Chapter 19 Quantum Physics 1 Notes Answers

Check Your Understanding 1

1. $P = \dfrac{nE_{photon}}{t}$

   where energy of 1 photon

   $$400\text{ W} = \frac{n\left(\dfrac{6.63\times10^{-34}(3\times10^{8})}{400\times10^{-9}}\right)}{60\text{ s}}$$

   4.82×10^{22} photons

2. $E_{photon} = \dfrac{hc}{\lambda} \div 1.6\times10^{-19} = 3.36\text{ eV}$

   $E_{photon} = \Phi + KE_{\max}$

   $KE_{\max} = E_{photon} - \Phi = 1\text{ eV}$

3. $I = \dfrac{ne}{t}$

   no. of electrons per sec $\dfrac{n}{t} = \dfrac{I}{e} = \dfrac{10\times10^{-3}}{1.6\times10^{-19}} = 6.25\times10^{16}$

   no. of photons per sec $\dfrac{N}{t} = 6.25\times10^{16}\times20$

   Power $P = \dfrac{N}{t}(hf) = 1.25\times10^{18}\times6.63\times10^{-34}\times6.0\times10^{14} = 0.50\text{ W}$

4. (a) stopping potential V_s = 1 V, thus $KE_{\max}$ = 1 eV

   $E_{photon} = \dfrac{hc}{\lambda} \div 1.6\times10^{-19} = 3.3\text{ eV}$

   $\Phi = E_{photon} - KE_{\max} = 2.3\text{ eV}$

   (b) no change to stopping potential. Saturation current is halved to 1.0 nA

Check Your Understanding 2

1. Ans

(i) with 6.00×10^{-19} J , atoms can only be excited to Level 4.

Subsequent number of transitions ${}^{4}C_{2}=6$

(ii) longest wavelength of radiation corresponds to lowest energy, emitted due to transition from level 4 to 3.

$$(5.81-5.12)\times10^{-19}=\frac{hc}{\lambda}$$

$$\lambda=\frac{6.63\times10^{-34}(3.0\times10^{8})}{0.69\times10^{-19}}=2.88\times10^{-6}\ \text{m}$$

Infra Red

2. Ans

(a) (i) Emission line spectrum – coloured lines on a dark background

absorption line spectrum – dark lines on a bright, coloured background

(ii)