PHYSICS

41. (1)
42. (4)
43. (3)
44. (1)
45. (2)

Displacement current

$$I_d = C\frac{dV}{dt} = C\frac{d}{dt}(V_0 \sin\omega t)$$

46. (3)

Using, $\lambda = \frac{12.27}{\sqrt{V}}$ Å

$$\Rightarrow \sqrt{V} = \frac{12.27\times10^{-10}}{1.227\times10^{-11}} = 10^2$$

[Given $\lambda = 1.227 \times 10^{-11}$ m]

$\therefore$ V = 10^4 volt

47. (4)

Power, $P = \frac{E}{t} = \frac{n}{t}\left(\frac{hc}{\lambda}\right)$

$\therefore$ Number of protons/second, $\frac{n}{t} = \frac{P}{\left(\frac{hc}{\lambda}\right)}$

$$\frac{n}{t} = \frac{3.3\times10^{-3}\times6\times10^{-7}}{6.6\times10^{-34}\times3\times10^{8}} = 10^{16}$$

48. (4)

From Einstein's photoelectric equation

$$\frac{hc}{\lambda} = \phi_0 + k$$

where ϕ_0 = work function

k = maximum kinetic energy of photoelectrons

$$\therefore \frac{hc}{\lambda} = k = \frac{P^2}{2m}$$

$$\Rightarrow P = \sqrt{\frac{2mhc}{\lambda}} \quad [\because \phi = \text{negligible}]$$

de-Broglie wavelength,

$$\lambda_d = \frac{h}{p} = \frac{h}{\sqrt{\frac{2mhc}{\lambda}}} \Rightarrow \sqrt{\lambda} = \lambda_d\sqrt{\frac{2mc}{h}}$$

$$\therefore \lambda = \left(\frac{2mc}{h}\right)\lambda_d^2$$

49. (2)

$$(E_2 - E_1) = h\nu = \frac{hc}{\lambda}$$

$$\therefore \frac{hc}{\lambda_1} = (E_C - E_B),\ \frac{hc}{\lambda_2} = (E_B - E_A) \text{ and}$$

$$\frac{hc}{\lambda_3} = (E_C - E_A)$$

Now, $(E_C - E_A) = (E_C - E_B) + (E_B - E_A)$

or $\frac{hc}{\lambda_3} = \frac{hc}{\lambda_1} + \frac{hc}{\lambda_2}$ or $\frac{1}{\lambda_3} = \frac{1}{\lambda_1} + \frac{1}{\lambda_2}$

$$\therefore \frac{1}{\lambda_3} = \frac{\lambda_1 + \lambda_2}{\lambda_1\lambda_2} \text{ or } \lambda_3 = \frac{\lambda_1\lambda_2}{\lambda_1 + \lambda_2}$$

50. (1)

Gain in BE = (BE) of products – (BE) of reactants.

= [120 + 120] × 8.5 – [240] × 7.6

= (240) × 8.5 – 240 × 7.6

= (2040 – 1824) MeV = 216 MeV