DPP
DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 4

Topic :- Dual nature of radiation and matter

1 **(c)**

Slope of $V_0 - v$ curve for all metals be same $\left(\frac{h}{e}\right)$, *i.e.*, curves should be parallel

2 **(b)**

According to de-Broglie hypothesis

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

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

$$\therefore \quad \lambda = \frac{6.6 \times 10^{-34}}{\sqrt{2 \times (1.6 \times 10^{-27})(1.6 \times 10^{-19}) \times 1000}}$$

$$= \frac{6.6 \times 10^{-34}}{7.16 \times 10^{-22}}$$

$$= 0.9 \times 10^{-12} \text{ m}$$

3 **(a)**

$$i = \frac{Ne}{t} \Rightarrow \frac{N}{t} = \frac{i}{e} = \frac{3.2 \times 10^{-3}}{1.6 \times 10^{-19}} = 2 \times 10^{16}/s$$

4 **(c)**

Speed of the cathode rays is $10^7 m/sec - 3 \times 10^7 m/s$

5 **(b)**

Stopping potential $V_0 = \frac{hc}{e}\left[\frac{1}{\lambda} - \frac{1}{\lambda_0}\right]$. As λ decreases so V_0 increases

6 **(b)**

The momentum of the photon

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

7 **(c)**

When pressure in a tube is reduced in the range 1 cm and 10^{-3}cm; the mean free path of moving electron in the discharge tube increases. As a result of which the electron gets higher KE while moving towards anode and then cause ionisation of the atoms with which it will collide on its ways causing excitation phenomenon.

8 **(c)**

Specific charge on proton $=\left(\frac{e}{m}\right)_p$

$=9.6 \times 10^7 \text{C} - \text{kg}^{-1}$ specific charge on α- particle,

$\left(\frac{q}{m}\right)_\alpha = \frac{2e}{4m} = \frac{1}{2}\left(\frac{e}{m}\right)_p = \frac{1}{2} \times 9.6 \times 10^7$

$= 4.8 \times 10^7\ C - kg^{-1}$

9 **(c)**

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

or $v = \frac{h}{m\lambda} = \frac{6.6 \times 10^{-34}}{9.1 \times 10^{-31} \times 5200 \times 10^{-10}}$

$= 1.4 \times 10^3\ \text{ms}^{-1}$

10 **(c)**

For photoelectric effect,

$$eV_0 = hv \Rightarrow v = \frac{eV_0}{h}$$

$$v = \frac{1.6 \times 10^{-19} \times 3.2}{6.6 \times 10^{-34}}$$

$$= 0.775 \times 10^{15}\text{Hz}$$

11 **(a)**

On increasing wavelength of light of the photoelectric current decreases and at a certain wavelength (cut off) above which photoelectric current stops

12 **(a)**

If an electron and a proton propagating in the form of waves and their wavelength are same, then according to the relation

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

Also, $\lambda_{\text{electron}} = \lambda_{proton}$ $\therefore$ $E_e = E_p$

Hence, their energies are same.

13 **(b)**

Stopping potential does not depend upon intensity of incident light (I)

14 **(a)**

Any charge in the universe is given by

$q = ne \Rightarrow e = \frac{q}{n}$ (where n is an integer)

$q_1:q_2:q_3:q_4:q_5:q_6 :: n_1:n_2:n_3:n_4:n_5:n_6$

6.563 :8.204 :11.5 :13.13 :16.48 :18.09

$::n_1:n_2 :n_3:n_4:n_5:n_6$

Divide by 6.563

1 :1.25 :1.75 :2.0 :2.5 :2.75 $::n_1:n_2:n_3:n_4:n_5:n_6$

Multiplied by 4

4 :5 :7 :8 :10 :11 :: $n_1:n_2:n_3:n_4:n_5:n_6$

$$e = \frac{q_1 + q_2 + q_3 + q_4 + q_5 + q_6}{n_1 + n_2 + n_3 + n_4 + n_5 + n_6} = \frac{73.967 \times 10^{-19}}{45}$$

$= 1.641 \times 10^{-19} C$

[**Note** : If you take 45.0743 in place of 45, you will get the exact value]

16 **(b)**

In the presence of inert gas photoelectrons emitted by cathode ionize the gas by collision and hence the current increases

17 **(a)**

Energy of photon $E = \frac{hc}{\lambda} = mc^2$;

momentum of photon $= mc = h/\lambda$

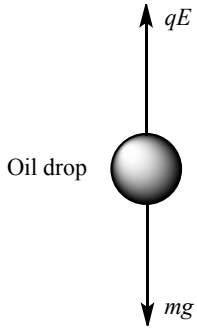
18 **(b)**

In X-ray tube, target must be heavy element with high melting point

19 **(c)**

Robert Millikan performed the experiment to determine the charge on an electron.

When a drop is suspended, its weight mg is exactly equal to the electric force applied qE, where E is electric field, q the charge, m the mass of drop and g the acceleration due to gravity.



Hence, solving for q, we get

$$q = \frac{mg}{E}$$

Given, $m = 16 \times 10^{-6}$kg, $g = 10 ms^{-2}$,

$E = 10^6 V–m^{-1}$

$\therefore \qquad q = \frac{16 \times 10^6 \times 10}{10^6} = 16 \times 10^{-11}$ C

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