Name: _____

Lab 12. Atomic Line Spectra

Introduction

Gaseous atoms, when exposed to a high electric field, emit light in narrow wavelength bands, corresponding to energy transitions between their atomic orbitals. The energy *E* of a photon, or single unit of light, is related to its frequency *f* by the formula $E = hf$, where h is the Planck constant, $6.626 \times 10^{-}$ J·s.

Materials

- Gas discharge tubes including H and Hg
- Diffraction grating
- Meter stick supports
- LibreTexts lab sheet
- high voltage power supply
- two meter sticks
- grating holder

Procedure

1. Take measurements of the mercury spectrum as directed.
2. Record the spectra of the other tubes: hydrogen, oxygen, nitrogen, helium, neon at least.

Calculations

1. Set up the formula converting mercury spectrum line position to wavelength as described in the instructions. I recommend using a spreadsheet.
2. Calculate the wavelengths of the spectral lines of your other elements. I recommend using the same spreadsheet.
3. Try to find which transitions of the H spectrum

$$\frac{1}{\lambda} = R_{\infty}\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

That you observed visually in this exercise

Questions

1. (2 points) What was the most difficult part of this lab? Explain.

3. (2 points) What H spectral transitions did you observe?

Report

Turn in this lab sheet with the data and calculations tables completed and questions answered.

Scoring

8 points in lab

8 points data

4 points questions

10 points calculations

Tables

Redox Reaction Data Table
(3.5 points)

Mass of calorimeter and lid	
Volume of $CuCl_2$ solution	
Mass of calorimeter, lid, and solution	
Concentration of $CuCl_2$ solute	
Mass of Fe powder	
Initial temperature	
Maximum temperature	

Redox Reaction Calculations Table
(4.5 points)

Mass of $CuCl_2$ solution	
Moles of $CuCl_2$ solute	
Molar mass of Fe	
Moles of Fe	
Limiting reactant	
Moles Cu / mole limiting reactant	
Theoretical yield of Cu n (moles)	
Temperature change ΔT	
Heat input to reactants q	
Molar enthalpy change $\Delta H = q/n$	

Acid-Base Reaction Data Table

(3.5 points)

Mass of calorimeter and lid	
Volume of HCl solution	
Mass of calorimeter, lid, and solution	
Concentration of HCl solute	
Mass of $NaHCO_3$ powder	
Initial temperature	
Minimum temperature	

Acid-Base Reaction Calculations Table

(4.5 points)

Mass of HCl solution	
Moles of HCl solute	
Molar mass of $NaHCO_3$	
Moles of $NaHCO_3$	
Limiting reactant	
Moles NaCl / mole limiting reactant	
Theoretical yield of NaCl n (moles)	
Temperature change ΔT	
Heat input to reactants q	
Molar enthalpy change $\Delta H = q/n$	