Lab Session 11, Experiment 10: Determination of the Molar Mass of Oxygen

The molar mass (sometimes called the gram molar mass, or the molecular weight) of a gaseous compound can be calculated if the following are known: the mass, volume, temperature, and pressure of the gas. In this experiment, the molar mass of oxygen will be determined. Potassium chlorate will be decomposed to produce oxygen. The mass of oxygen generated will equal the difference between the mass of $KClO_3$ before decomposition and the mass of the residue after decomposition. The volume of the oxygen will be the volume of water displaced from a bottle initially filled with water. The total gaseous pressure ($P_{oxygen} + P_{water}$) will be assumed to be barometric pressure. The temperature of the oxygen will be assumed to be the same as that of the water displaced.

10A Experiment

Record all measurements in the data table provided.

1. Fill $KClO_3$ into your large test tube to a depth of 2-3 cm. Add a small quantity of MnO_2 and weigh the test tube with contents.
2. Mix well. Mount the test tube as shown in Figure 11.1. *Note*: All connections must be tight. This includes glass tubes through stoppers, stoppers in vessels, and rubber tubing connections to glass tubes. The latter may require a hose clamp or wire winding.

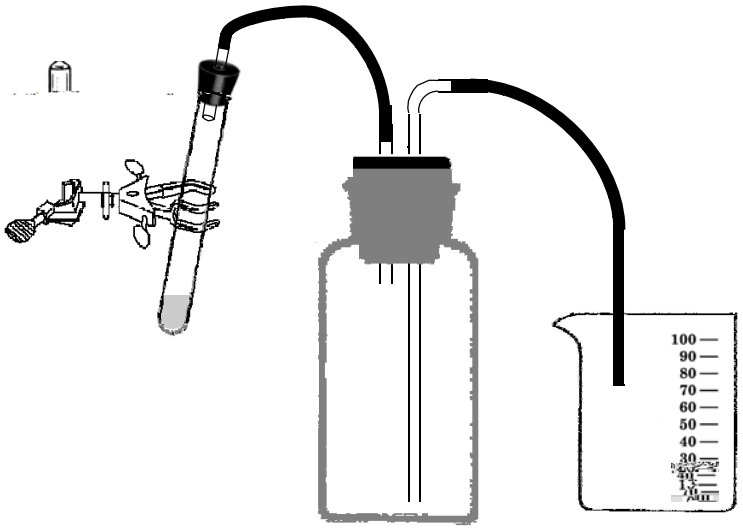

Figure 11.1

3. Before heat is applied to the test tube, the assembly must be checked to make sure that water will not be transferred from the bottle to the beaker by siphoning. Proceed with this check as stopper that m proceeding. If there is no evidence of siphoning, proceed to th

4. Apply heat from your burner, slowly at first, to begin the decomposition of the chlorate. After a little more than half the water in the bottle has been transferred to the beaker, discontinue the heating.
5. Allow the test tube to cool to room temperature, then place a pinch-clamp over the rubber tube. Remove and weigh the test tube. Measure the volume and temperature of the water in the beaker, which is equivalent to the volume and temperature of oxygen generated.
6. Obtain the vapor pressure of water from the table below and calculate the pressure of dry oxygen. You will have to convert the vapor pressure of water from Torr to atm. [1 atm = 760 Torr]

Vapor Pressure of Water

10B Exercise

1. Why is it necessary to allow the test tube to cool before it is removed for weighing?

2. Why must the water delivery tube extend nearly to the bottom of the flask?

3. When water flow ceases, what can be assumed as the relationship between barometric pressure (P_{atm}) and the pressure inside the flask ($P_{oxygen} + P_{water}$)?

4. Is it necessary to decompose all the chlorate?

Report Form 10: Determination of the Molar Mass of Oxygen

Name_____

Partner_____Section #_____

10A Experiment

(a) Mass of test tube and contents before heating	g	
(b) Mass of test tube and contents after heating	g	
(c) Mass of oxygen in flask [(a)–(b)]	g	
(d) Volume of water transferred = Volume of O_2	mL	L
(e) Temperature of water = Temperature of O_2	ºC	K
(f) Barometric pressure = P_{atm}	Torr	atm
(g) Vapor pressure of water	Torr	atm
(h) Pressure of dry oxygen [(f)–(g)]	Torr	atm
(i) Molar mass of oxygen	g/mol	

(j) % error = [(|(i) – 32.00| / 32.00)