

LAB [25 pts]
Reaction Types

Name _____
Lab partner(s) _____
Period _____ Date _____

Purpose: To observe chemical reactions, identify clues to the occurrence of a reaction and its products, classify the reactions and write balanced equations for them.

Background:

Evidence of a Chemical Reaction

For many chemical reactions, clues to indicate that a reaction did indeed occur can be observed. Such clues include production or absorption of heat, absorption or emission of light, production of a sound, a change of color, formation of a precipitate or a new product, or release of a gas. Some chemical reactions may exhibit only one of these clues, while other chemical reactions may reveal several clues. By looking for these clues, you can determine whether a chemical reaction has occurred and what kind of reaction has occurred.

Procedure: Write up: Hand in the completed data sheet

- Fill out the data sheet by doing the following for each reaction:
 - (1) record your observations of the reactants and write down their formulas.
 - (2) Do the reaction, record your observations of the products and determine their formulas.
 - (3) Balance your overall equation. Don't forget to put in (s), (l), (g) and (aq) labels on substances.
 - (4) Write the overall reaction by using the names of each substance.
- Do the post lab questions.

Safety: Goggles must be worn at all times. AgNO_3 stains skin and clothing -- avoid skin contact. KOH and NaOH are bases and corrosive to the skin-- avoid skin contact.

Demonstrations:

- **Reaction #1:** A Combination Reaction
 - 1) Examine a piece of magnesium ribbon. Record its appearance.
 - 2) Using tongs, hold the magnesium in the burner flame until the ribbon starts to burn.
 - DO NOT LOOK DIRECTLY INTO THE FLAME! Record observations.
 - 3) When the ribbon stops burning, put this new product into an evaporation dish. Record observations.
 - 4) Fill out the overall reaction on your data sheet. (With formulas and with names.)

HINT: magnesium is being oxidized by an element in the air.
- **Reaction #3:** A Decomposition Reaction
 - 1) Put about 15 mL of hydrogen peroxide (H_2O_2) into a flask.
 - 2) Add a very small amount of MnO_2 . Watch rxn for 1 minute. Record observations
 - 3) Hold a glowing splint above the flask. Record observations. (This is NOT your reaction).
 - 4) Write overall reaction. (*HINT: MnO_2 is a catalyst, not a reactant—write it over the arrow.*)

Lab Work:

A) Combination Reaction

- **Reaction #2:**
 - 1) Obtain a small clean copper sheet. Examine copper and record its appearance.
 - 2) Set up a Bunsen burner
 - 3) Use tongs to hold the copper in the hot blue flame for about 1 minute. Record your observations of any change in its appearance.
 - 4) Write the overall reaction.

HINT: Copper is being oxidized by an element in the air. Also, the copper ions in the final product have a +2 charge.

B) Decomposition Reaction

• Reaction #4:

- 1) Get a small scoop of CuCO_3 (solid) and put it into a clean dry test tube. Record its appearance.
- 2) Clamp the test tube onto a ring stand. The test tube should be slightly tilted away from people.
- 3) Heat bottom of test tube strongly for about 2 minutes. Record observations of solid.
- 4) Light a wooden splint with the flame of the Bunsen burner. Move the Bunsen burner out from under your test tube. Immediately insert the burning wooden splint into the test tube. Record observations.
- 5) Write the overall reaction.

HINT: *What color is the solid product? What product did you form earlier in the lab which has that color? Also--what happened to the flame and why?*

C) Single Replacement Reaction

• Reaction #5:

- 1) Rinse a test tube with DI H_2O and put in piece of copper wire. Record appearance of wire.
- 2) Fill the test tube $\sim\frac{1}{4} - \frac{1}{3}$ with 0.1 M AgNO_3 (aq) solution. Note color of solution.
***Be careful!** AgNO_3 can stain hands and clothing. Wear gloves when handling solution.
- 3) Let the substances react for at least 5 minutes. (While you wait, move onto the next reaction.)
- 4) Record all observations. Write the overall reaction.

NOTE: *Cu has a 2+ charge in the ionic product.*

D) Double Replacement Reactions (Both are precipitation Reactions)

• Reaction #6:

- 1) Put 20 drops of 0.4 M NaOH (aq) solution into a test tube. Observe appearance.
- 2) Observe the appearance of 0.1 M FeCl_3 (aq) solution. Add 20 drops of this solution into the test tube. A change should have taken place. Record observations.
- 3) Write overall reaction. *Remember-- if the solution is cloudy, a solid is formed. Determine which product is (s) and which is (aq)*

• Reaction #7:

- 1) Put 20 drops of 0.4 M KOH (aq) solution into a test tube. Observe appearance.
- 2) Observe the appearance of 0.1 M $\text{Co}(\text{NO}_3)_2$ (aq) solution. Add 20 drops of this solution into the test tube. A change should have taken place. Record observations.
- 3) Write overall reaction. *Remember-- if the solution is cloudy, a solid is formed. Determine which product is (s) and which is (aq).*

E) Combustion Reaction

• Reaction #8:

Caution: Perform this reaction away from any open flame.

- 1) Using a pipet, place 20 drops of ethyl alcohol ($\text{C}_2\text{H}_5\text{OH}$) in a Pyrex watch glass. Observe.
- 2) Light a butane safety lighter or a match. Bring the flame close to the ethyl alcohol in the watch glass so that the alcohol begins to burn. Allow the ethyl alcohol to burn until it is completely consumed. Observe and record changes. Do not touch the hot watch glass.
- 3) Write overall reaction. *Remember that combustion requires an element from the air and always produces the same products (Candle Lab!).*

Conclusion: Answer the conclusion on a separate sheet of paper in paragraph form.

Pick one reaction of each type that you performed. Identify the reaction, explain what type it is, and why it meets the criteria (or how it follows the definition) of that particular type. Explain how you determined the products, including formulas. Explain how you knew what the products were by referring to your observations of your experiment and also the charges in the reactant(s) (if applicable). Describe any product's color or states of matter that helped you also determine what the product was. You should have five well written paragraphs.

LAB [25 pts]
Reaction Types-- DATA SHEET

Name _____

Lab partner(s) _____

Period _____ Date _____

A) Combination Reactions

Reaction #1:

Overall Reaction: _____ + _____ → _____
(using formulas-- balance equation)

Evidence/observation: _____
(for each substance)

Overall Reaction: _____ + _____ → _____
(using names)

Reaction #2:

Overall Reaction: _____ + _____ → _____
(using formulas-- balance equation)

Evidence/observation: _____
(for each substance)

Overall Reaction: _____ + _____ → _____
(using names)

B) Decomposition Reactions

Reaction #3:

Overall Reaction: _____ → _____ + _____
(using formulas-- balance equation)

Evidence/observation: _____
(for each substance)

Overall Reaction: _____ → _____ + _____
(using names)

Reaction #4:

Overall Reaction: _____ → _____ + _____
(using formulas-- balance equation)

Evidence/observation: _____
(for each substance)

Overall Reaction: _____ → _____ + _____
(using names)

C) Single Replacement Reaction

Reaction #5:

Overall Reaction: _____ + _____ → _____ + _____
(using formulas-- balance equation)

Evidence/observation: _____
(for each substance)

Overall Reaction: _____ + _____ → _____ + _____
(using names)

D) Double Replacement Reactions

Reaction #6:

Overall Reaction: _____ + _____ → _____ + _____
(using formulas-- balance equation -- label (s) and (aq))

Evidence/observation: _____
(for each substance)

Overall Reaction: _____ + _____ → _____ + _____
(using names)

Reaction #7:

Overall Reaction: _____ + _____ → _____ + _____
(using formulas-- balance equation-- label (s) and (aq))

Evidence/observation: _____
(for each substance)

Overall Reaction: _____ + _____ → _____ + _____
(using names)

E) Combustion Reaction

Reaction #8:

Overall Reaction: _____ + _____ → _____ + _____
(using formulas-- balance equation -- label (l) and (g))

Evidence/observation: _____
(for each substance)

Overall Reaction: _____ + _____ → _____ + _____
(using names)

Post Lab Questions: For the following reactions: Write the overall reaction (with correct formulas), balance the equation and determine the type of reaction (5 types on 1st page of lab)

Type of reaction

1) Solid manganese (II) sulfate is heated and forms solid manganese (II) oxide and sulfur trioxide gas.

2) A solution of nickel (II) sulfate is mixed with a solution of lithium phosphate and forms solid nickel (II) phosphate and lithium sulfate solution.

3) Chlorine gas reacts with aqueous potassium iodide to form potassium chloride solution and solid iodine.

4) Nickel powder (solid) reacts with oxygen gas to form solid nickel(III) oxide.
