DPP

DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 5

Topic :- Dual nature of radiation and matter

1 **(b)**

The work function of sodium

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

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

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

or $W = 2.47$eV $(\because 1\text{eV} = 1.6 \times 10^{-19}\text{ J})$

or $W = 2.5$eV(approximately)

2 **(b)**

$$p = \frac{h}{\lambda} = \frac{6.6 \times 10^{-34}}{0.01 \times 10^{-10}} = 6.6 \times 10^{-22} kg - m/s$$

4 **(b)**

If an electron and a photon propagates in the form of waves having the same wavelength, it implies that they have same momentum. This is according to de-Broglie equation

$$p \propto \frac{1}{\lambda}$$

6 **(b)**

Retarding potential,

$$V_s = \frac{hc}{\lambda e} - \frac{\phi_0}{e} = \frac{1240 \times 10^{-9}}{330 \times 10^{-9}} - 1.07$$

$= 3.73 - 1.07 = 2.66$ V

7 **(b)**

$K_{\max} = (hv - W_0); v =$ frequency of incident light

8 **(c)**

$$\lambda_{\min} = \frac{12375}{50 \times 10^3} \text{Å} = 0.247 = 0.25\text{Å}$$

9 **(c)**

$$E_K - E_L = \frac{hc}{\lambda} = \frac{(6.6 \times 10^{-34})(3 \times 10^8)}{(0.021 \times 10^{-9})(1.6 \times 10^{-19})} eV = 59 KeV$$

10 **(a)**

Maximum KE $= E - \phi_0 = 3.4 - 2 = 1.4$ eV

11 **(a)**

The cut-off wavelength $\lambda_{\min}$ corresponds to an electron transferring (approximately) all of its energy to an X-ray photon, thus producing a photon with the greatest possible frequency and least possible wavelengh.

From relation

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

$$= \frac{(4.14 \times 10^{-15})(3 \times 10^8)}{35.0 \times 10^3}$$

$$= 3.55 \times 10^{-11} \text{ m} = 35.5\text{pm}$$

12 **(d)**

de-Broglie wavelength

$$\lambda = \frac{h}{\sqrt{2mE}}$$

$$\therefore \quad \frac{\lambda_1}{\lambda_2} = \sqrt{\frac{E_2}{E_1}} \Rightarrow \frac{1 \times 10^{-9}}{0.5 \times 10^{-9}} = \sqrt{\frac{E_2}{E_1}}$$

$$\Rightarrow \quad 2 = \sqrt{\frac{E_2}{E_1}} \Rightarrow \frac{E_2}{E_1} = 4$$

$\therefore$ $E_2 = 4E_1$

$\therefore$ Energy to be added $= E_2 - E_1$

$= 4E_1 - E_1 = 3E_1$

13 **(c)**

We know that

$qE = mg$

$$\frac{qQ}{\varepsilon_0 A} = mg \text{ or } q = \frac{\varepsilon_0 A mg}{Q}$$

$$= \frac{8.85 \times 10^{-12} \times 2 \times 10^{-2} \times 2.5 \times 10^{-7} \times 10}{5 \times 10^{-7}} C$$

$= 8.85 \times 10^{-13} C$

15 **(b)**

For an electron

Mass, $m_e = 9.11 \times 10^{-31} kg$

Kinetic energy, $K = 10eV = 10 \times 1.6 \times 10^{-19} J$

de Broglie wavelength, $\lambda_e = \frac{h}{\sqrt{2m_e K}}$ ...(i)

For the person Mass, $m = 66kg$

Speed, $v = 100kmhr^{-1} = 100 \times \frac{5}{18} ms^{-1}$

de Broglie wavelength, $\lambda = \frac{h}{mv}$ ...(ii)

Diving (i) by (ii), we get

$$\frac{\lambda_e}{\lambda} = \frac{h}{\sqrt{2m_e K}} \times \frac{mv}{h} = \frac{mv}{\sqrt{2m_e K}}$$

$$= \frac{66 \times 100 \times \frac{5}{18}}{\sqrt{2 \times 9.11 \times 10^{-31} \times 10 \times 1.6 \times 10^{-19}}} = 1.07 \times 10^{27}$$

17 **(b)**

$$\lambda = \frac{h}{mv} = \frac{h\sqrt{1 - v^2/c^2}}{m_0 v} = 0 \quad (\because v = c)$$

18 **(b)**

Slope of $V_0 - v$ curve $= \frac{h}{e}$

$\Rightarrow h =$ Slope $\times e = 1.6 \times 10^{-19} \times 4.12 \times 10^{-15}$

$= 6.6 \times 10^{-34} J\text{-}s$

19 **(b)**

The wavelength range of X-ray is 0.1 Å − 100 Å

20 **(b)**

$q\,V = \frac{1}{2}mv^2$ or $v = \sqrt{2qV/m}$ ie, $v \propto \sqrt{V}$

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