

679.

Problem 47.25 (RHK)

In a particular grating the sodium doublet is viewed in third order at 10.2° to the normal and is barely resolved. We have to find (a) the ruling spacing and (b) the total width of the grating.

Solution:

(a)

The grating equation is

$$d \sin \theta = m\lambda, \quad m = 0, \pm 1, \pm 2, \dots$$

We calculate first the ruling spacing d using the information that in the third order, $m = 3$, the doublet occurs at 10.2° to the normal. We thus find that

$$d = \frac{3 \times 589 \text{ nm}}{\sin(10.2^\circ)} = 9.978 \text{ } \mu\text{m} .$$

(b)

The other information is that the doublet is barely resolvable in the third order. Using the expression for the resolving power of grating we find the total number of rulings N in the grating.



$$\frac{\lambda}{\Delta\lambda} = 3N,$$

$$\therefore N = \frac{589 \text{ nm}}{3 \times 0.6 \text{ nm}} = 327.$$

Therefore, the total width of the grating will be $327 \times 9.978 \text{ } \mu\text{m} = 3.26 \text{ mm}$.

