# Tutorial sheet-2

Q-1 In an X-ray diffraction experiment using $CuK_\alpha$ radiation of $\lambda = 1.54 \text{ Å}$, the 1st reflection from an fcc crystal is observed when $2\theta$ is 84°. Determine the indices of this reflection and the corresponding interplanar spacing. Show that only one more reflection is possible. Determine the indices of that reflection & the corresponding interplanar spacing.

Q2 A crystal reflects monochromatic X-rays strongly when the Bragg's glancing angle for a 1st order reflection is 15°. What are the glancing angles for the 2nd and 3rd order reflections of the same type.

Q3 A Powder pattern is obtained from an f.cc crystal having lattice parameter of 3.52 Å using X-ray of $\lambda = 1.79 \text{ Å}$. Determine the lowest and the highest reflections possible.

Q4 Find out reciprocal lattice vectors for a space lattice defined by the

following primitive translational vectors:

$\vec{a} = 5\hat{i} + 5\hat{j} - 5\hat{k}$ ; $\vec{b} = -5\hat{i} + 5\hat{j} + 5\hat{k}$

$\vec{c} = 5\hat{i} - 5\hat{j} + 5\hat{k}$.

Also find out the volume of the primitive cell.

Q5 The primitive translational vectors of the reciprocal space lattice may be taken as

$\vec{a} = \left(\frac{a}{2}\right)\hat{i} + \left(\frac{\sqrt{3}a}{2}\right)\hat{j}$ ; $\vec{b} = \left(-\frac{a}{2}\right)\hat{i} + \left(\frac{\sqrt{3}a}{2}\right)\hat{j}$

$\vec{c} = c\hat{k}$

Determine the primitive translation vectors of the reciprocal lattice.

Answers 1) (111), 1.15Å ; (200), 0.996Å

2) 31.2°, 50.9°

3) (111) and (222)

4) $\left(\frac{\pi}{5}\right)(\hat{i}+\hat{j})$, $\frac{\pi}{5}(\hat{j}+\hat{k})$, $\frac{\pi}{5}(\hat{k}+\hat{i})$

5) $\frac{2\pi}{a}\hat{i} + \frac{2\pi}{\sqrt{3}a}\hat{j}$, $-\frac{2\pi}{a}\hat{i} + \frac{2\pi}{\sqrt{3}a}\hat{j}$, $\frac{2\pi}{c}\hat{k}$