

Experiment 8 – Spectroscopy

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Lab Section 407

Results and Discussion

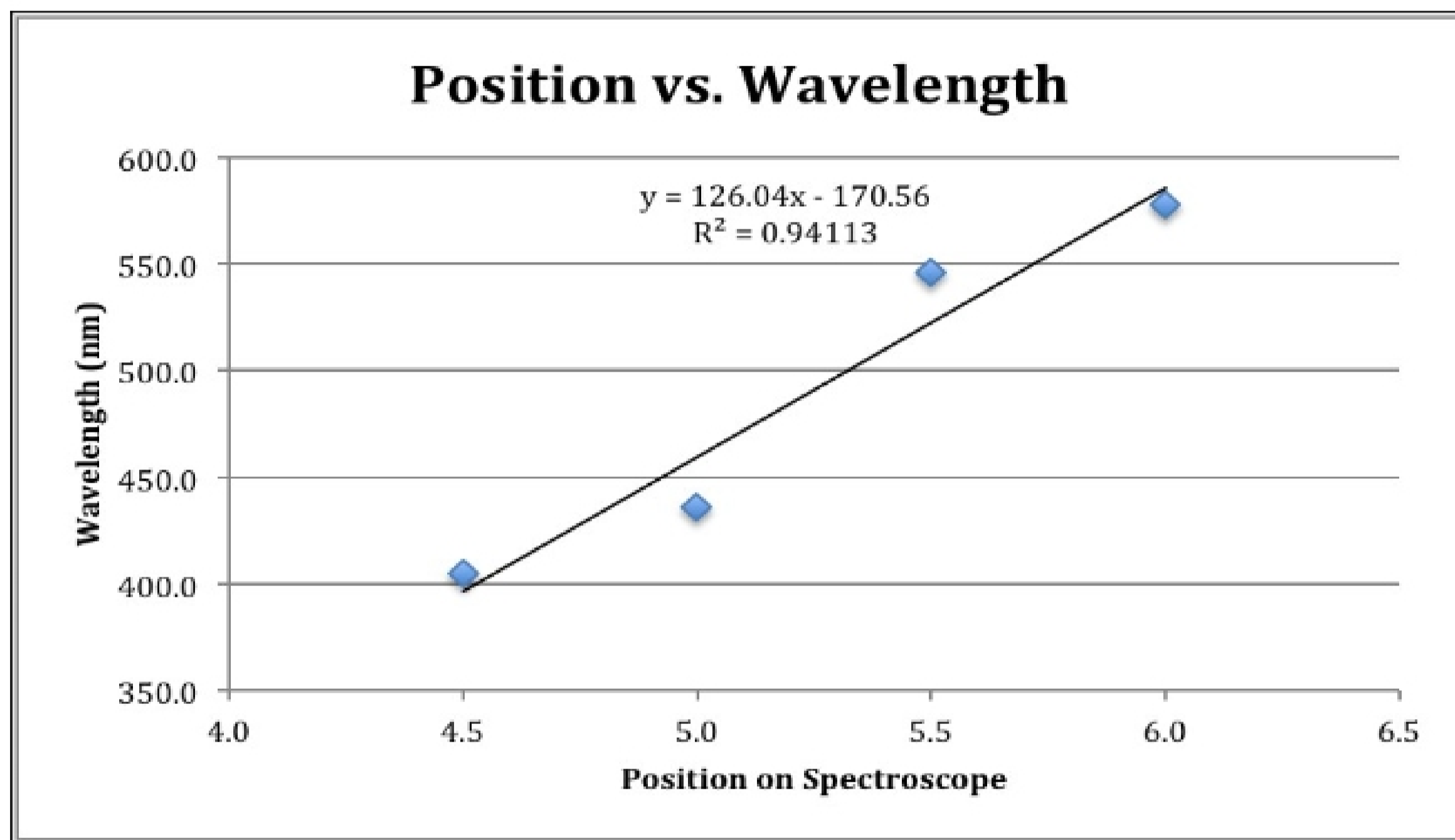


Figure 1. The figure above represents wavelengths of light in nanometers as they relate to the numerical positions on the spectroscope. A positive correlation is represented as the wavelength of light increases, the position on the spectroscope increases as well.

Table 1. Emission lines

Color of Line	Position on Spectroscope	Wavelength (nm)
Violet	4.5	404.7
Green	5.5	546.1
Blue	5.0	435.8
Yellow	6.0	578.0
Equation for Calibration Line	$y = 126.04x - 170.56$	

Table 2. Light sources and their wavelengths and spectral intensities.

Light Source	Wavelength Range (nm)	Region(s) of Maximum Intensity
Candle	737.74-1015.03 (4.5-6.7)	Green
Incandescent Bulb	712.74-1065.44 (4.3-7.1)	Orange/Red
Bunsen Burner	737.74-989.82 (4.5-6.5)	Green/Yellow

Table 3. Accepted wavelengths and error for spectral lines.

Color of Line	Position on Spectroscope	Calculated Wavelength (nm)	Literature Wavelength (nm)	Percent Error
Violet	4.5	396.62	400	0.845%
Teal	5.0	459.64	475	3.23%
Yellow	6.0	585.68	570	2.75%
Red	6.75	680.21	650	4.65%

Table 4. Frequencies and energies of spectral lines.

Color of Line	Wavelength (nm)	Frequency (Hz)	Energy (J)	Transition
Violet	396.62	7.56×10^{14}	5.01×10^{-19}	7.04
Teal	459.64	6.52×10^{14}	4.32×10^{-19}	4.39
Yellow	585.68	5.12×10^{14}	3.39×10^{-19}	3.25
Red	680.21	4.41×10^{14}	2.92×10^{-19}	2.94

Table 5. Elemental flame colors and wavelengths.

Element	Color of Flame	Color of Emission Lines	Position	Wavelength (nm)
Lithium	Red/Yellow	Red/Purple	6.1-7.0	1052.84
Copper	Green	Green	5.5	863.78
Potassium	Purple	Purple	6.1	939.40
Iron	Orange	Orange	6.1	939.40
Sodium	Green	Green	6.1	939.40

Table 6. Unknown compound flame color and wavelength.

Color of Flame	Color of Emission Lines	Position	Wavelength (nm)	Elements in Unknown Mixture
Orange/Yellow	Orange/Yellow	6.1	939.40	Lithium + Iron

Conclusion:

In this experiment, the spectroscope was utilized to analyze many different sources of light. The spectroscope was calibrated to accurately establish a standard for wavelength as it relates to position that the spectroscope displays. A positive correlation was found between the wavelength in nanometers and the position of light on the spectroscope. Upon analyzing different light sources including a candle, incandescent bulb, and Bunsen burner, it was determined that the candle had the shortest wavelength and the incandescent bulb had the longest wavelength.

After examining a hydrogen tube and analyzing the wavelengths of light produced by it, those wavelengths were compared to literature data on the subject and percent error was calculated with all being less than 5%. The spectroscope was utilized in finding wavelengths of light when placed in a Bunsen burner and it was found that lithium had the longest wavelength (while emitting red/yellow spectral lines) and copper had the shortest wavelength (while emitting green spectral lines). The unknown compound tested, based on data collected of the other elements was determined to be a mixture of lithium and iron based on its spectral emission of orange/yellow lines and a wavelength of 939.40nm.