Year 12 Physics

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0.1 Investigations

0.1.1 Investigation 1: Speed of Light Investigations

Summarise the historical and contemporary methods used to determine the speed of light and explain its current relationship to the measurement of time and distance.

0.1.2 Investigation 2: Spectral

Aim: To determine the emission spectra of various elements

Materials

- Spectroscope
- Spectral lamps with:
  - Hydrogen
  - Helium
  - Neon
  - Sulphur
  - Mercury
- Spectral lamp support
- Spectral lamp power supply

Risk Assessment

Hazard	Precaution
High voltage power pack	Turn off when not in use, do not touch contact points
Cuts from glass	Check spectral lamp before use, keep away from edge of table to prevent dropping
Burns from UV light	Don't observe directly, only view via spectrometer

Method

1. Prepare spectral support and power supply at 400V
2. Insert hydrogen spectral
3. Use spectrometer to observe emission spectrum and record wavelengths using chart on spectrometer
4. Repeat steps 2-3 with helium, neon, sulfur, and mercury
5. Record results

Results

Element	Result

0.1.3 Investigation 4: Interference and Diffraction

Aim: To observe the diffraction and interference of light using diffraction gratings

Materials

- Laser pointer
- A diffraction grating set
- Meter ruler or tape measure

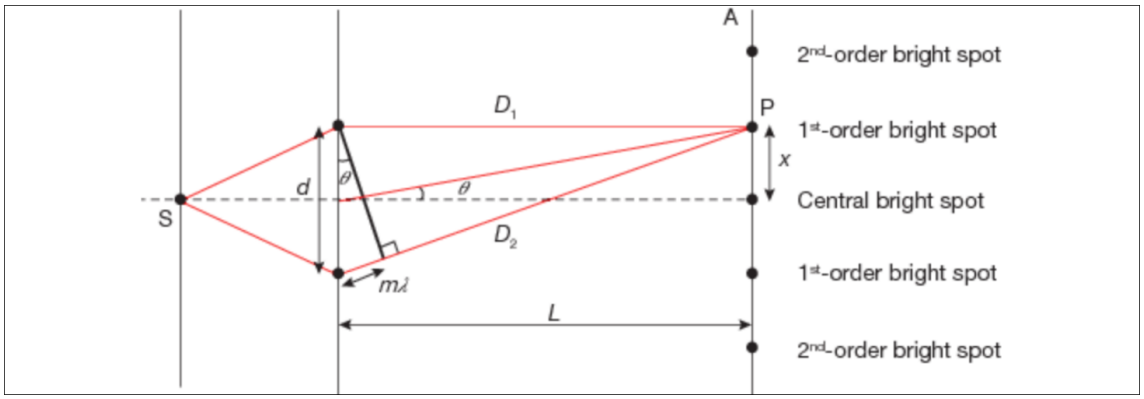
Risk Assessment

Hazard	Precaution
Retina burns	Do not directly look at laser light
Dropping equipment	Handle with caution, keep secure on table

Method

1. Use supports such as retort stands to set up the laser pointer so that it shines perpendicularly onto a screen, wall, or board at least one meter away.
2. Mount the diffraction grating directly in front of the laser pointer so that a regular row of dots appears on the screen.
3. Measure the values of x and L, and record these in your results table, along with the N value for your grating.
4. Repeat this procedure for each grating of different N value.
5. Analyse the data to determine the wavelength of the laser pointer.

Results



Slit separation d (m)	x (m)	L (m)	λ (m)	λ (nm)
100×10^{-6}	0.034	5.44	6.25×10^{-7}	625
200×10^{-6}	0.016	5.44	5.88×10^{-7}	588
300×10^{-6}	0.011	5.44	6.07×10^{-7}	607

Slit separation 1

$$\text{At very small angles, } \sin\theta = \tan\theta$$

$$\begin{aligned} d\sin\theta &= m\lambda \\ \sin\theta = \frac{m\lambda}{d} &= \frac{x}{L} \\ \lambda &= \frac{dx}{L} \\ &= \frac{100 \times 10^{-6} \times 0.034}{5.44} \\ &= 6.25 \times 10^{-7} \end{aligned}$$

$$\text{Actual } \lambda \text{ of Ne-He laser} = 6.328 \times 10^{-7}$$

Slit separation 2

$$\begin{aligned} d\sin\theta &= m\lambda \\ \sin\theta = \frac{m\lambda}{d} &= \frac{x}{L} \\ \lambda &= \frac{dx}{L} \\ &= \frac{200 \times 10^{-6} \times 0.016}{5.44} \\ &= 5.88 \times 10^{-7} \end{aligned}$$

$$\text{Actual } \lambda \text{ of Ne-He laser} = 6.328 \times 10^{-7}$$

Slit separation 3

$$\begin{aligned} d\sin\theta &= m\lambda \\ \sin\theta = \frac{m\lambda}{d} &= \frac{x}{L} \\ \lambda &= \frac{dx}{L} \\ &= \frac{300 \times 10^{-6} \times 0.011}{5.44} \\ &= 6.07 \times 10^{-7} \end{aligned}$$

$$\text{Actual } \lambda \text{ of Ne-He laser} = 6.328 \times 10^{-7}$$