Model answer paper and Marking Scheme

Internal Assessment Test 1

Applied Physics 1

Date of exam: 18/09/2018

Marks: 15

Q.1

a) Data:-

Silver has FCC structure -

$r = 1.414$ Å

To find:-

$d(200) = ?$ $d(111) = ?$

Formula:- 1) $r = \frac{a}{2\sqrt{2}}$ —— 1/2 M

2) $d = \frac{a}{\sqrt{h^2+k^2+l^2}}$ —— 1/2 M

Solution:-

$\therefore a = r \times 2\sqrt{2} = 3.99$ Å

Now, $d(200) = \frac{3.99}{\sqrt{(2)^2+(0)^2+(0)^2}}$

$= \underline{1.99}$ Å —— 1/2 M

$d(111) = \frac{3.99}{\sqrt{(1)^2+(1)^2+(1)^2}}$

$= \underline{2.303}$ Å —— 1/2 M

Data :-

$d = 0.282\ nm$

$\theta = 8.58°$

$n = 1$

To find :-

$\lambda = ?$

Formula :-

$2d\sin\theta = n\lambda$ ——— 1/2 M

Solution :-

$\lambda = 2 \times (0.282 \times 10^{-9}) \times \sin(8.58°)$ —— 1/2 M

$\lambda = 8.414 \times 10^{-11}\ m$ —— 1/2 M

$= 0.841\ Å$ ——— 1/2 M

c. Data :-

Thickness, $y = 40\ cms = 0.40\ m$

$t_{defective} = t_1 = 30\ \mu s$

$t_{non\text{-}defective} = t_2 = 80\ \mu s$

To find :-

The dist. at which defect is located (x) = ?

Formula :- $d = \frac{vt}{2}$ ——— 1/2 M

Solution :-

$y = \frac{vt_2}{2}$, $x = \frac{vt_1}{2}$

$\frac{y}{x} = \frac{t_2}{t_1}$ ——— 1 M

$\therefore x = y \cdot t_1 / t_2$ —— 1/2 m

$= 15\ cm$

The defect is located at 15 cm below the surface.

d. Data :-

$f = 1\,MHz = 1 \times 10^6\,Hz$

$\rho = 2.65 \times 10^3\,kg/m^3$

$Y = 8 \times 10^{10}\,N/m^2$

To find :-

Thickness (t) = ?

Formula :-

$$f = \frac{1}{2t}\sqrt{Y/\rho}$$ —1/2M

Solution :-

$$f = \frac{1}{2t}\sqrt{Y/\rho}$$

$$t = \frac{1}{2f}\sqrt{Y/\rho}$$

$$= \frac{1}{2 \times 1 \times 10^6}\sqrt{\frac{8 \times 10^{10}}{2.65 \times 10^3}}$$ —1/2

$$= 2.747 \times 10^{-3}\,m$$

$t = 2.747\,mm$ —1M

e. Data :-

$\rho = 2180\,kg/m^3$

$Na = 23$, $Cl = 35.5$ } NaCl = 58.5

FCC → $n = 4$

Formula :-

$$\rho = \frac{nM}{Na^3}$$

To find :-

a = ?

Solution →

$$a = \left(\frac{nM}{N\rho}\right)^{1/3}$$ —1/2M

$$= \left(\frac{4 \times 58.5}{6.023 \times 10^{26} \times 2180}\right)^{1/3}$$ —1/2M

$a = 5.62\,Å$ —1/2M.

Dist. b/w two adjacent atoms $d = a/2$

$= 2.81\,Å$ —1/2

Q.2

a) Draw the unit cell of HCP — 2M

Co-ordination Number — 1/2 M
Atomic Radius — 1/2 M
No. of atoms per unit cell — 1/2 M
Explanation of Diagram — 1 1/2 M
& explanation on
co-ordination no., atomic radius &
No. of atoms per unit cell.

b) Bragg's Law –

Diagram — 1M
Explanation — 1M

Derivation
($\Delta = BC + \ldots$)
$\Delta = 2d\sin\theta$
} — 1 1/2 M

$\Delta = n\lambda$ — 1/2 M

$2d\sin\theta = n\lambda$ — 1 M

Q.3

a) What is Piezoelectric Effect —— 1M

Diagram —— 1M

Construction & Working

$f = \frac{1}{2t}\sqrt{\frac{Y}{s}}$ $f' = \frac{1}{2\pi\sqrt{LC}}$ —— 2M

$f = f'$

b) Magnetostriction Oscillator —— 1M

Diagram —— 1M

Working as a ultrasound generator —— 2M.