



## Assignment #8 - LabReport #4

You cannot edit this entry after it is graded.

Description	The usual format.
I worked in a group with	Dazzo, Gina; Ellis, Audrianna
The work for this assignment is in	My notebook

**Grade** **9 / 10**

Graded on Sep 22, 2023, 8:22 AM CDT

Jason Cody - Sep 22, 2023, 8:22 AM CDT

### Evaluating Photons and Electrons

Testing varying photons of light in varying methods (LED test, flame test and hydrogen test) to determine wavelength of light and energy of light. LEDs are used to confirm Planck's constant, flame test will be used to observe the electromagnetic spectrum and how electrons react to heat energy, and the hydrogen test will be used to calculate the energy of specific wavelengths of light. OK. How will the results be evaluated?

9/18/2023

Kateley, L. J., *Introduction to Chemistry in the Laboratory, 20th Ed.*, Lake Forest College,

2019, Experiment 4, Appendix B. OK

**Data & Observations** The microLab model FS-528 light spectrometer creates a line with a slope of  $7.841 \times 10^{-34} \text{ J x s}^{-1}$ . The percent error between this number and Planck's constant ( $6.626 \times 10^{-34} \text{ J x s}^{-1}$ ) is 18.34%. The SpectroVis Plus fiber optic was used to measure the wavelengths of light of the LEDs on the microLab Energy of Light device. The last infrared light was unable to be measured because SpectroVis only measured up to 900nm. Unknown substances were burned and the class consensus on the color was recorded in Table 2. Known solutions were burned with the following results (color in parenthesis were what Tobias, who is colorblind, saw:

Na - orange (red)

Sr - (orange) red/violet/ orange

K - light orange (white/light grey - tinge of pink)

Cu - Green (green)

Ca - Orange/Red (red)

Li - Violet/Red (purple/blue)

My group for the hydrogen lab included Gina Dazzo and Tobias Ellis.

Figure 1. The Energy of Light - Analysis OK

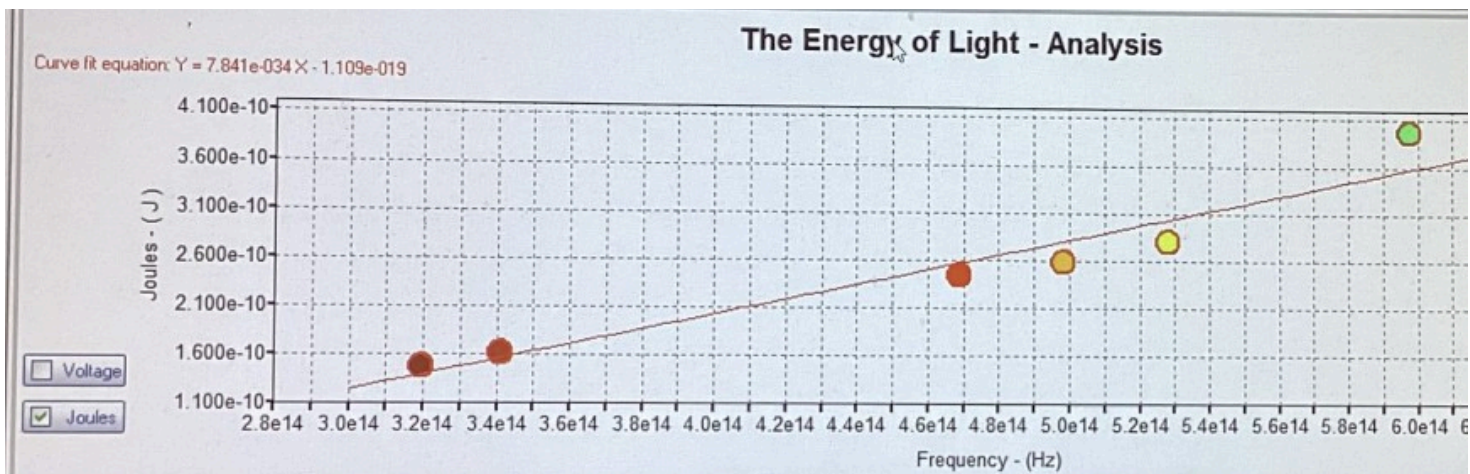


Table 1. Labeled and measured wavelength ( $\lambda$ ) values for emission from LEDs in the Energy of Light module OK

Color of LED	Label Value ( $\lambda$ , nm)	Measured Value ( $\lambda$ , nm)	% Error (using label as "true value")
Blue	470	472.4	0.51
Green	502	512.2	1.99
Yellow-Green	568	563.6	0.77
Yellow	602	604.7	0.45
Red	640	651.9	1.86
Infrared	880	856.3	2.69
Infrared	940	N/A	N/A

Table 2. Flame test: unknown solutions colors and proposed ion in solution OK

Unknown	Observed Color	Proposed ion in solution
A	Red	Sr
B	Green	Cu
C	Yellow/Orange	K Oops: Na+
D	Orange/Purple	Ca K+
E	Purple/Red	Li
F	Orange/Red	Na Ca2+

Table 3. Observed color, wavelength, and calculated energy transitions in hydrogen atoms OK, but watch SF (subtraction reduces them)

Observed Color	Starting Energy, $n_i$	Ending Energy, $n_f$	$\lambda_{\text{max}}$ (nm)	Calculated Energy (J) from Eq. 1 $E = hc/\lambda = hv$	Calculated Energy (J) from Eq. 2 $\Delta E = R_H(1/n_i^2 - 1/n_f^2)$
Purple	6	2	409.0	$4.857 \times 10^{-19}$	$-4.844 \times 10^{-19}$
Purple	5	2	433.0	$4.588 \times 10^{-19}$	$-4.578 \times 10^{-19}$
Teal	4	2	485.0	$4.096 \times 10^{-19}$	$-4.088 \times 10^{-19}$
Red	3	2	656.0	$3.028 \times 10^{-19}$	$-3.027 \times 10^{-19}$

## Calculations

Percent Error = [Experimental value - expected value]/expected value] x 100

$$6.626 \times 10^{-34} \text{ Js}^{-1} \times 2.998 \times 10^8 \text{ s}^{-1} / 409 \text{ nm} (1 \times 10^{-9} \text{ m} / 1 \text{ nm}) = 4.857 \times 10^{-19} \text{ J}$$

$$R_H = 2.180 \times 10^{-18} \text{ J}$$

$$2.180 \times 10^{-18} \text{ J} (1/36 - 1/4) = -4.844 \times 10^{-19}$$

$$4.857 \times 10^{-19} - 4.844 \times 10^{-19} / 4.857 \times 10^{-19} \times 100 = 3.840\% \text{ Oops. calculator error here.}$$

## Conclusions

The percent error on all qualitative components was low therefore accuracy was high. For the LED test percent error was 18.34% when Planck's constant was used as expected value. For the hydrogen test percent error varied between 3.840% and 0.1910% between the two different equations. There is a difference because of error from the SpectroVis spectrometer. **OK, what might you do differently next time? How easy was the flame test for distinguishing the ions?**