

## Assignment - 4

- 1.) BCC iron,  $a = 0.2866 \text{ nm}$ ,  $\lambda = 0.179 \text{ nm}$   
Interplanar spacing for (220) set of planes,

$$d_{220} = \frac{0.2866}{\sqrt{2^2 + 2^2 + 0^2}} \text{ nm}$$

$$= \frac{0.2866}{2\sqrt{2}} \text{ nm}$$

$$= \boxed{0.1013 \text{ nm}}$$

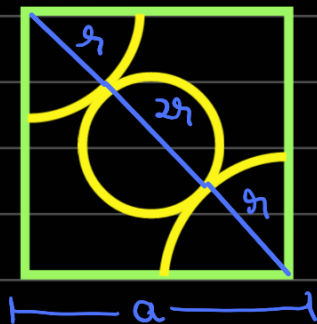
Diffraction angle,  $2\theta = 2\sin^{-1} \frac{\lambda}{2d_{220}}$

$$= 2\sin^{-1} \frac{0.179}{2 \times 0.1013}$$

$$\approx \boxed{124.138^\circ}$$

2.)  $\theta_{\text{In}} = 69.22^\circ / 2 = 34.61^\circ$

As it crystallises in an FCC structure:



$$4r = a\sqrt{2}$$
$$\Rightarrow a = 2\sqrt{2}r$$

$$d_{220} = \frac{a}{\sqrt{2^2 + 2^2 + 0^2}} = \frac{2\sqrt{2}r_{\text{In}}}{2\sqrt{2}} = r_{\text{In}}$$

$$\Rightarrow r_{\text{In}} = \frac{\lambda}{2\sin\theta} = \frac{1.54054}{2 \times \sin 34.61^\circ} \text{ \AA} = \boxed{1.356 \text{ \AA}}$$

$$\text{Now, } \eta_{pt} = 0.1387$$

$$\begin{aligned} d_{113} &= \frac{2\sqrt{2}\eta_{pt}}{\sqrt{1^2+1^2+3^2}} = 2\eta_{pt}\sqrt{\frac{2}{11}} \\ &= 2 \times 0.1387 \sqrt{\frac{2}{11}} \text{ nm} \\ &= 0.1183 \text{ nm} \end{aligned}$$

$n=2$  for 2nd order reflection

$$\begin{aligned} \text{So } 2\theta &= 2\sin^{-1}\left(\frac{2\lambda}{2d}\right) = 2\sin^{-1}\left(\frac{0.154054}{0.1183}\right) \\ &= 2\sin^{-1}(1.3022) \end{aligned}$$

↓  
Invalid input for  
 $\sin^{-1}(x)$

It means 2nd order reflection is not possible.  
——x——