Lecture 14

1-3 => Self Study.

4) a) I_0 incident photons

$$I(z) = I_0 \exp(-\alpha z).$$

For $\frac{1}{2}$ Incident photons $I(z) = \frac{I_0}{2}$

$$\frac{I_0}{2} = I_0 \exp(-\alpha z)$$

$$\ln\left(\frac{1}{2}\right) = -\alpha z$$

$$0.693 = \alpha z$$

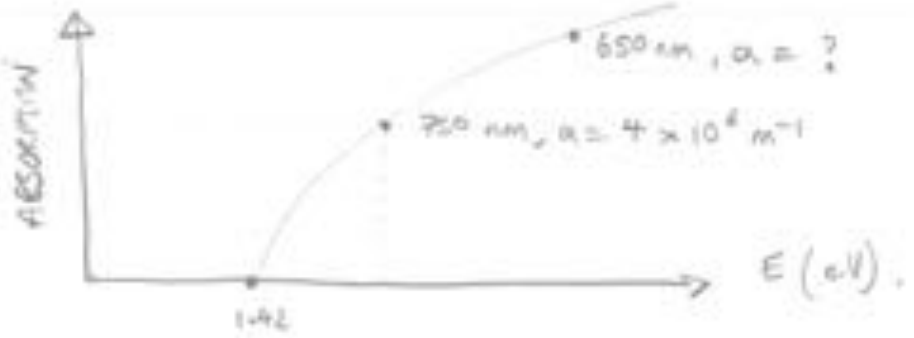
$$z = \frac{0.693}{4 \times 10^6} \quad m$$

$$= 0.173 \times 10^{-6} \quad m$$

$$= 173 \text{ nm} \quad \text{or} \quad 0.173 \ \mu m$$

LECTURE 14

4) b)



ABSORPTION ∝ DoS.

$$g(E) \propto (E - E_c)^{\frac{1}{2}} \quad \text{.... BUT FIRST ...}$$

CONVERT UNITS ... 650, 750 nm → E (eV)

$$E = h\nu = \frac{hc}{\lambda} \Rightarrow \text{in eV ...} = \frac{hc}{\lambda e}$$

$$E_{750\,nm} = \frac{6.624 \times 10^{-34} \times 3 \times 10^{8}}{750 \times 10^{-9} \times 1.6 \times 10^{-19}} = \frac{6.625 \times 3}{7.5 \times 1.6} \times 10^{0}$$

$$= 1.657 \text{ eV}.$$

$$E_{650\,nm} = \frac{6.626 \times 10^{-34} \times 3 \times 10^{8}}{650 \times 10^{-9} \times 1.6 \times 10^{-19}} = \frac{6.626 \times 3}{6.5 \times 1.6} \times 10^{0}$$

$$= 1.911 \text{ eV}$$

$$ABS = C\,(E - E_c)^{\frac{1}{2}}$$

⇒ FIRST DETERMINE C FROM 750 nm DATA.

LECTURE 14

4) b) cont'd.

$$4\times10^{6} = C\left(1.657 - 1.42\right)^{\frac{1}{2}}$$

$$\text{So } C = \frac{4\times10^{6}}{0.487} = 8.216\times10^{6}.$$

$$\text{So, ABS @ 650 nm} = 8.216\times10^{6}\left(1.911 - 1.42\right)^{\frac{1}{2}} \ m^{-1}$$

$$= 5.76\times10^{6}\ m^{-1}$$

LECTURE 14

4) c) INCREASING TEMP ..... CHANGES BAND-GAP ↑? ↓?
ANALYSE DoS EQN ..... DISCUSS ....

d) INSPECT EQUATIONS .... DISCUSS