EXERCISE 23
Determination of the Molar Gas Volume

Objective:

To determine the molar gas volume:

By weighing a volume of oxygen gas and measuring the volume it occupies; the volume of 1 mole of oxygen at STP (molar gas volume also known as gram-molecular volume) can be calculated.

Potassium chlorate decomposes upon heating to potassium chloride and oxygen according to the following equation:

$$2KClO_3 \longrightarrow 2KCl + 3O_3$$

The loss of weight in $KClO_3$ sample is the weight of oxygen formed.

The oxygen is collected by water displacement and its volume is measured by measuring the volume of the water displaced.

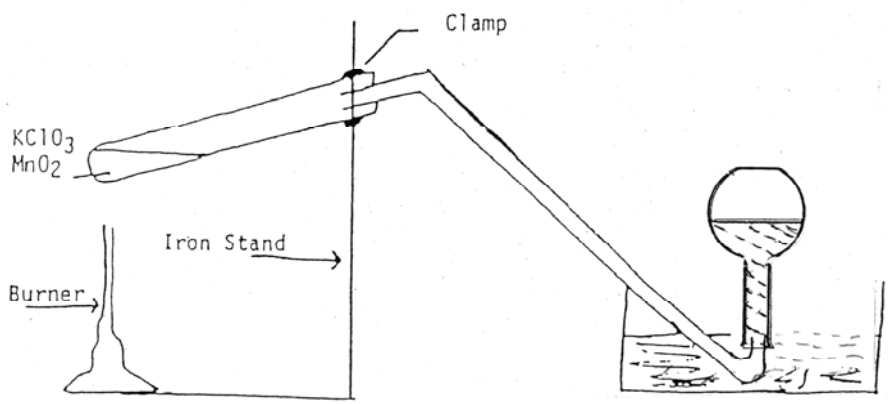

Figure 23-1

Equipment:

1. balances
2. Test tube
3. Clamps and Iron Stand
4. 500 ml Florence Flask
5. trough

<u>Procedure</u>:

1. Add approximately 0.1 g of manganese dioxide (MnO_2) to a dry, clean test tube. Weigh the test tube and contents to the nearest 0.01 g using the balance.

2. Add approximately 1 to 1.2 g of $KClO_3$ to the test tube, mix $KClO_3$ and MnO_2 thoroughly (very important) and weigh to the nearest 0.01 g.

3. Calculate the mass of $KClO_3$.

4. Heat the test tube and contents until the evolution of oxygen is complete. Immediately remove the burner and disconnect the hot test tube from the rest of the system and remove from water.

   Allow the test tube and contents to cool to room temperature, then weigh to the nearest 0.01 g.

5. Calculate the weight of oxygen formed.

6A. Record the temperature of the water in the trough.

B. Record the barometric pressure.

7. Lower the Florence Flask until the level of the water inside and outside the flask is the same. Now stopper the flask and set bottle upright; remove the stopper and measure the volume of water needed to fill the bottle. (Use a graduated cylinder.) This represents the volume of oxygen evolved at room temperature and pressure.

8. From the data, calculate the volume of dry oxygen at STP.

9. From the data, calculate the volume of 32 g of oxygen at STP.

10. What is the accepted volume?

11. Calculate the percent error and show all your calculations.

EXERCISE 23

ANSWER SHEET

NAME _____ SECTION_____ DATE _____

1. weight of test tube and MnO_2 _____

2. weight of test tube MnO_2 and $KClO_3$ _____

3. weight of $KClO_3$ _____

4. weight of test tube and contents after heating _____

5. weight of oxygen _____

6. temperature of water _____

   barometric pressure _____

7. volume of oxygen _____

8. volume of dry oxygen at STP (show work) _____

9. volume of 32 g of oxygen at STP (molar gas volume) _____

10. the accepted molar gas volume _____

11. percent error _____