Name: ______________________________ Date: ________

Lab #: 19

Gases Lab: Ideal vs. Real Gases

Introduction:

The Kinetic Molecular Theory (KMT) of gases explains the behavior of gases in terms of the ideal gas model. These properties include:

- random motion
- insignificant volume
- little attraction
- Conservation of energy during collisions.

Scientists' student gases according to this model of how gases SHOULD behave.

Gases that act ideal usually have lower molecular weights and nonpolar molecular structures. By being lighter and nonpolar, gases are able to move more freely with little or no attractive forces. Real gases do not encompass all the properties of ideal gases, many being either too heavy in molecular weight or having molecule polarity. Real gases deviate from ideal gas behavior by having some volume, some attractive forces, and losing energy upon collision.

Procedure:

- **Part 1: Production of Hydrogen Gas**

Materials: Magnesium pieces, 1.0 M hydrochloric acid (HCl), Medium test tube, Stopper, Wooden splint, Candle & matches

1. Place 1-2 small pieces of magnesium in the test tube.
2. Add one dropper full of hydrochloric acid, HCl (aq) to cover the magnesium, swirl and cover the test tube with a stopper. Record your observations in the space below.

   Observations: ____

   ____

3. After 60 seconds or so, have your partner light the wooden splint.
4. CAREFULLY move the still lit wooden splint into the mouth of the test tube and be prepared for the "test" for the production of hydrogen gas. Re-stopper the test tube to collect more gas.
5. Re-light a splint and test the gas again. RECORD YOUR OBSERVATIONS.

   Observations: ____

   ____

6. Remember, this is merely a test that is used to identify the presence of hydrogen gas, the test itself, DOES NOT explain whether it is ideal or real.

- **Part 2: Production of Carbon Dioxide**

Materials: Sodium hydrogencarbonate (baking soda), Acetic acid (vinegar) 0.80 M, 125 mL Erlenmeyer flask, beral pipet, Wooden splints, candle & matches

1. Measure about ½ teaspoon (a small scoop) of baking soda and place it into the flask.
2. Using the pipet, add enough vinegar to cover the baking soda. Record your observations below.

   Observations: ____

   ____

3. HINT: You DO NOT have to stopper the reaction (think about why). Swirl the flask so that all is reacting.
4. Light a wooden splint and carefully tip the flask, holding the burning splint, move it inside the flask, and observe the effect that the gas (carbon dioxide) has on the flame. Again, this is merely a test for CO_2, and does NOT explain why it is real or ideal.
5. Using the candle, re-light the splint and test the gas again. RECORD YOUR OBSERVATIONS.

   Observations: ____

   ____

Questions:

1. Describe what happened when you placed the burning splint in the test tube in part 1.
2. Decribe what happened when you placed the burning splint in the flask in part 2.
3. Compare/describe the reaction between the gas produced and the burning splint for part 1 vs. part 2.
4. a) Write out the following reaction:

   Magnesium + hydrochloric acid (HCl) yields hydrogen gas + magnesium chloride

   b) Balance the reaction above and write the completed balanced reaction in the space below.

   c) Is this a physical or chemical change? ______________________

   d) If chemical, what type of reaction is this? ______________________

5. a) Write out the following reaction:

   Acidic acid + sodium hydrogencarbonate yields sodium acetate + water + carbon dioxide

   b) Balance the reaction above and write the completed balanced reaction in the space below.

   e) Is this a physical or chemical change? ______________________

6. Explain why you think the container must be stoppered in procedure 1 for the gas to be collected?
7. Explain why you think the stopper was NOT necessary in the collection of gas in procedure 2?
8. One gas required a stopper, one gas didn't... which gas is more ideal? Your answer must be explained in terms of the Kinetic Molecular Theory of ideal gases.
9. Describe the effect of carbon dioxide (gas 2) on the flame and why it is useful in fire extinguishers based on its density.
10. Would helium be useful in fire extinguishers? Explain why or why not.