Flick Your Bic
Application

Problem:

How can you determine the molecular mass of the gas butane?

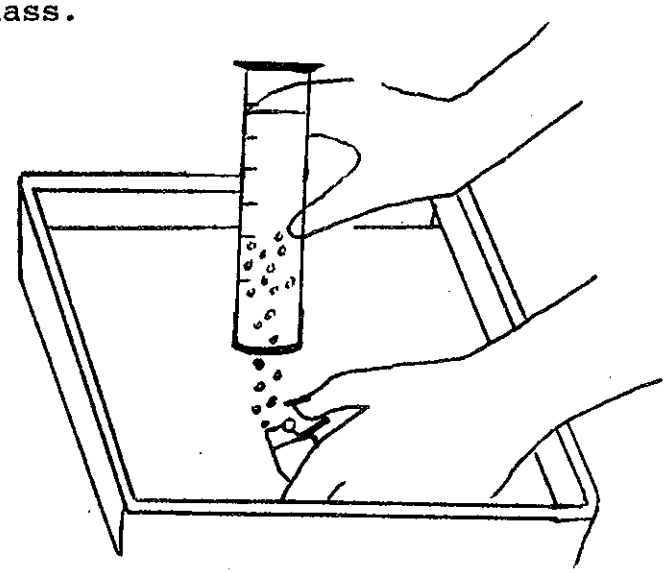
Materials:

butane lighter
thermometer
water trough
metric balance
250 mL graduated cylinder

Procedure:

Avogadro's hypothesis states that equal volumes of gases under constant temperature and pressure contain equal numbers of particles. Therefore one mole of any gas particles will occupy 22.4 L of volume at S.T.P.

In this experiment your job will be to determine the molecular mass of butane gas. Given a "Bic" lighter, you will release butane gas, allowing it to displace between 150 and 200 mL of water. This process is shown in the drawing below. Knowing the volume of butane gas, and from the measured temperature, pressure and mass of the butane gas used, you will be able to calculate its molecular mass.



Before beginning your data collection, construct a data table in which to record all of your data. Be sure that all numbers are labeled clearly in your table.

You will need to make a correction in your atmospheric pressure reading due to the vapor pressure of the water. Use the data provided in the table below in determining the vapor pressure of your water sample.

Vapor Pressure of Water at Various Temperatures

Temperature (°C)	Pressure (mm)	Temperature (°C)	Pressure (mm)
15	12.8	23	21.0
16	13.6	24	22.4
17	14.5	25	23.7
18	15.5	26	25.2
19	16.5	27	26.7
20	17.5	28	28.3
21	18.8	29	30.0
22	19.8	30	31.8

Summing Up:

1. Determine the molecular mass of butane from the experimental data. Show all of your calculations, including units.

2. Find the molecular formula for butane and determine its molecular mass. How does your experimental value compare to the actual molecular mass of butane?

3. Name several sources of error which could help to account for any differences between your experimental value for the molecular mass of butane and the actual molecular mass.