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Object → To determine wavelength of Laser Light with the help of transmission grating.

Apparatus required → Laser light source, transmission grating, optical bench two vertical stand, convex lance and white wall screen.

Formula used →

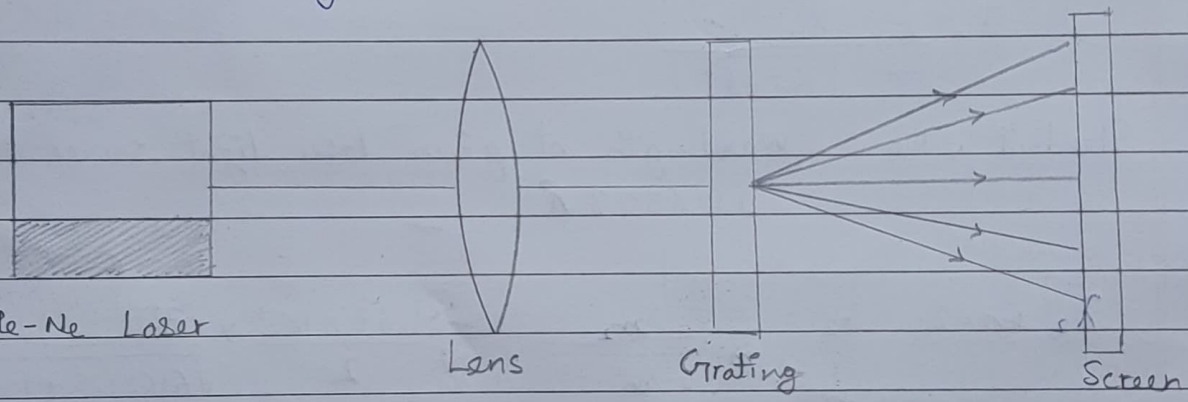
$$\lambda = \frac{e}{m} \sin\theta$$

$$\lambda = \frac{e}{m} \frac{x_m}{\sqrt{x^2+f^2}}$$

where,

λ = wavelength of laser light source.
e = grating element
x_m = distance of first order maxima from the central maxima
f = focal length of the convex lens.

Diagram -



Observation table → Grating element = 1.68×10^{-4}

Distance of screen from the source = 123 cm

S. no.	Order of Spectrum (m)	$x_m = \frac{(y_n + y'_n)}{2}$	x_m^2	Distance between screen to slit	$\lambda_m = \frac{e}{m} \frac{x_m}{\sqrt{x_m^2 + f^2}}$	Mean (λ) $\lambda = \frac{\lambda_1 + \lambda_2}{2}$
1	$Y_2 = 78$	$x_1 = \frac{78+79}{2} = 78.5$	$x_1^2 = 6162.25$	66 cm	$\lambda_1 = 10373.5\ A^\circ$	$\lambda = 6337.9\ \text{Å}$
2	$Y_1 = 28$	$x_2 = \frac{28+29}{2} = 28.5$	$x_2^2 = 812.25$	66 cm	$\lambda_2 = 2302.3\ A^\circ$	
3	$Y_0 = 0$					
4	$Y_1' = 29$					
5	$Y_2' = 79$					

Calculation→ Formula, $\lambda = \frac{e}{m} \sin\theta$, $\tan\theta = \frac{Y}{D}$, $\theta = \tan^{-1}\left(\frac{Y}{D}\right)$

$$\lambda_m = \frac{e}{m} \frac{x_m}{\sqrt{x_m^2 + f^2}}$$

$$m=1,\ \lambda_1 = \frac{e}{1} \frac{x_1}{\sqrt{x_1^2 + f^2}} = \frac{1.68 \times 10^{-4}}{1} \times \frac{78.5}{\sqrt{6162.25 + 10000}}$$

$$= \frac{131.88 \times 10^{-4}}{127.1308381} = 1.03735 \times 10^{-4} = 10373.5\ \text{Å}$$

$$m=2,\ \lambda_2 = \frac{e}{2} \frac{x_2}{\sqrt{x_2^2 + f^2}} = \frac{1.68 \times 10^{-4}}{2} \times \frac{28.5}{\sqrt{812.25 + 10000}}$$

$$= \frac{47.88 \times 10^{-4}}{207.9639392} = 0.23023 \times 10^{-4} = 2302.3\ \text{Å}$$

$$\lambda = \frac{\lambda_1 + \lambda_2}{2} = \frac{(10373.5 + 2302.3)}{2} = \frac{12675.8}{2} = 6337.9\ \text{Å}$$

Standard value :- Wavelength of laser light source is $\lambda = 6328\ \text{Å}$

Result → The wavelength of given laser light source is $\lambda = 6337.9\ \text{Å}$

Precaution →
1> Lens should be straight
2> Lens should not be moved while taking the reading.
3> Always take the reading perpendicularly.
4> Distance should be measured carefully.