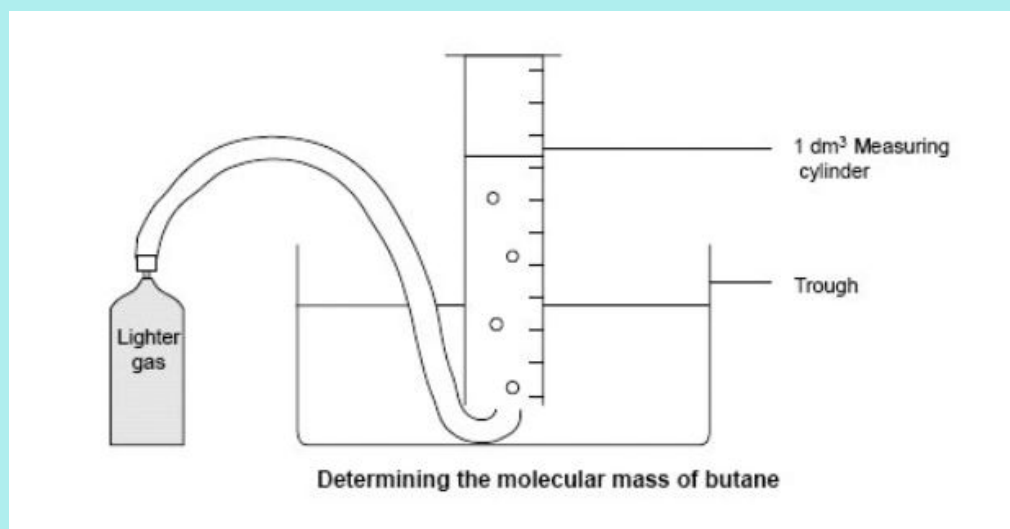
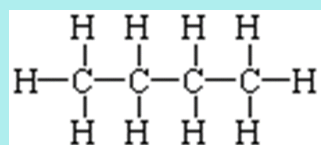
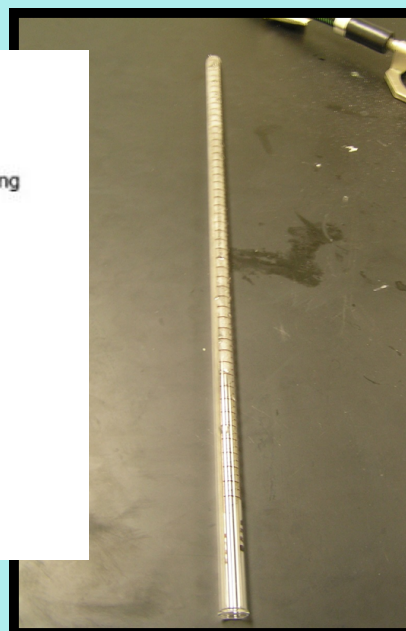
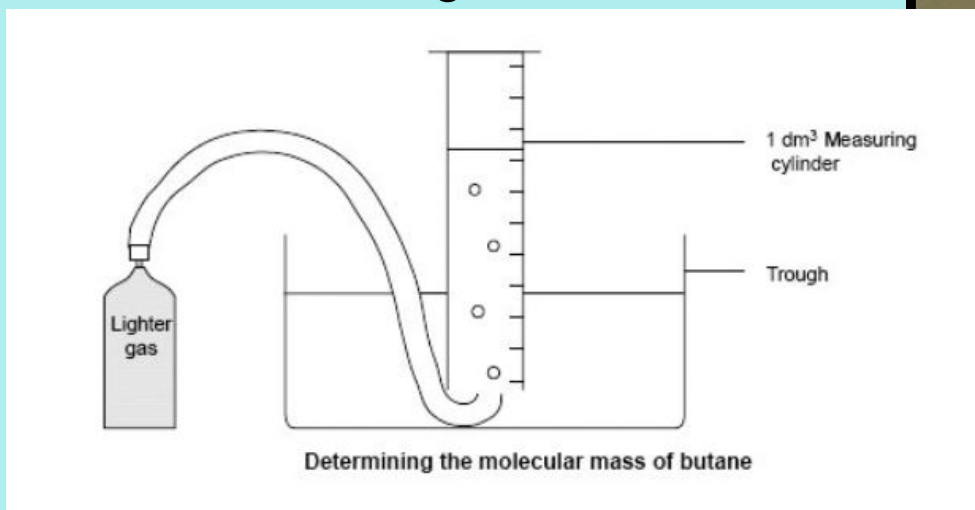


Butane lab



Materials

- 5 gallon bucket
- Thermometer
- Lighter or at least part of it.
- Water
- Food coloring (I used for sake of pictures)
- Eudiometer or gas collection tube



One end is open.

Gas Delivery Technique



Notice the lighter never gets wet. In this case, red die is flowing out the bottom do to the fact water is being displaced

Objective: Determine molar mass of butane.

determine $\frac{\text{grams}}{\text{mole}}$

You will need to find the mass and moles.



before



after

Mass: subtract mass of lighter before and after

$$15.013 - 14.940 = .073\text{g}$$

Moles: use $PV=nRT$

Moles: use $PV=nRT$

$$T=16.1^{\circ}\text{C} = \underline{\hspace{2cm}} \text{ K}$$

P_{gas} (in atm)

$$P_{\text{atm}} = P_{\text{gas}} + P_{\text{water vapor}}$$



look up $\left(\begin{array}{l} P_{\text{atm}} = 29.93 \text{ inHg} * \left(\frac{25.4 \text{ mm}}{1 \text{ in}} \right) = 760.22 \text{ mmHg} \\ P_{\text{water vapor}} = 13.1 \text{ mmHg} \end{array} \right.$

$$760.22 = p_{\text{gas}} + 13.1 \text{ mmHg}$$

$$P_{\text{gas}} = 747.12 \text{ mmHg}$$

convert to atm:

$$P_{\text{gas}} = 747.12 \text{ mmHg} * \frac{1 \text{ atm}}{760.0 \text{ mmHg}} = .9830 \text{ atm}$$

$$V=32.8 \text{ mL}$$

$$V=0.0328\text{L}$$



Solve for moles

$$PV = nRT$$

$$PV/RT = n$$

$$P = 0.9830 \text{ atm}$$

$$V = 0.0328 \text{ L}$$

$$R = 0.0821$$

$$T = 289.1\text{K}$$

$$n = 0.001358 \text{ moles}$$

Find Molar Mass

$$\text{Molar mass} = \frac{\text{grams}}{\text{mole}}$$

from mass change in butane lighter

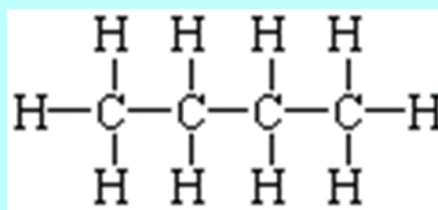
from PV=nRT

$$\frac{0.073\text{g}}{0.001358 \text{ moles}} = 53.7\text{g/mol}$$

Error analysis

Percent error

Butane
 C_4H_{10}
58.04g/mol



What is the percent error?

$$\% \text{ error} = \frac{\text{your result} - \text{accepted value}}{\text{accepted value}} * 100 \%$$

$$\% \text{ error} = \frac{|53.7 - 58.04|}{58.04} * 100 = 7.47\%$$

Percent error is an absolute value.
and is always positive.

A sample of nitrogen was produced and collected through water displacement, in which the temperature of the water was 24°C . The atmospheric pressure that day was 764 mmHg. What is the pressure of the nitrogen sample collected?

$$P_{\text{atm}} = P_{\text{GAS}} + P_{\text{water vapor}}$$

$$764 \text{ mmHg} = P_{\text{GAS}} + \cancel{22.4}$$

$$- 22.4 \qquad \qquad \qquad - 22.4$$

$$741.6$$

What is the molar mass of an unknown gas if its mass is 0.642g. The conditions of the gas are at STP and its volume is 448 mL.

$$T = 273\text{K}$$

$$P = 1 \text{ atm}$$

$$\text{mass} = 0.642$$

$$V = 0.448\text{L}$$

$$PV = nRT$$

$$\text{molar mass} = \frac{g}{\text{mol}} = \frac{0.642\text{g}}{0.02} = 32.1 \frac{\text{g}}{\text{mol}}$$

$$n = \frac{PV}{RT} = \frac{(1 \text{ atm})(0.448\text{L})}{(0.0821)(273)} = 0.020 \text{ mol}$$

