

Lab reports

Situation: A fictitious experiment is done where the wavelength (λ) of light is measured using a spectrometer for various different frequencies (f). The Spectrometer has an accuracy of 30nm. The theoretical relationship is that $f\lambda = c$ the speed of light. The students were instructed to graph λ vs $1/f$ and compare with theory.

Lab report from Student #1

We measured the wavelength as a function of frequency using the spectrometer. Our results agreed with the theory very well.

| f | λ |
|-----------------------|-------------------|
| 4.2×10^{16} | $7.34\text{E-}07$ |
| 4.8×10^{16} | $6.00\text{E-}07$ |
| 6.8×10^{16} | $4.91\text{E-}07$ |
| 9.3×10^{16} | $3.13\text{E-}07$ |
| 1.15×10^{17} | $3.41\text{E-}07$ |

This student missed the point of Labs.

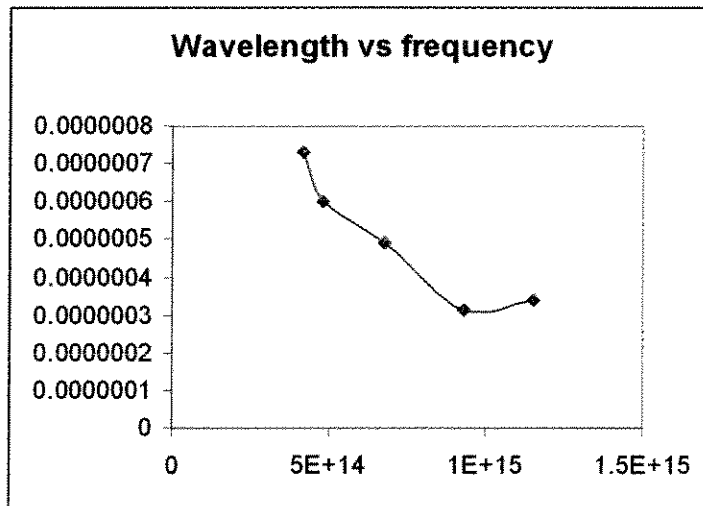
0/10

Lab Report from Student #2

Setup: We setup the source and the spectrometer and we measured the following data:

| f | λ |
|-----------------------|--------------------|
| 4.2×10^{16} | $7.34 \text{E-}07$ |
| 4.8×10^{16} | $6.00 \text{E-}07$ |
| 6.8×10^{16} | $4.91 \text{E-}07$ |
| 9.3×10^{16} | $3.13 \text{E-}07$ |
| 1.15×10^{17} | $3.41 \text{E-}07$ |

Then we graphed the data:



The data agrees with the theory very well.

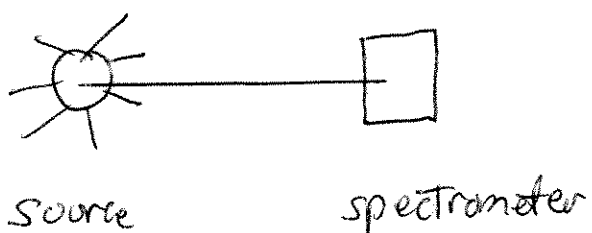
Conclusion: The experiment went well. All measurements came out as expected. It was a fun lab.

*This student did not write / explain enough
and the graph is completely wrong -*

$\frac{1}{10}$

Lab Report from Student #3

- 1) Introduction: Our goal in this lab is to measure the wavelength for different frequencies of light and compare to the theoretical relationship $f\lambda = c$
- 2) Setup: We setup the spectrometer and the source as shown in the diagram.
Note the spectrometer has an accuracy of 30nm.

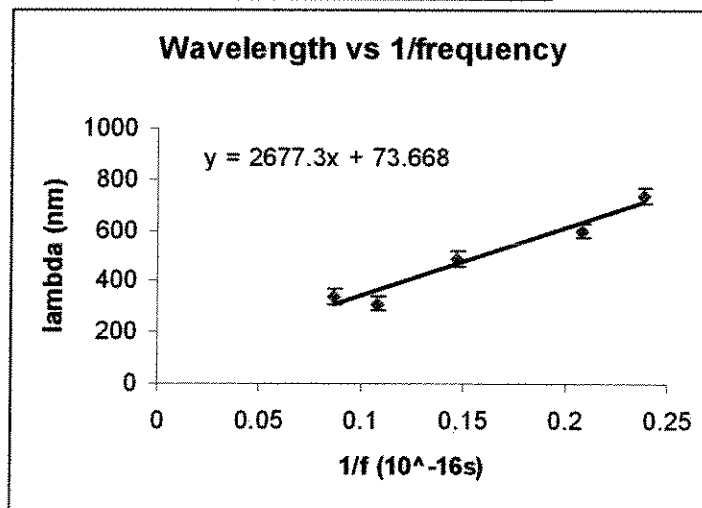


- 3) Data: We then measured the wavelength as a function of frequency. We had some difficulty measuring the wavelength for the higher frequencies. However the lower frequencies were easy to measure. The data is shown in the table:

| f (10 ¹⁶ Hz) | λ (nm) | Error (nm) |
|-------------------------|----------------|------------|
| 4.2 | 734 | +30 |
| 4.8 | 600 | +30 |
| 6.8 | 490 | +30 |
| 9.3 | 313 | +30 |
| 11.5 | 341 | +30 |

- 4) Analysis: We constructed a graph of wavelength as a function of $1/f$ and added error bars to the graph

| f (10 ¹⁶ Hz) | 1/f | λ (nm) | Error (nm) |
|-------------------------|------------|--------|------------|
| 4.2 | 0.23809524 | 734 | -30 |
| 4.8 | 0.20833333 | 600 | -30 |
| 6.8 | 0.14705882 | 490 | -30 |
| 9.3 | 0.10752688 | 313 | -30 |
| 11.5 | 0.08695652 | 341 | -30 |



The data is almost a straight line within error bars. The error bars reflect the accuracy of the spectrometer. The slope that we measured from the graph is 2677.3×10^5 m/s. The slope that we should have gotten is 3000×10^5 m/s a constant the speed of light

- 5) Conclusion: The goal of the experiment was to measure the wavelength for different frequencies of light and compare to the theoretical relation λ vs $1/f$. We had some difficulty measuring the wavelength at the higher frequencies This may have thrown our data off a bit. When we graphed λ vs

1/f we expected to get a slope of $3000 \times 10^5 \text{ m/s}$ the speed of light. Our experimental slope is $2677.3 \times 10^5 \text{ m/s}$. This is an 11% error. Since the error bars are fairly small it seems that this error is not explained by the accuracy of the instrument and that there may be some other errors that are not accounted for. We note that this is consistent with our difficulty in measuring the wavelengths at the higher frequencies. Overall, Our experiment did not agree with the theoretical expectations as well as we would like. Our experiment gives results that are similar to the expected results only off by 11%. We conclude that a better experimental procedure would produce better experimental results more inline with the theoretical predictions.

This student could have explained more about the problems encountered.

And explained the error analysis better

$$\frac{8.5}{10}$$