

MOLAR MASS AND CHEMICAL FORMULA OF A VOLATILE LIQUID

The purpose of this experiment is to determine the molar mass of a compound that is a volatile liquid and (using the elemental analysis provided) to determine its molecular formula. The mass of a known volume of vapor is determined, and the ideal gas law is used to calculate the molar mass. The moles (n) term in the ideal gas law may be replaced with the ratio of mass over molar mass:

$$PV = nRT$$

$$n = (\text{mass})/(\text{molar mass})$$

$$PV = (\text{mass})RT/(\text{molar mass})$$

With a partner, obtain these items from the designated point in the lab: 125 mL Erlenmeyer flask, thermometer, and numbered unknown.

Procedure:

1. Use the analytical balance to weigh the clean, dry flask, aluminum foil, and rubber band.
2. Pour about 3 mL of the unknown into the flask, cover with the foil, and secure the foil with the rubber band.
3. Put about 200 mL of water and a few boiling chips into your largest beaker, float the flask (containing your unknown) in the beaker, and cover with the watch glass (concave up, so the watch glass doesn't slide off).
4. Heat slowly until the water boils. Continue boiling just until the last trace of the unknown liquid has evaporated in the flask.
5. Immediately after vaporization has completed, carefully remove the flask, measure the temperature of the boiling water, and then discontinue heating.
6. Dry the flask well with a paper towel, and then allow it to cool to room temperature (about 20 minutes). The flask must come to room temperature. A few drops of liquid should form in the flask from the condensed vapor.
7. Record the barometric pressure in the lab. Convert to atm.
8. Weigh the flask with the foil and rubber band still in place and determine the mass of the vapor that had filled the flask.
9. Rinse out the flask and determine the volume by filling it carefully with water from a graduated cylinder.
10. Return the wet 125 mL flask to the designated point in the lab, and obtain a dry one. Also obtain a new piece of aluminum foil. Repeat the experiment for a second trial.
11. Be sure you copy down the elemental analysis data for your sample.

After completing the procedure but before leaving lab, write in your notebook a brief statement (two to three sentences) on the quality and reasonableness of the data you collected. Note what you might do differently if you performed the lab again.