

(6)

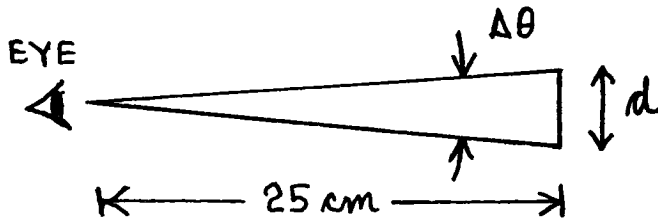
Using the Rayleigh criterion, the smallest angle which the technician's eye can resolve, is

$$\alpha_c = 1.22 \frac{\lambda}{D} = 1.22 \frac{(550 \times 10^{-9} \text{m})}{(5 \times 10^{-3} \text{m})} = 1.34 \times 10^{-4} \text{rad.}$$

where $D = 5 \text{mm} =$ diameter of the pupil of his eye.

If $d =$ spacing between the lines of the grating, the angle subtended is

$$\Delta\theta = \frac{d}{25 \text{cm}}$$



To make out the individual lines requires

$$\Delta\theta > \alpha_c$$

$$d_A = \frac{1 \text{mm}}{20} = \frac{10^{-3} \text{m}}{20} = 5 \times 10^{-5} \text{m}$$

$$\Delta\theta_A = \frac{d_A}{25 \text{cm}} = \frac{5 \times 10^{-5} \text{m}}{0.25 \text{m}} = 2 \times 10^{-4} \text{rad} > \alpha_c$$

$$d_B = \frac{1 \text{mm}}{200} = \frac{1}{10} d_A \quad \text{and} \quad \Delta\theta_B = \frac{1}{10} \Delta\theta_A = 2 \times 10^{-5} \text{rad} < \alpha_c$$

$$d_C = \frac{1 \text{mm}}{2000} = \frac{1}{100} d_A \quad \text{and} \quad \Delta\theta_C = \frac{1}{100} \Delta\theta_A = 2 \times 10^{-6} \text{rad} < \alpha_c$$

The technician can make out the lines only in case A