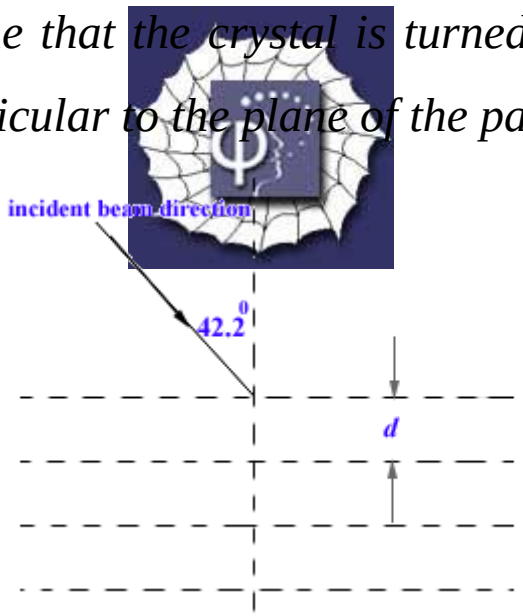
688.

Problem 47.40 (RHK)

Monochromatic x rays $(\lambda = 0.125\ \text{nm})$ *fall on a crystal of sodium chloride, making an angle of* 42.2^0 *with the reference line shown in the figure. The interplanar separation is* $d = 0.252\ \text{nm}$. *We have to find the angle through which the crystal must be turned to give a diffracted beam associated with the planes shown. We may assume that the crystal is turned about an axis that is perpendicular to the plane of the page.*



Solution:

Let the Bragg angle for the x rays of wavelength, $\lambda = 0.125\ \text{nm}$, to be reflected from the lattice with interplanar separation $d = 0.252\ \text{nm}$, be θ.

Using the Bragg equation, we will find the value of θ. It is given as follows;

$$\sin\theta = \frac{\lambda}{2d} = \frac{0.125 \text{ nm}}{2 \times 0.252 \text{ nm}} = 2.48 \times 10^{-1},$$

and

$$\theta = \sin^{-1}\left(2.48 \times 10^{-1}\right) = 2.51 \times 10^{-1} \text{ rad} = 14.36^{0}.$$

The crystal will have to be rotated clockwise by $33.4^{0}, \left(90^{0} - 42.2^{0} - 14.36^{0} = 33.4^{0}\right)$, so that the angle between the incident x rays and the crystal planes is 14.36^{0} required for Bragg reflection.