MOLAR MASS OF BUTANE LAB

Academic Chemistry

NAME:_____

DATE:_____ PD: _____

Objective: Dalton's law and the ideal gas law – Show how these gas laws can be used to determine the molar mass of butane.

Preparation:

1) Fill the sink with **room temperature** water.
2) Submerge the 100-mL graduated cylinder in water and fill it completely with water. There should be no air bubbles.
3) Submerge the disposable butane lighter in water, remove it, and then dry it off as thoroughly as possible.
4) Weigh the butane lighter to the nearest 0.01g and record the mass. This is your initial mass of the lighter.

Procedure:

5) Using a thermometer, measure and record temperature of the water bath. Record the barometric pressure off the board.

6) While holding the inverted graduated cylinder, place the lighter in the water underneath the opening and fill the graduated cylinder with butane by holding down the trigger.

7) At first, displace about 90 mL of water. Then, adjust the graduated cylinder so that the 100-mL mark lines up with the height of the water in the sink. Finish filling the graduated cylinder with butane until it reaches the 100-mL mark.

8) Release the gas from the graduated cylinder. Dry off the butane lighter and weigh it again. Record the mass.

Data:

1) Water bath temperature _____°C	4) Initial mass of lighter _____g
2) Barometric pressure(P_{atm}) _____mmHg	5) Final mass of lighter _____g
3) Volume of gas collected _____mL	6) Mass of butane released _____g

Post-Lab calculations and questions:

7) What ***two*** gases are in the graduated cylinder after step #7 of the experiment?

8) What is the ***vapor pressure*** of water (P_{H2O}) at the water bath temperature?

9) Use Dalton's Law of partial pressures to determine the ***partial pressure of butane*** in the graduated cylinder: ($P_{but} = P_{atm} - P_{H2O}$)

10) Use the Ideal gas law to find the number of ***moles*** of butane released from the lighter.

11) Using data from your experiment, what is the ***experimental*** molar mass (g/mol) of butane?

$$\textbf{Experimental Molar Mass} = \frac{\text{mass of butane released}}{\text{moles of butane released}}$$

12) The molecular formula of butane is C_4H_{10}. Using the periodic table, what is its ***accepted*** molar mass?

13) Determine the ***percent error*** using the accepted molar mass of butane.

$$\textbf{\% Error} = \frac{|\text{experimental molar mass} - \text{accepted molar mass}|}{\text{accepted molar mass}} \times 100$$

Water Vapor Pressure at Various Temperatures			
Temp (^{0}C)	**Pressure**	**Temp (^{0}C)**	**Pressure**
19	16.5 mmHg	25	23.8 mmHg
20	17.5	26	25.2
21	18.6	27	26.7
22	19.8	28	28.3
23	21.0	29	30.0
24	22.4	30	31.8