Lower Merion High School Chemistry

Gas Spectrum Tubes

Lab #5

When a substance is exposed to a quantity of energy, the electrons in the substance can absorb and emit a photon or photons of energy. Photons of certain wavelengths are visible to the human eye. Each element has its own pattern of energy emission. By comparing patterns of energy emission, we will be able to identify unknown elements.

Materials:

Gas spectrum tubes containing the following:

Neon	helium
argon	nitrogen
hydrogen	three unknown gases

Spectrum tube power sources
Fluorescent light source
Spectroscope

Procedure:

Select one of the known gaseous elements and observe the gas through the spectroscope. Line the gas tube up with the slit on the spectroscope. Then, observe the bright line spectrum that will be visible over the scale to the right of the slit. Record the color of each line bright line and the position on the scale of that particular line. You should observe at least three lines for each substance observed. Follow this procedure for each of the gas tubes and the fluorescent light source.

Calculations:

For each of the observed lines, calculate the frequency and energy of that particular wavelength. To obtain the wavelength in appropriate units, multiply your observed value by 100. For example, a value of 5.4 is equal to 540 nanometers. Then, use the following equations to obtain the frequency and energy of each line.

$$\nu = \frac{3.00 \times 10^8 \text{ m/s}}{\lambda} \qquad\qquad 1 \text{ nm} = 1 \times 10^{-9} \text{ m}$$

$$E = h\nu \qquad\qquad h = 6.6262 \times 10^{-34} \text{ J-s}$$

Also, from your results, determine the identity of the unknown gases.