_V$

So, $n_R > n_V$

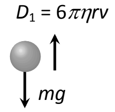
9 **(a)**

Mosley's law is $f = a(Z - b)^2$

11 **(c)**

In the absence of electric field ($i.e.$ E $= 0$)

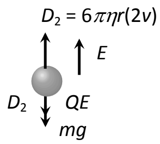
$mg = 6\pi\eta rv$



...(i)

In the presence of Electric field

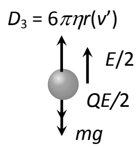
$mg + QE = 6\pi\eta r(2v)$



...(ii)

When electric field to reduced to $E/2$

$mg + Q(E/2) = 6\pi\eta r(v')$



...(iii)

After solving (i), (ii) and (iii)

We get $v' = \frac{3}{2}v$

13 **(c)**

Crystal structure is explored through the diffraction of waves having a wavelength comparable with the interatomatic spacing (10^{-10}m) in crystals. Radiation of larger wavelength cannot resolve the details of structure, while radiation of much shorter wavelength is diffracted through inconveniently small angles. Usually diffraction of X-rays is employed in the study of crystal structure as X-rays have wavelength comparable to interatomic spacing.

14 **(c)**

Linear momntum of an electron in n th orbit $L = \frac{nh}{2\pi'}$

for $n = 2$ then $\quad L = \frac{h}{\pi}$

15 **(d)**

Current $\quad i = \frac{ne}{t}$

$$\Rightarrow \qquad \frac{n}{t} = \frac{i}{e} = \frac{3.2 \times 10^{-3}}{1.6 \times 10^{-19}} = 2 \times 10^{6}/\text{s}$$

16 **(c)**

$$\lambda = \frac{h}{\sqrt{2mE}} = \frac{h}{\sqrt{2m_\alpha Q_\alpha V}}$$

On putting $Q_\alpha = 2 \times 1.6 \times 10^{-19} C$

$m_\alpha = 4m_p = 4 \times 1.67 \times 10^{-27} kg \Rightarrow \lambda = \frac{0.101}{\sqrt{V}}$ Å

20 **(c)**

$$m = \frac{m_0}{\sqrt{1 - v^2/c^2}} = \frac{m_0}{\sqrt{1 - (0.8c)^2/c^2}} = \frac{5m_0}{3}$$

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