Title: Spectroscope Lab

Name:
Date:
Period:

Purpose/ Background: As early as 1752, the first clues to understanding atomic structure appeared when scientists began to study the emission and absorption of light from different elements. Early in the twentieth century, Rutherford was able to provide some detailed explanation of the observed spectra of some elements. From this study came the introduction of spectroscopy and the development of spectral analysis.

An instrument used to detect and study the emission spectra of various substances is called a spectroscope. A spectroscope is a simple instrument which contains a prism or diffraction grading. The prism separates the light emitted from a substance into specific energies. The apparatus used in this lab is a simple spectroscope.

When an atom or molecule gains of loses energy, this energy is transferred to and from atoms or molecules in definite discrete units of radiant energy called photons. The energies of electrons in atoms or molecules are restricted to definite quantities, called energy levels. These energy levels are fixed for a given atom and to change the energy state, a photon must be emitted or absorbed. In other words, an electron must move from one energy level to another. The lines in the spectra represent amounts of energy emitted when excited electrons move from one energy level to another.

In this lab we will be looking at light given off by different chemicals through the spectroscope. We will draw spectra and calculate the energy of different colors of light.

By following the equation $c=\lambda\nu$ and $E=h\nu$ and by knowing that c and h are constants, the energy will be able to be calculated by information gained from the lab. This will result in the value of ν, which will be substituted in the equation, $E=h\nu$. We know that h= plank's constant (6.63×10^{-34}Js)

Data:

While looking at a light source, you will draw the spectra you see through the spectroscope
Sources: White Light (Florescent), Hydrogen, Neon, Helium, Mercury, Oxygen, & Nitrogen

Source: _________________

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7 6 5 4

Source: _________________

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7 6 5 4

<u>Calculations:</u> Calculate the frequency and the energy <u>for a different color in each of the 6 samples.</u> Show all you work for the <u>12 Calculations</u> on separate sheet of paper.

Sample Calculation:

Example: You pick a Yellow line for Nitrogen

Using the formula: $c = \lambda\nu$

$$\nu = \frac{3.00 \times 10^{8} \text{m/s}}{6.25 \times 10^{-7} \text{m}}$$

$$\nu = 4.80 \times 10^{14} \text{Hz}$$

Using the formula: $E = h\nu$

$$E = (4.80 \text{ X } 10^{14} \text{ Hz})(6.63 \times 10^{-34} \text{J/Hz})$$

$$E = 3.18 \text{ X } 10^{-19} \text{J}$$

<u>Questions:</u>

1. What causes spectral lines?
2. What are some possible errors in your experiment?
3. Why does each element have a different number of spectral lines?

<u>Reflection:</u>

3-5 Sentence reflection that summarizes what you learn from doing this lab.