Identifying Types of Chemical Reactions Lab

**Purpose:**
In this experiment students observe four simple types of reactions. Many chemical reactions are accompanied by observable physical changes. The appearance of a solid (precipitate) when solutions of a substance are mixed is one such change. In this lab activity you will observe what happens when a number of different substances are combined. Based on the reactants (or “ingredients”) you will be asked to predict the products. The reactions you will observe will be one of four types and should be classified as synthesis, single displacement, double displacement or decomposition.

There will be four stations with specific directions at each station. The reactants will be listed for you and your goal is to:
1. Classify the type of reaction that will occur. Form a hypothesis based upon the reactants that are available and patterns that have been reviewed with you in class. Refer to notes if necessary!
2. Predict the products based upon your classification of the reaction.
3. Include states of matter when writing the chemical equation. (s, l, g, aq.) This will be based upon direct observations – did you start with a solid? A liquid? Was a gas produced? All ionic compounds in a liquid phase are considered aqueous (aq) – dissolved in solution.
4. Balance the final chemical reaction.

**Vocabulary Review:**
Catalyst
Synthesis
Decomposition
Precipitate

**Data Collection:**

**Station 1**
Before you do anything else answer the following questions

List reactants:

Based upon above information what type of reaction do you expect will occur?

Write out the complete chemical equation for this reaction based on your answers to the above question.
Record observations:

<table>
<thead>
<tr>
<th>Before: List reactants and describe physical appearance</th>
<th>After: List products and describe physical appearance</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

Station 2

Before you do anything else answer the following questions

List reactants:

Based upon above information what type of reaction do you expect will occur?

Write out the complete chemical equation for this reaction based on your answers to the above question.

Record observations:

<table>
<thead>
<tr>
<th>Before: List reactants and describe physical appearance</th>
<th>After: List products and describe physical appearance</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

Station 3

Before you do anything else answer the following questions

List reactants:

Based upon above information what type of reaction do you expect will occur?

Write out the complete chemical equation for this reaction based on your answers to the above question.
Record observations:

<table>
<thead>
<tr>
<th>Before: List reactants and describe physical appearance</th>
<th>After: List products and describe physical appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

**Station 4**
Before you do anything else answer the following questions

List reactants:

Based upon above information what type of reaction do you expect will occur?

Write out the complete chemical equation for this reaction based on your answers to the above question.

Record observations:

<table>
<thead>
<tr>
<th>Before: List reactants and describe physical appearance</th>
<th>After: List products and describe physical appearance</th>
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</thead>
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</tbody>
</table>

Analysis:
1. Which observations noted during each of the reactions indicated that a reaction had occurred?
   Station #1

   Station #2

   Station #3

   Station #4
Conclusion:

2. Write the name and chemical formula of the product(s) in the reactions:

<table>
<thead>
<tr>
<th>Product Description</th>
<th>Product Name</th>
<th>Product Chemical Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>black solid formed at station #1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>liquid product formed at station #2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>gaseous product formed at station #3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>liquid product formed at station #3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pale blue precipitate formed at station #4</td>
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</tbody>
</table>

Write a balanced chemical equation for each reaction performed in this lab.

*Synthesis:*

\[ \underline{\text{_________}} + \underline{\text{_________}} \rightarrow \underline{\text{_________}} \]

*Decomposition:*

\[ \underline{\text{_________}} \rightarrow \underline{\text{_________}} + \underline{\text{_________}} \]

*Single Displacement:*

\[ \underline{\text{_________}} + \underline{\text{_______}} \rightarrow \underline{\text{_________}} + \underline{\text{_________}} \]

*Double Displacement:*

\[ \underline{\text{________________}} + \underline{\text{__________}} \rightarrow \underline{\text{__________}} + \underline{\text{__________}} \]
Station #1 (synthesis)

1. Water bath needs to be started when you arrive at this station. Place 5 mL of CuSO$_4$ in a large test tube. This chemical will serve as a catalyst for the reaction that will take place.

2. Place a small piece of paper on the electronic balance. Zero the balance. Carefully place 0.2 g of granular copper (Cu) (this is a very small amount) onto the paper previously placed on the balance. When done, set on the lab table.

3. Place another small piece of paper on the electronic balance. Zero the balance. Carefully place 0.1 g of powered sulfur (S) (again, this is a very small amount) onto the paper on the balance. Pour this powder onto the first paper.

4. Fold the paper with the solid mixture into a spout and pour the mixture into the test tube with the solution. Stir with a stirring rod.

5. Using the test-tube holder, place the tube into the water bath. Stir with a stirring rod a few times and continue heating until a black solid forms.
Station #2 (Single displacement)
1. Place 20 drops of AgNO₃ solution in one well of a 6-well reaction plate.

2. Note the well number on the white paper image of the micro plate. You will come back after the designated time to check on your results.

3. Place a tiny piece of copper (Cu) wire into the well with the silver nitrate solution (AgNO₃).

4. Keep the plate absolutely still for the next half-hour.

5. Record observations after a half-hour.
Station #3 (decomposition)

1. Place 10 mL of hydrogen peroxide (H₂O₂) in a large test tube.

2. Add a small piece of potato. The potato has an enzyme that breaks down the poisonous H₂O₂ in cells. This enzyme is a catalyst for this reaction.

3. Place a stopper on the tube to trap any products. Let this system set for twenty minutes.

4. Light a splint, blow it out, and quickly place it into the flask. If it glows again in the tube, then oxygen (O₂) is present.
Station #4 (double displacement)

1. Add 5 mL of Na₂CO₃ and 5 mL of MgCl₂ to a large test tube.
2. Swirl the tube gently until a precipitate forms.