**An Introduction to Chemical Reactions**

**Purpose**: You will perform examples of and practice predicting products for the five basic chemical reactions. Once you know what the products and reactants are from each reaction, you will balance the equations in order to follow the Law of Conservation of Matter.

**Safety**: Students should follow all safety guidelines for working with flames and chemicals. Aprons and Safety Goggles must be worn at all times!!! Before you perform any reactions look up the reactants in the Flinn Scientific catalog. You will be looking for any hazards associated with these chemicals. Incorporate all safety concerns about which you learn into the flowchart for that particular lab station.

**Procedure:** The activities for this lab are divided into five areas: Synthesis; Decomposition; Combustion; Single Replacement; and Double Replacement. Each area has one or more reactions for you to perform. You may visit the lab stations in any order.

***Before*** you perform the activities at **each** new lab station:

* create a flowchart for the procedure(s), incorporating **safety warnings** that you read in the Flinn Scientific catalog, and notes to yourself. Use the instructions on the back side of this page to guide you.

For each reaction, your goals are to:

* predict the products of the reaction
* write a balanced equation with correct formulas
* indicate the states of matter (g = gas, l = liquid, s = solid, aq = aqueous) for each substance
* if heat or light is obviously produced or absorbed, indicate that by including Energy in the equation on the appropriate side of the equation.

**Results and Write Up:** For your individual write up in your lab notebook, make sure to include the following for ***each*** reaction (lab station):

1. flowchart of procedures, including safety information;
2. your predictions about the products;
3. observations of the reactants, products, and the reaction itself;
4. balanced equations including the states of matter and energy, if appropriate;
5. your conclusion regarding which of the five types of reactions occurred;
6. (Honors) identification of which reactions are oxidation-reduction (redox);
7. (Honors) assignment of oxidation numbers in redox reactions.

***There will be a lab quiz for this lab a few days after its conclusion.***

**Experiments**

|  |
| --- |
| **I.**  Magnesium Ribbon + Oxygen 🡪  Combine the piece of magnesium ribbon with heat from a Bunsen burner. Remove the ribbon from the flame as soon as it ignites, holding it over the evaporating dish.  Where does the oxygen come from? Be careful of the bright light! Observe the substance produced and determine its chemical formula using your knowledge of bonding.  ***Check list:***  Safety Info: magnesium ribbon  Materials:  Create a flowchart:  Predict reaction:  Observations before reaction:  Observations after reaction:  Reaction in words:  Balanced chemical equation, including states of matter and production and/or use of energy: |
| **II.** Ammonium carbonate 🡪  Gently heat a *small scoop* (about the size of a jelly bean) of ammonium carbonate in a test tube for about 30 seconds. What products are produced? Look closely at what is leaving the test tube. Test it for alkalinity by placing a piece of moistened litmus paper near the mouth of the test tube. Identify any odor that is readily apparent by wafting the fumes towards your nose. Test for carbon dioxide by putting a burning splint halfway down into the test tube. What would happen to the flame if carbon dioxide was present? What else did you observe in the test tube? Disposal: Trash and sink.  ***Check list:***  Safety Info: ammonium carbonate  Materials:  Create a flowchart:  Predict reaction:  Observations before reaction:  Observations after reaction:  Reaction in words:  Balanced chemical equation, including states of matter and production and/or use of energy: |
| **III.**  Ethyl alcohol (C2H5OH) + 🡪  Pour a small amount of ethanol (ethyl alcohol) into the evaporating dish. Fill a test tube about one-third full with cold tap water for use later. Light the ethanol with the butane lighter. Remove the lighter as soon as the ethanol ignites. Hold the Erlenmeyer flask or test tube containing cold water in a test tube clamp 8 to 10 cm above the burning alcohol for 5 to 10 seconds. What do you see/feel on the outside of the test tube after you remove it from above the flame? (subtle change). Disposal: Allow the ethanol to burn completely until it is consumed.  ***Check list:***  Safety Info: ethyl alcohol  Materials:  Create a flowchart:  Predict reaction:  Observations before reaction:  Observations after reaction:  Reaction in words:  Balanced chemical equation, including states of matter and production and/or use of energy: |

|  |
| --- |
| **IV.**  Zinc + Hydrochloric Acid 🡪  Calcium + Water 🡪  Combine a small piece of metal in about 20 drops of the acid or water, following the equations above! Determine the products that were produced. (Hint: Test for hydrogen gas with a wooden splint.) Disposal: waste beaker.  ***Check list:***  Safety Info: zinc (pieces), hydrochloric acid, calcium (turnings)  Materials:  Create a flowchart:  Predict reaction:  Observations before each reaction:  Observations after each reaction:  Reactions in words:  Balanced chemical equations, including states of matter and production and/or use of energy: |
| **V.**  Lead (II) Nitrate + Sodium Iodide 🡪  Silver Nitrate + Sodium Chloride 🡪  The substances above are solid ionic compounds that have been dissolved in water. For both of these reactions, add 3 drops of the first solution to the spot plate and then add 3 drops of the second solution. Note what happens. Determine which product ended up as a solid precipitate, and which one remained dissolved in the water. Use the solubility sheet at this station. When finished, rinse the waste solutions and precipitates into the beaker provided.  ***Check list:***  Safety Info: lead (II) nitrate, sodium iodide, silver nitrate, sodium chloride  Materials:  Create a flowchart:  Observations before each reaction:  Predict reaction:  Observations after each reaction:  Reactions in words:  Balanced chemical equation, including states of matter and production and/or use of energy: |
| **VI.** Calcium carbonate + hydrochloric acid 🡪  Add approximately 1 mL (20 drops) of 1M hydrochloric acid to a small amount (size of a jelly bean) of calcium carbonate in a test tube. What products are produced? Test for carbon dioxide production by putting a lighted wood splint halfway down the test tube. What do you see in the test tube? Disposal: sink.  ***Check list:***  Safety Info: calcium carbonate, hydrochloric acid  Materials:  Create a flowchart:  Predict reaction:  Observations before reaction:  Observations after reaction:  Reaction in words:  Balanced chemical equation, including states of matter and production and/or use of energy: |

|  |
| --- |
| **VII.** Zinc + copper (II) chloride 🡪  Add one to two pieces of zinc to 2 mL (~ 40 drops) of a solution of copper (II) chloride in a test tube. What do you see happening in the test tube? Record all your observations. No need for splint test. Disposal: waste beaker.  ***Check list:***  Safety Info: zinc, copper (II) chloride  Materials:  Create a flowchart:  Predict reaction:  Observations before reaction:  Observations after reaction:  Reaction in words:  Balanced chemical equation, including states of matter and production and/or use of energy: |
| **VIII.** Sodium hydroxide + hydrochloric acid 🡪  Put 20 drops of the sodium hydroxide solution into a test tube. Add one drop of phenolphthalein solution to the sodium hydroxide solution. Make sure they are mixed together. Add the hydrochloric acid solution to the sodium hydroxide/phenolphthalein solution drop by drop. How many drops did it take for a permanent color change? What very familiar chemical was produced in this reaction? Disposal: sink.  ***Check list:***  Safety Info: 1 M sodium hydroxide, 1 M hydrochloric acid  Materials:  Create a flowchart:  Predict reaction:  Observations before reaction:  Observations after reaction:  Reaction in words:  Balanced chemical equation, including states of matter and production and/or use of energy: |