I. INTRODUCTION

A. COMBINATION REACTIONS

In a combination reaction, two or more substances, elements and/or compounds, combine to form a single product.

1. Combination of a METAL and a NONMETAL to produce a BINARY IONIC COMPOUND.
   \[2 \text{Mg(s)} + \text{O}_2(g) \rightarrow 2 \text{MgO(s)}\]

2. Combination of TWO NONMETALS to produce a BINARY MOLECULAR COMPOUND.
   \[\text{S(s)} + \text{O}_2(g) \rightarrow \text{SO}_2(g)\]

3. Combination of METAL OXIDE and NONMETAL OXIDE.
   a. Combination of a METAL OXIDE and WATER to produce a METAL HYDROXIDE.
      \[\text{Na}_2\text{O(s)} + \text{H}_2\text{O(l)} \rightarrow 2 \text{NaOH(aq)}\]
   b. Combination of a METAL OXIDE and \text{CO}_2 to produce a METAL CARBONATE.
      \[\text{K}_2\text{O(s)} + \text{CO}_2(g) \rightarrow \text{K}_2\text{CO}_3(s)\]
   c. Combination of a METAL OXIDE and \text{SO}_2 to produce a METAL SULFITE.
      \[\text{Cs}_2\text{O(s)} + \text{SO}_2(g) \rightarrow \text{Cs}_2\text{SO}_3(s)\]

4. Combination of NONMETAL OXIDE and WATER to produce an ACID. (Whenever a nonmetal oxide reacts with water and acid is produced.)
   a. Combination of \text{CO}_2 and \text{H}_2\text{O} to produce \text{H}_2\text{CO}_3
      \[\text{CO}_2(g) + \text{H}_2\text{O(l)} \rightarrow \text{H}_2\text{CO}_3(aq)\]
   b. Combination of \text{SO}_2 and \text{H}_2\text{O} to produce \text{H}_2\text{SO}_3
      \[\text{SO}_2(g) + \text{H}_2\text{O(l)} \rightarrow \text{H}_2\text{SO}_3(aq)\]

B. DECOMPOSITION REACTIONS

In a decomposition reaction a single compound reacts to produce two or more products.

1. Decomposition of a BINARY COMPOUND to produce TWO ELEMENTS
   \[2 \text{NaCl(s)} \overset{\text{\^}}{\rightarrow} 2 \text{Na(s)} + \text{Cl}_2(g)\]

2. Decomposition of a TERNARY COMPOUND
   a. Decomposition of CARBONATES to produce OXIDES and \text{CO}_2
      (1) Decomposition of a METAL CARBONATE to produce a METAL OXIDE and \text{CO}_2
      \[\text{BaCO}_3(s) \overset{\text{\^}}{\rightarrow} \text{BaO(s)} + \text{CO}_2(g)\]
      (2) Decomposition of \text{H}_2\text{CO}_3 to produce \text{H}_2\text{O} and \text{CO}_2
      \[\text{H}_2\text{CO}_3(aq) \rightarrow \text{H}_2\text{O(l)} + \text{CO}_2(g)\]
   b. Decomposition of SULFITES to produce OXIDES and \text{SO}_2
      (1) Decomposition of a METAL SULFITE to produce a METAL OXIDE and \text{CO}_2
      \[\text{Na}_2\text{SO}_3(s) \rightarrow \text{Na}_2\text{O(s)} + \text{SO}_2(g)\]
      (2) Decomposition of \text{H}_2\text{SO}_3 to produce \text{H}_2\text{O} and \text{SO}_2
      \[\text{H}_2\text{SO}_3(aq) \rightarrow \text{H}_2\text{O(l)} + \text{SO}_2(g)\]
C. SINGLE REPLACEMENT REACTIONS

In a single replacement reaction an element reacts with a compound. The element displaces an element from the compound and takes its place.

1. **METALS REPLACE METALS AND HYDROGEN**
   
   \[
   \text{Fe(s)} + \text{CuSO}_4(aq) \rightarrow \text{FeSO}_4(aq) + \text{Cu(s)}
   \]
   
   \[
   \text{Zn(s)} + 2\text{HCl(aq)} \rightarrow \text{ZnCl}_2(aq) + \text{H}_2(g)
   \]

2. **NONMETALS REPLACE NONMETALS**

   \[
   \text{Cl}_2(aq) + 2\text{NaBr(aq)} \rightarrow \text{Br}_2(aq) + 2\text{NaCl(aq)}
   \]

3. **Activities of Metals**

   A single replacement reaction will occur only if the element reacting is more "active" than the element it is replacing. If the element reacting is a metal, it replaces a metal (or hydrogen) in the compound. However, the reaction will occur only if a more active metal is replacing a less active metal—that is—the following reaction will occur only if Zn is more active than Cu:

   \[
   \text{Zn(s)} + \text{CuSO}_4(aq) \rightarrow \text{Cu(s)} + \text{ZnSO}_4(aq)
   \]

   Because zinc does replace copper, it is said to be more active than copper. Since copper is less active than zinc, copper could not replace zinc—that is—the following reaction would **not** occur.

   \[
   \text{Cu(s)} + \text{ZnSO}_4(aq) \rightarrow \text{Zn(s)} + \text{CuSO}_4(aq)
   \]

   An **ACTIVITY SERIES** is a list of metals in order of their activities. In the case of the example above, Zn would be listed above Cu.

   In the case of single replacement reactions, hydrogen acts like a metal. Only the **most** active metals will replace hydrogen from water at room temperature.

   \[
   \text{M(s)} + \text{H}_2\text{O(l)} \rightarrow \text{MOH(aq)} + \text{H}_2(g)
   \]

   Metals that do not react with water that’s at room temperature may react with hot water. A metal that reacts with hot but not cold room (temperature) water is less active than the one that reacts with cold water.

D. DOUBLE REPLACEMENT REACTIONS

In a double replacement reaction two compounds react to form two compounds. In the reaction the two compounds "switch last names".

\[
\text{AgNO}_3(aq) + \text{KCl(aq)} \rightarrow \text{AgCl(s)} + \text{KNO}_3(aq)
\]

Silver nitrate  potassium chloride  silver chloride  potassium nitrate

A double replacement reaction will occur only if one of the products of the reaction is one of the following:

1. Insoluble ionic compound
2. Insoluble gas
3. Weak acid or weak base
4. Water
For example, the following two reactions would occur because in the first a weak acid is formed and in the second, an insoluble ionic compound is formed:

\[
\text{HNO}_3(\text{aq}) + \text{KC}_2\text{H}_3\text{O}_2(\text{aq}) \rightarrow \text{KNO}_3(\text{aq}) + \text{HC}_2\text{H}_3\text{O}_2(\text{aq})
\]

\[
\text{AgNO}_3(\text{aq}) + \text{KCl}(\text{aq}) \rightarrow \text{AgCl}(s) + \text{KNO}_3(\text{aq})
\]

However, the following reaction does not occur because both products are soluble ionic compounds:

\[
\text{NaCl}(\text{aq}) + \text{LiOH}(\text{aq}) \rightarrow \text{NaOH}(\text{aq}) + \text{LiCl}(\text{aq})
\]

**E. COMBUSTION REACTIONS**

In a combustion reaction an organic compound reacts with oxygen to produce CO

2 and water. An organic compound will have carbon and hydrogen in its formula, and possibly oxygen or other nonmetals.

\[
\text{C}_2\text{H}_6\text{O}(l) + 3 \text{O}_2(g) \rightarrow 2 \text{CO}_2(g) + 3 \text{H}_2\text{O}(g)
\]

**II. EXPERIMENT**

**CAUTION**

- Silver nitrate solution will stain your hands, clothing, papers. Rinse your hands after handling.
- Solutions of sodium hydroxide, NaOH, and ammonia, NH

3, are can harm your skin and your eyes. Any base solution spilled on your skin or splashed into your eyes should be rinsed immediately with a large volume of water.
- Solutions of hydrochloric acid, HCl, and sulfuric acid, H\n
2SO

4, can harm your eyes, skin, and clothing. Handle with care. Any acid solution spilled on your skin or splashed into your eyes should be rinsed immediately with a large volume of water.

**A. COMBINATION REACTIONS**

1. Reaction of Magnesium and Oxygen

   **In the HOOD**, hold the end of a piece of magnesium ribbon in the hot spot of the Bunsen burner flame to ignite it. Avert your eyes.

   Observation: ---------------------------------------------------------------

   Reaction Equation: \[ 2 \text{Mg}(s) + \text{O}_2(g) \rightarrow 2 \text{MgO}(s) \]

2. Reaction of Magnesium Oxide and Water

   Put the ash, MgO, from step 1 above onto your watch glass. Add a few drops of deionized water to it and mix well. Use litmus paper to determine whether the resulting mixture is acidic, basic, or neutral.

   Observation: ---------------------------------------------------------------

   Reaction Equation: \[ \text{MgO}(s) + \text{H}_2\text{O}(l) \rightarrow \text{Mg(OH)}_2(\text{aq}) \]
3. Reaction of a Phosphorus and Oxygen

Get a “gas collecting bottle” from the reagent bench and take it and your cover glass to the hood where the instructor will ignite a sample of phosphorus in a “deflagrating spoon” and lower it briefly into your gas bottle. As soon as the spoon is removed, rapidly place the cover glass over the mouth of the bottle so that the smoke does not escape.

Reaction Equation: \(4 \text{P(s)} + 5 \text{O}_2(g) \rightarrow 2 \text{P}_2\text{O}_5(s)\)

4. Reaction of Diphosphorus Pentoxide and Water

Lift the cover glass briefly to add about 1 mL of deionized water to the smoke in the bottle. Put the cover glass back on immediately and shake well. Test the solution with litmus paper to determine whether it is acidic, basic, or neutral.

Observation: _______________________________________________________________

Reaction Equation: \(\text{P}_2\text{O}_5(s) + 3 \text{H}_2\text{O(l)} \rightarrow 2 \text{H}_3\text{PO}_4(aq)\)

B. DECOMPOSITION REACTIONS

1. Decomposition of Hydrogen Peroxide

Put about 3 mL of hydrogen peroxide solution in a small test tube. Add a tiny amount of MnO\(_2\) catalyst. (A catalyst makes a reaction occur faster.)

Observation: ___________________________________________________________________

Reaction Equation: \(2 \text{H}_2\text{O}_2(aq) \rightarrow 2 \text{H}_2\text{O(l)} + \text{O}_2(g)\)

**DISPOSAL:** Dispose of the hydrogen peroxide reaction mixture in the waste container labeled "Manganese dioxide/Hydrogen peroxide mixture".

2. Decomposition of Cupric Carbonate

Put a very small amount of solid copper (II) carbonate into your crucible and warm gently for one minute, then heat strongly for an additional 3 minutes.

Observation: ___________________________________________________________________

Reaction Equation: \(\text{CuCO}_3(s) \rightarrow \text{CuO(s)} + \text{CO}_2(g)\)

**DISPOSAL:** Dispose of the reaction mixture in the waste container for \(\text{CuCO}_3\)

C. SINGLE REPLACEMENT REACTIONS
1. Activities of Metals and Hydrogen

Use your spot plates for parts b-e below. (Part a will be demonstrated by your instructor.) Some of the reactions are slower than others. If a reaction does not appear to occur immediately, do not assume it is not reacting. Give it some more time —say 10-15 minutes.

a. Reaction of Sodium and Water (demonstration)
   
   Observation: ______________________________________________________________

   Reaction Equation: \[ 2 \text{Na(s)} + 2 \text{H}_2\text{O(l)} \rightarrow 2 \text{NaOH(aq)} + \text{H}_2(g) \]

   Is sodium more active than hydrogen? ___________________

b. Reaction of Cu and Silver Nitrate

   Place one piece of Cu in a well of a spot plate by itself, then add about 5-10 drops of aqueous silver nitrate, \(\text{AgNO}_3\), solution. Do not put any other samples in the spot plate.

   Observation: ______________________________________________________________

   Reaction Equation: \[ \text{Cu(s)} + 2 \text{AgNO}_3(aq) \rightarrow \text{Cu(NO}_3)_2(aq) + 2 \text{Ag(s)} \]

   Is copper more active than silver? ___________________

   **DI SPOSAL:** Before using the spot plate for any other samples, dispose of reaction mixture in special waste container labeled WASTE SILVER NITRATE or SILVER WASTE.

c. Reaction of Copper and Sulfuric Acid

   Place one piece of Cu in a well of a spot plate and add about 5 drops of 3 M sulfuric acid, \(\text{H}_2\text{SO}_4\) solution.

   Observation: ______________________________________________________________

   Reaction Equation: \[ \text{Cu(s)} + \text{H}_2\text{SO}_4(aq) \rightarrow \text{CuSO}_4(aq) + \text{H}_2(g) \]

   Is copper more active than hydrogen? ___________________

d. Reaction of Zinc and Sulfuric Acid

   Place one piece of “mossy” Zn in a well of a spot plate and add about 5 drops of 3 M sulfuric acid, \(\text{H}_2\text{SO}_4\) solution.

   Observation: ______________________________________________________________

   Reaction Equation: \[ \text{Zn(s)} + \text{H}_2\text{SO}_4(aq) \rightarrow \text{ZnSO}_4(aq) + \text{H}_2(g) \]

   Is zinc more active than hydrogen? ___________________
e. Reaction of Zinc and Magnesium Sulfate

Place one piece “mossy” Zn in a well of a spot plate and add about 5 drops of a 0.1 M magnesium sulfate, MgSO\(_4\), solution.

Observation: 

Reaction Equation:  
\[ \text{Zn}(s) + \text{MgSO}_4(aq) \rightarrow \text{ZnSO}_4(aq) + \text{Mg}(s) \]

Is zinc more active than magnesium? ___________________

**DISPOSAL:** Dispose of the reaction mixtures in your spot plate by first separating solids from liquids by filtration, then throwing the filter paper into the trash can and the liquid in the sink.

f. Reaction of Calcium and Water

Put 1 piece of Ca in a test tube and add about 3 mL of room temperature deionized water. Do not put any other samples in the spot plate.

Observation: 

Reaction Equation:  
\[ \text{Ca}(s) + 2 \text{H}_2\text{O}(l) \rightarrow \text{Ca(OH)}_2(aq) + \text{H}_2(g) \]

Is calcium more active than hydrogen? ___________________

Does calcium replace hydrogen from water at room temperature? ______________

**DISPOSAL:** Dispose of the reaction mixture by first separating solid from liquid by filtration, then put the unreacted Ca into the waste container labeled: Waste Calcium Metal. Put the filter paper into the trash can and pour the liquid down the sink.

g. Reaction of Magnesium and Water

Put 1 piece of Mg in a test tube and add about 3 mL of room temperature deionized water.

Observation: 

Does magnesium replace hydrogen from water at room temperature? ______________

Is Mg more active than Ca? ______________

**DISPOSAL:** Dispose of the mixture by first separating solid from liquid by filtration, then throwing the filter paper into the trash can and the liquid into the sink.
2. Write an activity series for the metals (and hydrogen) you tested:

   MOST ACTIVE

   __________________

   __________________

   __________________

   __________________

   __________________

   __________________

   __________________

   __________________

   __________________

   LEAST ACTIVE

D. COMBUSTION REACTIONS

When you light a Bunsen burner, you are igniting methane, CH$_4$, the primary component of "natural gas". Methane reacts with oxygen to produce carbon dioxide and water. Write the equation for the combustion of methane:

-----------------------------------------------------------------------------------------------------------------------------------

STOP HERE

END OF DAY ONE
E. DOUBLE REPLACEMENT REACTIONS

1. Mix approximately equal volumes (4-5 drops each) of the solutions indicated below in the wells of your spot plates as indicated below and look for evidence of a chemical reaction. (If a precipitate is formed, be sure to write the color of the precipitate.) Record your observations in Table 11.1. (If no reaction occurs, write N.R. in the table.) Save the reaction mixtures until after you have identified your unknown solution.

<table>
<thead>
<tr>
<th></th>
<th>NaOH</th>
<th>Na₂CO₃</th>
<th>Zn(NO₃)₂</th>
<th>NaCl</th>
<th>AgNO₃</th>
<th>AlCl₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>KNO₃</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>AlCl₃</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>AgNO₃</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NaCl</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zn(NO₃)₂</td>
<td>19</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Na₂CO₃</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Save the reaction mixtures until after you have identified your unknown solution.
2. Mix approximately equal volumes (4-5 drops each) of your unknown solution with each of the solutions indicated below. Record your observations in Table 11.2 below. Identify your unknown by comparison of the reaction mixtures in spot plate 3 with those in spot plates 1 & 2.

![Spot Plate 3 Diagram]

**Table 11.2**

<table>
<thead>
<tr>
<th></th>
<th>NaOH</th>
<th>Na₂CO₃</th>
<th>Zn(NO₃)₂</th>
<th>NaCl</th>
<th>AgNO₃</th>
<th>AlCl₃</th>
<th>KNO₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Identity of unknown solution: _______________________

**DISPOSAL:** Reaction mixtures containing AgNO₃ and other silver compounds must be placed in a the special waste container labeled “SILVER WASTE”. To dispose of these reaction mixtures, identified by the $\times$ symbol, use your medicine dropper to transfer them from the spot plates to the special waste container.

To dispose of the remainder of the reaction mixtures, separate solids from liquids by filtration, and pour liquids into the sink and throw solids into the trash can.

3. On your report sheet, write balanced equations for all reactions that occur.
A. COMBINATION REACTIONS

1. Reaction of Magnesium and Oxygen
   Observation: 
   Reaction Equation: 

2. Reaction of Magnesium Oxide and Water
   Observation: 
   Reaction Equation: 

3. Reaction of a Phosphorus and Oxygen
   Observation: 
   Reaction Equation: 

4. Reaction of Diphosphorus Pentoxide and Water
   Observation: 
   Reaction Equation: 

B. DECOMPOSITION REACTIONS

1. Decomposition of Hydrogen Peroxide
   Observation: 
   Reaction Equation: 

2. Decomposition of Cupric Carbonate
   Observation: 
   Reaction Equation: 
C. SINGLE REPLACEMENT REACTIONS

NOTE: Write equations only for those reactions that did occur.

1. Activities of Metals and Hydrogen
   a. Reaction of Sodium and Water
      Observation: ________________________________________________________
      Reaction Equation: \( 2 \text{Na(s)} + 2 \text{H}_2\text{O(l)} \rightarrow 2 \text{NaOH(aq)} + \text{H}_2(g) \)
      Is sodium more active than hydrogen? ___________________
   b. Reaction of Copper and Silver Nitrate
      Observation: ___________________________________________________________
      Reaction Equation: _________________________________________________________
      Is copper more active than silver? ___________________
   c. Reaction of Copper and Sulfuric Acid
      Observation: ___________________________________________________________
      Reaction Equation: _________________________________________________________
      Is copper more active than hydrogen? ___________________
   d. Reaction of Zinc and Sulfuric Acid
      Observation: ___________________________________________________________
      Reaction Equation: _________________________________________________________
      Is zinc more active than hydrogen? ___________________
   e. Reaction of Zinc and Magnesium Sulfate
      Observation: ___________________________________________________________
      Reaction Equation: _________________________________________________________
      Is zinc more active than magnesium? ___________________
   f. Reaction of Calcium and Water
      Observation: ___________________________________________________________
      Reaction Equation: _________________________________________________________
      Is calcium more active than hydrogen? ___________________
      Does calcium replace hydrogen from water at room temperature? ________________
g. Reaction of Magnesium and Water

Magnesium and Room Temperature Water.

Observation: ________________________________

Reaction Equation: ________________________________

Does magnesium replace hydrogen from water at room temperature? _____________

Is Mg more active than Ca? ______________

2. Activity Series for Metals and Hydrogen

MOST ACTIVE

________________________________

________________________________

________________________________

________________________________

________________________________

________________________________

LEAST ACTIVE

D. COMBUSTION REACTIONS

Equation for the combustion reaction of methane, CH₄.

___________________________________________

___________________________________________
# E. DOUBLE REPLACEMENT REACTIONS

## Table 11.1

<table>
<thead>
<tr>
<th></th>
<th>NaOH</th>
<th>Na₂CO₃</th>
<th>Zn(NO₃)₂</th>
<th>NaCl</th>
<th>AgNO₃</th>
<th>AlCl₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>KNO₃</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>AlCl₃</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>AgNO₃</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NaCl</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zn(NO₃)₂</td>
<td>19</td>
<td></td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Na₂CO₃</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Table 11.2

<table>
<thead>
<tr>
<th></th>
<th>NaOH</th>
<th>Na₂CO₃</th>
<th>Zn(NO₃)₂</th>
<th>NaCl</th>
<th>AgNO₃</th>
<th>AlCl₃</th>
<th>KNO₃</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Unknown Solution Letter _________ Identity of Unknown Solution _______________________

DOUBLE REPLACEMENT REACTION EQUATIONS: Complete and balance the equation for each double replacement reaction that actually occurred. (Otherwise write N.R.) Include correct physical states for all products.

<table>
<thead>
<tr>
<th>Reaction</th>
<th>EQUATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>KNO₃(aq) + NaOH(aq) →</td>
</tr>
<tr>
<td>2</td>
<td>KNO₃(aq) + Na₂CO₃(aq) →</td>
</tr>
<tr>
<td>3</td>
<td>KNO₃(aq) + Zn(NO₃)₂(aq) →</td>
</tr>
<tr>
<td>4</td>
<td>KNO₃(aq) + NaCl(aq) →</td>
</tr>
<tr>
<td>5</td>
<td>KNO₃(aq) + AgNO₃(aq) →</td>
</tr>
<tr>
<td>6</td>
<td>KNO₃(aq) + AlCl₃(aq) →</td>
</tr>
<tr>
<td>7</td>
<td>AlCl₃(aq) + NaOH(aq) →</td>
</tr>
<tr>
<td>8</td>
<td>AlCl₃(aq) + Na₂CO₃(aq) →</td>
</tr>
<tr>
<td>9</td>
<td>AlCl₃(aq) + Zn(NO₃)₂(aq) →</td>
</tr>
<tr>
<td>10</td>
<td>AlCl₃(aq) + NaCl(aq) →</td>
</tr>
<tr>
<td>11</td>
<td>AlCl₃(aq) + AgNO₃(aq) →</td>
</tr>
<tr>
<td>12</td>
<td>AgNO₃(aq) + NaOH(aq) →</td>
</tr>
<tr>
<td>13</td>
<td>AgNO₃(aq) + Na₂CO₃(aq) →</td>
</tr>
<tr>
<td>14</td>
<td>AgNO₃(aq) + Zn(NO₃)₂(aq) →</td>
</tr>
<tr>
<td>15</td>
<td>AgNO₃(aq) + NaCl(aq) →</td>
</tr>
<tr>
<td>16</td>
<td>NaCl(aq) + NaOH(aq) →</td>
</tr>
<tr>
<td>17</td>
<td>NaCl(aq) + Na₂CO₃(aq) →</td>
</tr>
<tr>
<td>18</td>
<td>NaCl(aq) + Zn(NO₃)₂(aq) →</td>
</tr>
<tr>
<td>19</td>
<td>Zn(NO₃)₂(aq) + NaOH(aq) →</td>
</tr>
<tr>
<td>20</td>
<td>Zn(NO₃)₂(aq) + Na₂CO₃(aq) →</td>
</tr>
<tr>
<td>21</td>
<td>Na₂CO₃(aq) + NaOH(aq) →</td>
</tr>
</tbody>
</table>