CHEM 130: Spectrometer Lab Report

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Results

Table 1: Hydrogen Emission Spectrum

Line #	Wavelength (nm)	Energy (J)	color
1	410	4.8×10^{-19}	violet
2	433	4.5×10^{-19}	dark blue
3	485	4.0×10^{-19}	cyan
4	659	3.0×10^{-19}	red

Calculations

1. Conversion of wavelength to frequency for the different peak frequencies, given that $\frac{c}{\lambda} = \nu$.

$$\nu_1 = \frac{3 \times 10^8}{410 \times 10^{-9}} = 4.55 \times 10^{14} \tag{1}$$

$$\nu_2 = \frac{3 \times 10^8}{433 \times 10^{-9}} = 6.93 \times 10^{14} \tag{2}$$

$$\nu_3 = \frac{3 \times 10^8}{485 \times 10^{-9}} = 6.19 \times 10^{14} \tag{3}$$

$$\nu_4 = \frac{3 \times 10^8}{659 \times 10^{-9}} = 4.55 \times 10^{14} \tag{4}$$

2. Derivation of expected energy for the first peak, given that $E = \frac{hc}{\lambda}$.

$$\frac{(6.626 \times 10^{-34})(3 \times 10^8)}{659 \times 10^{-9}} = 3 \times 10^{-19} \text{ J} = 1.8 \text{ eV}$$

3. Percent error calculation for Rydberg Constant. This calculation was done assuming the Balmer Series:

$$\frac{|V_o - V_t|}{V_t} \rightarrow \frac{2.00 - 2.18}{2.18} \approx 0.0826\%$$

note: technically due to the number of significant digits excel displays, the Rydberg Constant should have been taken to 1 significant digit giving a 0% difference.

Figures

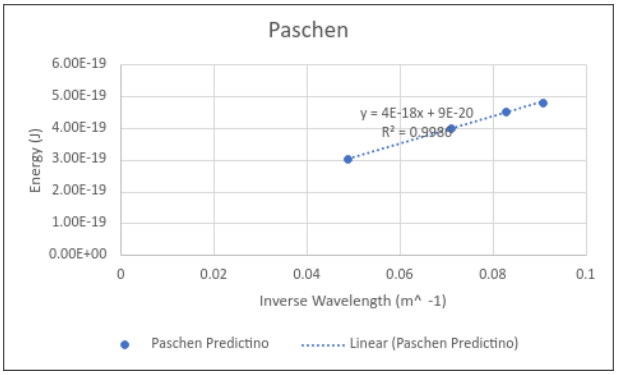

Figure 1: Paschen Series Prediction

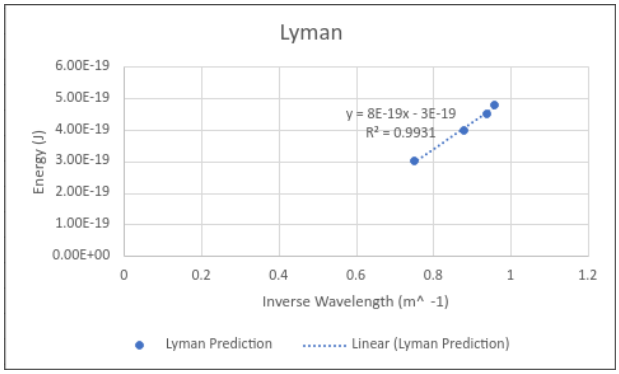

Figure 3: Lyman Series Prediction

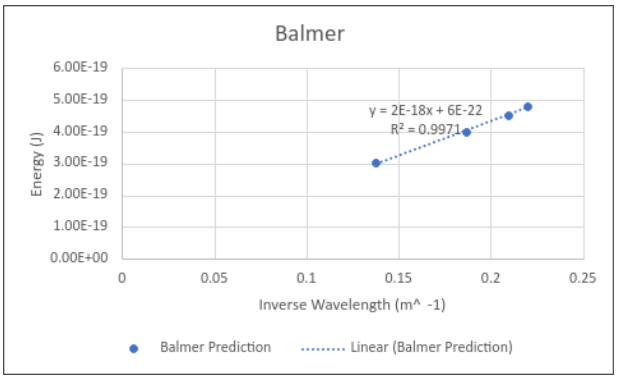

Figure 2: Balmer Series Prediction

Figures [1,2,3] contain predicted plots of measured energy versus inverse wavelength. Energy reduces as inverse wavelength decreases, which is to be expected as inverse wavelength is directly proportional to frequency, and low frequency photons carry less energy than high frequency photons.