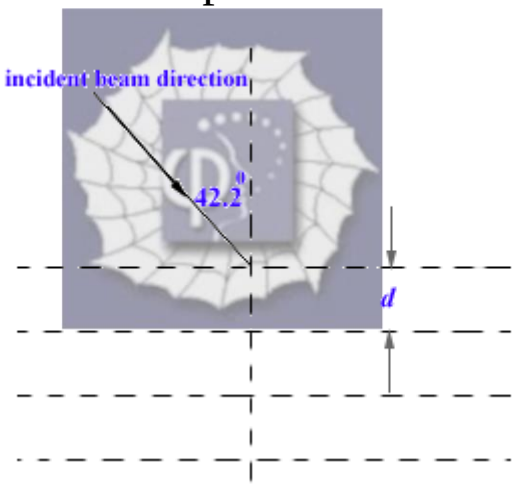
687.

Problem 47.38 (RHK)

Assume that the x-ray beam shown in the figure is not monochromatic but contains wavelengths in a band from 95.0 *to* 139 pm. *We have to find whether diffracted beams, associated with the planes shown, will occur, and, if so, find the wavelengths that are diffracted. We may assume that* $d = 275$ pm.



Solution:

The angle of incidence $\theta = 90^0 - 42.2^0 = 47.8^0$.

Interplanar separation $d = 275$ pm.

The Bragg equation is

$2d\sin\theta = m\lambda,\ m = 1,2,3....$

Using the data of the problem, we note that the wavelengths that will be Bragg reflected will be

$$\lambda = \frac{2d\sin\theta}{m} = \frac{2\times 275\times \sin 47.8^0}{m} \text{ pm}$$

$$= \frac{407.4}{m} \text{ pm.}$$

The set of wavelengths that are Bragg reflected is

$$A = \left\{ \begin{array}{l} \dfrac{407.4}{m} \text{ pm, } m = 1,2,3,..: 407.4 \text{ pm, } 203.7 \text{ pm,} \\ 135.6 \text{ pm, } 101.8 \text{ pm, } 80.8 \text{ pm...} \end{array} \right\}$$

The band of x-rays contains wavelengths between 95.0 pm to 139 pm. Therefore, the wavelengths that will undergo Bragg reflection from the planes of the lattice as shown in the figure will be 135.6 pm and 101.8 pm.