**Name** _____

**Date** _____ **Pd** ____

# Unit 7 Lab - Describing Chemical Reactions

## Introduction and Purpose

In this experiment you will observe examples of basic types of chemical reactions. You will learn to classify basic types of reactions and write balanced equations, including the role of energy, to effectively communicate and describe the chemistry of the reactions.

## Pre Lab Instructions*:

1. Read through the following procedures and highlight or mark each of the following items using three different colors. Highlight each item each time it appears in the procedure. Include a **key**.

   Color/mark 1: materials
   Color/mark 2: chemicals
   Color/mark 3: data to record (values and observations)

2. On a new page in your lab notebook, write an appropriate problem statement for the investigation.

3. Beneath your problem statement, generate an appropriate T-style data table. Include the necessary elements of a good data table. In the left side of the table, fill in the rows with the measurements and observations you will be making during the lab. On the right side of the table, be sure to leave enough space for when you actually make and record these measurements and/or observations during the lab. (You may wish to review your highlighting to help you with this).

*Pre-Lab elements ***MUST*** be completed in order to participate in the lab.

## Procedures

Carry out the reactions using the approximate quantities of reagents suggested. Unless otherwise stated, use test tubes. When heating reagents in test tubes, slant the test tube so that the opening is pointed *away* from people. Heat the test tube at the surface of the material and work down towards the bottom of the tube.
Be sure to make observations that will allow you to interpret what is happening in the reaction.

## Reactions:

A. Grasp a strip of magnesium ribbon in crucible tongs and ignite it in the burner flame. Hold it over a watch glass. Do not look directly at the flame! Place the ash in the watch glass.

B. Add a few drops of distilled $H_2O$ to the ash from reaction A. Stir with a stirring rod. Wait a couple of minutes and then place a drop of the solution on red litmus paper. Red litmus turning blue is evidence for the presence of a base (a substance producing aqueous hydroxide ions). *Litmus paper in trash can; rinse solution into waste beaker.*

C. Place about 1 scoopful of solid calcium carbonate, $CaCO_3$ into a dry test tube and heat strongly for 2 minutes. Toward the end of the heating, light a wood splint and place the flaming splint in the mouth of the test tube. Note what happens to the splint. *Cooled splint into trash; contents of test tube into waste beaker.*

D. Add 3M HCl to a test tube to a height of 1-2 cm. Add a piece of mossy zinc metal to the test tube. Cover the tube loosely with a piece of parafilm. Hold the test tube in your hand to feel if the temperature has changed. After a few minutes, light a wood splint, remove the parafilm, and insert the flaming splint into the mouth of the test tube. *Cooled splint into trash; chemicals into waste beaker.*

E. Place a strip of copper wire in a test tube with enough 0.1M $AgNO_3$ to cover it (1-2 cm high). Set this test tube aside, then observe the surface of the metal after 5-10 minutes. *Contents of test tube into waste beaker.*

F. Add 0.1M $AgNO_3$ to a test tube to a depth of about 1 cm. Add a similar quantity of 0.1M $CaCl_2$ solution. Observe the reaction. *Discard into waste beaker.*

G. Heat a square piece of copper metal strongly in the Bunsen burner flame for about 30 s. Remove the copper from the flame and note the change in appearance. *Discard the product in the trash can.*

H. Place a scoopful of solid $Na_2CO_3$ in a test tube to a depth of about 1 cm. Add a dropperful of 3M HCl. While the reaction is occurring, test with a flaming splint as in part C. Check to see if the temperature of the mixture has changed. *Splint into trash; chemicals into waste beaker.*

I. Place about 10 drops of isopropyl alcohol, $C_3H_7OH$, in a small evaporating dish. Ignite the alcohol from the top of the liquid with a flaming splint. Hold a cold watch glass well above the flame and observe the condensation of water on the bottom. The formation of the mist will be fleeting; **watch closely**.

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# Lab Questions

Answer the following questions using complete thoughts and sentences.

1. What are some of the observable changes providing evidence that a chemical reaction has taken place? (List all types observed during the lab)

2. How did the flaming splint behave when it was inserted into the tube with $CO_{2\ (g)}$?
   In what way was this different from the reaction of the $H_{2(g)}$ to the flaming splint?

3. In the reaction of magnesium with oxygen gas, a considerable amount of energy was released. This is an example of an *exothermic* reaction. From this evidence what can you conclude about the energy stored in the reactants compared to the energy stored in the product?
   What other examples of exothermic reactions did you observe (list **all** examples)?
   Re-write the balanced equation for the reaction of Mg and $O_2$, this time with the term "+ energy" on the appropriate side of the equation.

4. You had to heat the $CaCO_3$ strongly in order for it to decompose. This is an example of an *endothermic* reaction. What does this tell you about the energy stored in the reactants compared to the energy stored in the products?
   Write the balanced equation for the decomposition of $CaCO_3$, this time with the term "+ energy" on the appropriate side of the equation.

# Describing Chemical Reactions Lab – Post Lab Processing

For each reaction, use your observations to determine the products. Write the equations in your lab notebook, indicating phases for **all** reactants and products. Balance the chemical equations.

A. ___ $Mg_{(s)}$ + ___ $O_2$ →

B. ___ MgO + ___ $H_2O$ →

C. ___ $CaCO_3$ →

D. ___ Zn + _____ $HCl_{(aq)}$ →

E. ___ $AgNO_{3\ (aq)}$ + _____ $Cu_{(s)}$ →

F. _____ $AgNO_{3(aq)}$ + _____ $CaCl_{2(aq)}$ →

G. _____ $Cu_{(s)}$ + ___ $O_{2(g)}$ →

H. _____ $Na_2CO_{3(s)}$ + _____ $HCl_{(aq)}$ →

I. _____ $C_3H_7OH_{(l)}$ + _____ $O_{2(g)}$ →

Do you notice any similarities between any of the above reactions?
In your lab notebook, classify these reactions into groups or categories.
Be prepared to defend your grouping system and why reactions were assigned to each group. Show all work below:

## Post-lab Whiteboarding Questions (answer in your lab notebook):

Assigned Reaction:_____

Prepare Whiteboard presentations for your assigned reaction describing:

1. Observed evidence for a reaction (what proof that a chemical change actually occurred?)
2. Balanced equation for the reaction
3. Word equation: describe the reaction in standard English
4. Energy component – which side does the "+ energy" go on? (if observed, some are not obvious)
5. Explain your reasoning for which side of the equation you put the energy term.
6. Did the chemical energy in you particle system increase or decrease during this change? Is this an endothermic or exothermic reaction?
7. Particle diagram of mixture before and after reaction is complete.
8. In reality, were the reactants in the exact reaction ratio when you mixed them?
9. How would the pictures be different if the ratio in your container were different from the balanced equation? What would you find in your reaction container after the reaction stopped?