Density, Conservation of Mass, and Atomic Structure

What's the Wow?: You will see how gases interact with air and fire, differentiate between the conservation of mass and volume and observe how a neon sign as well as how fireworks are made.

Procedure:

A. Density[1]

1. Methane
   a. Add enough "Mr. Bubbles" soap solution to cover the bottom of a 600 mL beaker.
   b. Connect a length of tubing from a gas jet to a funnel. To quickly shut off of the gas, you only need to pinch the tubing closed with your fingers.
   c. Turn on the gas jet and immerse the funnel in the soap solution. Remove the funnel and shake the funnel to cause the bubble to break away from the funnel.
   d. Your partner should use a ruler with a lit candle attached to it to see how the flame interacts with the gas. **Safety Note: Always keep the candle flame well above your head! Make sure no one is close to the bubble when it is lit.**
   e. Think about the density of the methane gas to the density of air.

2. Hexanes
   a. Add 10 drops of hexanes to a 250 mL beaker and cover with a watch glass.
   b. "Pour" the vapor, but no liquid, from the 250 mL beaker to a 150 mL beaker for about 15 seconds.
   c. Remove the 250 mL beaker a distance away and light a match and lower it into the 150 mL beaker using a tongs.
   d. What does what you have just witnessed say about the density of hexane compared to air?
   e. If you have some remaining hexane, return it to the container marked "hexane residue".

3. Carbon dioxide
   a. Add several marble sized chunks of dry ice to a 250 mL beaker and cover with a watch glass.
   b. Light a tea candle in a second 250 mL beaker.
   c. "Pour" the vapor from the carbon dioxide beaker onto the candle.
   d. How does carbon dioxides' density compare to that of air?
   e. Pour some water onto your remaining dry ice to see what happens.

B. Conservation of Mass and Volume[2]

Measure 500 mL of water at the bottom of the meniscus into each of the two 500-mL volumetric flasks. Add both to the 1 L volumetric flask. The water should be close to, if not exactly at, the etched mark, i.e., the conservation of volume is upheld.

Measure 50 mL of water into a previously massed 50-mL volumetric flask and record the total mass. Measure 50 mL of ethanol into a second previously massed 50-mL volumetric flask and record its total mass. Pour both into a previously massed 100 mL volumetric flask and record the total mass. What can you say about conservation of mass here? What can you say about conservation of volume?

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[1] Adapted from *Environmental Chemistry: Experiments and Demonstrations,* 2nd ed., M.G. Ondrus, Wuerz Publishing, Winnipeg, Canada, 1996.

[2] Adapted from *http://chemlearn.chem.indiana.edu/demos/consmass.htm*

C. Atomic Structure

A. Gases

Begin by looking at Hydrogen (H_2) as it is electrically excited using a diffraction grating. Page 70 of your text shows nice spectra of many elements. Compare your hydrogen spectrum to at least two other gases (neon, mercury, helium, xenon, krypton, oxygen, or iodine). Not only are the colors of the lines important, but also the spacing between them. Draw the spectra in your notebook.

B. Cations

Dip the Q-tip into the lithium ion solution and hold the Q-tip just above the inner blue cone of the Bunsen burner flame. Observe the color emitted by the heated solution. Do not hold the Q-tip in the flame so long that you begin to burn it, but re-dip it in the metal solution if necessary. If it does catch fire, put it in the beaker of water at the station. Repeat the process at the different burners around the lab using the other metal ions (sodium, calcium, strontium, barium, copper, potassium, and lead). You may also want to look at the color using the blue glass filter, which will filter out some of the impurities. Lastly, choose an unknown solution and determine which cation is present.

Waste

Nothing generated in this lab is harmful to the environment and all liquids can go down the drain (except the hexane that has been returned).