NAME :- SHREYAS SRINIVASA
BLAZERID :- SSRINIVA

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PH 222L - P5

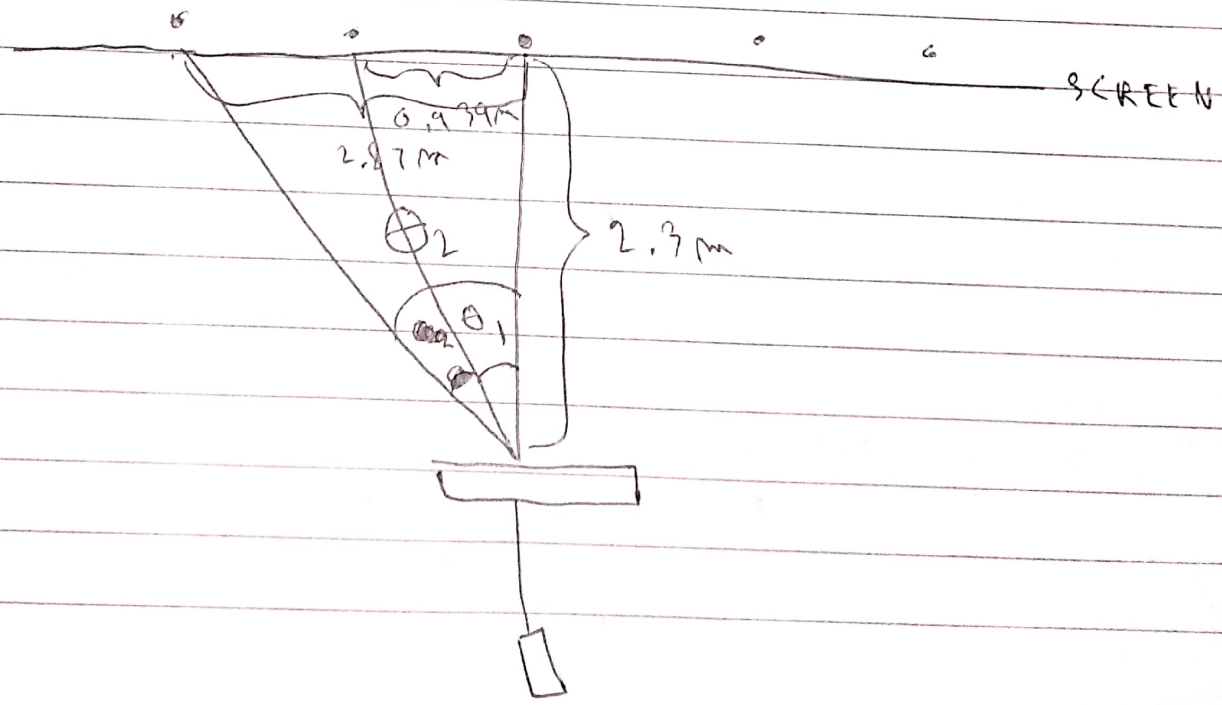
INVESTIGATION - 4

Distance from diffraction grating to the central maximum spot on the wall = 90.7 inches
= 2.3 m

Distance from central maximum spot (m=0) to m=1
= 37 inches
= 0.939 m

Distance from central maximum spot (m=0) to m=2.
= 113.3 inches

Note :- My wall is not uniform. So I apologize in advance if the data does not turn out proper.
= 2.87 m



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

$$d = \frac{1}{400 \text{ lines/mm}} = \frac{1}{400} \times 1\,mm = \frac{10^{-3}}{400}\,m$$

For $m = 1$,

$$\theta_1 = \tan^{-1}\left(\frac{0.439}{2.3}\right)$$

$$\theta_1 = \tan^{-1}(0.408)$$

$$= 22.1954$$

$$\sin\theta_1 = 0.3777$$

$$\lambda = \frac{10^{-3}}{400} \times 0.3777$$

$$= 7.555 \times 10^{-4} \times 10^{-3}$$

$$= 755.5 \times 10^{-9}$$

$$= 755.5\,nm$$

For $n = 2$,

$$\theta_2 = \tan^{-1}\left(\frac{2.87}{2.3}\right)$$

$$= \tan^{-1}(1.247)$$

$$\theta_2 = 51.273$$

$$\sin\theta_2 = 0.7801$$

$$\lambda = \frac{10^{-3}}{500} \times 0.7801$$

$$= 1.560 \times 10^{-3} \times 10^{-3}$$

$$= 1.560 \times 10^{-6}$$

$$= 1560 \times 10^{-9}$$

$$= 1560 \text{ nm}$$

% difference for $n = 1$ & 650 nm $= \frac{(755.5 - 650)}{\frac{755.5 + 650}{2}}$

$$= \frac{105.5}{702.75}$$

$$= 0.150 \times 100$$

$$= 15\%$$

$\Rightarrow$ difference

% difference between wavelength for m = 2 & 690 nm

$$= \frac{(1960 - 690)}{\frac{1960 + 690}{2}}$$

$$= \frac{910}{1105} = 0.823 \times 100$$

$$= 82.3\ \%\ \text{difference}$$