SAP ID - 60004200182
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Physics - Tutorial 2

6) Given: grating width = 3×10^{-2} m
diffraction order = 2
diffraction angle $\theta = 33^\circ$
wavelength = 600×10^{-9} m.

$\therefore \frac{d}{d} = \frac{m}{\sin\theta}$

$\therefore d = \frac{2 \times 600 \times 10^{-9}}{\sin 33}$

$\therefore d = 2.203 \times 10^{-6}$ m $= 2.303 \times 10^{-4}$ cm.

Number of lines per centimeter $= \frac{1}{d}$

$= \frac{1}{2.303 \times 10^{-4}}$

$\therefore \frac{1}{d} = 0.45392 \times 10^{-4}$

$\therefore \frac{1}{d} = 4569/\text{cm}$

$\therefore$ Total lines = (4539/cm)(3 cm width)

$= 1.36 \times 10^{4}$

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4) $d = 550\ nm$

$D = 40\ cm$

$\Delta y = 0.35\ mm$

Hence, the difference between the first and fifth minima will be

$$0.35 \times 10^{-3} = \frac{5 \cdot (550 \times 10^{-9})(40 \times 10^{-2})}{d} - \frac{(550 \times 10^{-9})(40 \times 10^{-2})}{d}$$

$\therefore d = 2.51 \times 10^{-3}\ m$

$d = 2.51\ mm$

7) $\lambda = 5500\ \text{Å}$

$= 55 \times 10^{-9}\ m$

$\Theta = 900$ seconds

$= \left(\frac{900}{3600}\right) = 0.25$

$d \sin\Theta = (2n+1)\frac{\lambda}{2}$

$d = \frac{3\lambda}{2\sin\Theta} = \frac{3 \times 55 \times 10^{-8}}{2 \times 4.36 \times 10^{-3}}$

$= \frac{165 \times 10^{-5}}{8.72}$

$= 18.92 \times 10^{-5}\ m$

$= 0.0189\ cm$

$\simeq 0.019\ cm$

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8) $R = \frac{\lambda}{\Delta\lambda}$

$\lambda = \frac{\lambda_1 + \lambda_2}{2}$ $\quad \Delta\lambda = \lambda_2 - \lambda_1$

$\therefore R = \frac{6400+6407}{2(7)} = \frac{12807}{14} = 914.785\,\text{Å}$

$R = mN$

$\therefore \frac{\lambda}{\Delta\lambda} = mN$

$\therefore N = \frac{\lambda}{\Delta\lambda m} = 457.3925$

$\therefore L = \frac{N}{\alpha} = \frac{457.3925}{500} = 0.914\,cm$

3) $d = 0.25\,mm$

$= 0.25 \times 10^{-3}\,m$

$\theta = 6min$

$= \left(\frac{6}{60}\right) = 0.1^\circ$

$d\sin\theta = n\lambda$ for minima

$\lambda = \frac{d\sin\theta}{n}$

$= 0.25 \times 10^{-3} \times 1.745 \times 10^{-3}$

$= 4.363 \times 10^{-7}\,m$

$= 4363 \times 10^{-10}\,m$

$\lambda = 4363\,\text{Å}$

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5) $3a = b$

$\therefore \frac{a+b}{a} = \frac{n}{3}$

$\therefore \frac{a+3a}{a} = \frac{n}{3}$

$\frac{4a}{a} = \frac{n}{3}$

$\therefore n = 4m$

$\therefore 4m$ maximum will be missing.
So 3 maximals exists.