

Name: _____

Chem 9, Section: _____

Lab Partner: _____

Experiment Date: _____

Flame Tests and Atomic Spectra

Part A: Flame Tests of Metal Cations

Experimental Data and Observations

Solution	Dominant Flame Color	Wavelength (nm)	Flame Intensity (low, medium, high)	Flame Duration (seconds)
BaCl ₂				
CaCl ₂				
CuCl ₂				
KCl				
LiCl				
NaCl				

Part B: Line Emission Spectra

Experimental Data and Observations

In the boxes provided, draw the spectral lines for the indicated elements. Indicate names colors below each line drawn.

Line Emission Spectrum for Helium

colors:

nm:

Line Emission Spectrum for Mercury

colors:

nm:

Line Emission Spectrum for Hydrogen

colors:

nm:

Data Analysis

Using the wavelengths recorded on page 1, calculate the corresponding wavelengths, frequencies and photon energies for each compound tested. Record the values, *in scientific notation*, in the table below.

Solution	Wavelength (m)	Frequency (s^{-1})	Energy (J)
BaCl ₂			
CaCl ₂			
CuCl ₂			
KCl			
LiCl			
NaCl			

Show a set of sample calculations for **NaCl** only below. Clearly show any equations you have used.

• Wavelength (in m):

• Frequency (in s^{-1}):

• Energy (in J):

Questions

1) Complete the following paragraph by circling the correct responses:

In this experiment, the metal cations in the solutions were initially in the (ground, excited) state. When placed in the flame, the metals then (absorbed, emitted) energy as (electricity, heat, EM radiation). When this occurred, electrons made transitions from (low, high) energy levels to (low, high) energy levels. The metals were then in the (ground, excited) state. The electrons in these metals then made transitions from (low, high) energy levels to (low, high) energy levels, resulting in the (absorption, emission) of energy as (electricity, heat, EM radiation).

2) What evidence is there that the colors observed in the flame tests are due to the metals, and not the nonmetals in the compounds tested?

3) Which metal cation was observed to emit radiation with the *longest wavelength*?

Compared to the other metals studied, did the radiation emitted by this metal cation have

- the highest or lowest frequency? _____
- the highest or lowest energy? _____

4) Why do the gas-discharge tubes need to be turned “on” before a color can be seen?

5) You observed the spectral lines for different elements. What is happening within an atom that causes it to emit light in specific lines in a spectrum?

6) Why did the different elements have different line emission spectra?

7) The radio station JACK FM broadcasts at a frequency of 93.5 kHz. Calculate its wavelength (λ) in nanometers. ($\text{Hz} = 1/\text{s}$)

8) For the same radio station, calculate the energy (E) in kilojoules, kJ.