**Chemical Reactions Lab: Synthesis**

Data Table

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| --- | --- |
| reaction | observations |
| #1 |  |
| #2 |  |
| #3 |  |

**Section I: Combination (synthesis) reactions A + X** 🡪 **AX**

Combination reactions occur when two or more substances come together to form a single new substance.

**Reaction 1:** Steel wool (containing Fe) combines with oxygen

1. Obtain a small piece of steel wool.
2. Pull it apart so that the wool strands are loosely separated.
3. Clear your counter of anything flammable such as paper.
4. Use crucible tongs to hold the steel wool in the Bunsen burner flame for minute or two.
5. Record at least two observations.
6. Place product back onto the watch glass until the end of the lab, then you can dispose of it into the trash can.

**Reaction 2:** Copper combines with oxygen

1. Obtain a small square of copper foil from on the lab bench.
2. Use crucible tongs to hold the copper foil square in the Bunsen burner flame for a minute or two until it is red hot.
3. Put the hot square back onto the watch glass.
4. Record at least two observations.
5. At the end of the lab you can dispose of the square into the trash can.

**Reaction 3:** Combination of carbon dioxide and water

1. Pour 50mL of distilled water into an Erlenmeyer flask. Place the flask on white paper to provide contrast to see the color change.
2. Add 10 drops of bromothymol blue indicator to the flask.
3. Use a straw to blow bubbles into the water indicator mixture.
4. Observe and record the color of the mixture.
5. Pour the contents of the Erlenmeyer flask down the sink. Rinse flask with tap water.

**Balanced Equations**

**Reaction #1**

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**Reaction #2**

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**Reaction #3**

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**Chemical Reactions Lab: Decomposition**

Data Table

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| reaction | observations |
| #4 |  |
| #5 |  |
| #6 |  |

**Section II: Decomposition reactions AX 🡪 A + X**

Decomposition reactions result as one substance breaks down to two or more simpler substances.

**Reaction 4:** Decomposition of sodium hydrogen carbonate (NaHCO3)

1. Using your scoopula, place a scoop of sodium hydrogen carbonate into a test tube. Plug this test tube with the rubber stopper.
2. Fill another test tube halfway with limewater and put the rubber hose end into the limewater.
3. Use the test tube holder to grip the test tube containing the sodium hydrogen carbonate and place that test tube into the Bunsen burner flame. Point the mouth of the test tube **away** from people. **GENTLY** heat by waving the test tube in and out of the flame.
4. After heating for 1-2 minutes, place both test tubes in the test tube rack and **immediately** remove the rubber hose from the limewater, but wait for the heated test tube to cool before removing rubber stopper. Now, record your observations.
5. After the heated test tube has cooled, remove the rubber stopper and observe the mouth of the test tube for moisture. Test the moisture with cobalt chloride paper. Record your observations.
6. Pour the used lime water down the sink. Clean with a bottle brush and water in your sink and then invert on your test tube rack to dry.
7. Empty the contents of the other test tube into the trash can. Clean with a bottle brush and water in your sink and then invert on your test tube rack to dry.

**Reaction 5:** Decomposition of copper carbonate (CuCO3)

1. Using your scoopula, place a scoop of copper carbonate into a test tube. Plug this test tube with the rubber stopper.
2. Obtain another test tube with limewater and put the rubber hose end into the limewater.
3. Use the test tube holder to grip the test tube containing the copper carbonate and place that test tube into the Bunsen burner flame. Point the mouth of the test tube **away** from people. **GENTLY** heat by waving the test tube in and out of the flame.
4. After heating for 1-2 minutes, place both test tubes in the test tube rack and **immediately** remove the rubber hose from the limewater, but wait for the heated test tube to cool before removing rubber stopper. Now, record your observations.
5. Pour the used lime water down the sink. Clean with a bottle brush and water in your sink and then invert on your test tube rack to dry.
6. Once the heated test tube has cooled, remove the rubber stopper and empty the contents of the other test tube into the trash can. Clean with a bottle brush and water in your sink and then invert on your test tube rack to dry.

**Reaction 6:** Decomposition of hydrogen peroxide (H2O2)

1. Using a graduated cylinder, measure out ~5 mL of hydrogen peroxide and pour this into one of your test tubes.
2. Using a microspatula, transfer a small amount of manganese(IV) oxide (MnO2) into the test tube containing the hydrogen peroxide.
3. Invert a second test tube over the mouth of this test tube to trap the gas. Wait a few minutes.
4. Test the gas that is being given off by placing a glowing splint into the tube. Record your observations.
5. Douse the splint before putting into trash can. Place this test tube in the rack at the chemical waste station. Clean your other test tubes and leave them at your lab station.

**Balanced Equations**

**Reaction #4**

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**Reaction #5**

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**Reaction #6**

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**Chemical Reactions Lab: Single Displacement**

Data Table

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| reaction | observations |
| #7 |  |
| #8 |  |
| #9 |  |

**Section III: Single replacement reactions A + BX** 🡪 **AX + B**

In these reactions, one substance will replace another substance in the compound.

**Reaction 7**: Reaction of zinc and lead(II) nitrate, Pb(NO3)

1. Place 15 drops of lead(II) nitrate into a test tube.

2. Drop a piece of zinc into the solution; put test tube in test tube rack and let it react until you are done with the rest of the lab.

3. (*After you are finished with reaction #9)* Record your observations.

4. Dispose of contents of test tube by emptying it into the container indicated by your teacher, then washing it with a bottle brush and water at your sink. Invert the test tube to dry.

**Reaction 8**: Reaction of calcium and water

1. Obtain a piece of calcium from your vial.

2. Drop the calcium into a test tube 1/3 full of water. Place in your test tube rack.

3. Invert a second test tube over the mouth of this test tube to trap the gas. Wait a few minutes to allow the tube to fill with the gas.

4. Test the gas evolved for flammability by using a flaming splint near the mouth of the tube. Record your observations

5. Add 3 drops of bromothymol blue indicator and swirl. Record your observations.

6. Dispose of contents of test tube by emptying it into the container indicated by your teacher, then washing it with a bottle brush and water at your sink. Invert the test tube to dry.

**Reaction 9:** Reaction of zinc and hydrochloric acid

1. Fill a test tube 1/4 full with 3M HCl. Place in your test tube rack.

2. Add three pieces of zinc.

3. Invert a second test tube over the mouth of this test tube to trap the gas. Wait a few minutes to allow the tube to fill with gas. There should be vigorous bubbling.

4. Test the gas given off for flammability by using a lit splint near the mouth of the test tube. Record your observations.

5. Dispose of contents of test tube by emptying it into the container indicated by your teacher, then washing it with a bottle brush and water at your sink. Invert the test tube to dry.

**Balanced Equations**

**Reaction #7**

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**Reaction #8**

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**Reaction #9**

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**Chemical Reactions Lab: Double Displacement**

Data Table

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| reaction | observations |
| #10 |  |
| #11 |  |
| #12 |  |

**Section IV: Double replacement reactions AX + BY** 🡪 **AY + BX**

In double replacement reactions, the substances are ionized and dissolved in water. The ions are free to move around and find another partner. If the partnership results in a compound which is insoluble in water, a precipitate (a solid) will form. If a gas is formed, you will see bubbles.

**Reaction 10**: Lead(II) nitrate, Pb(NO3)2  reacts with potassium iodide, KI

1. Add 15 drops of lead (II) nitrate to a test tube.

2. Add 15 drops of potassium iodide to the tube.

3. Record your observations.

4. Place the yellow solid in a designated waste container as instructed by your teacher.

5. Using a bottle brush, wash your test tube in your sink with water and invert to drain.

**Reaction 11**: Hydrochloric acid, HCl reacts with sodium hydroxide, NaOH

1. Using your plastic graduated cylinder, measure out 5mL of 3M NaOH and pour this into your evaporating dish.

2. Using your glass graduated cylinder, measure of 5mL of 3M HCl and pour this also into your evaporating dish.

3. Using a clay triangle and ring on your ring stand, **gently** boil away the liquid in your evaporating dish just until you have damp crystals. Remove the Bunsen burner from under the evaporating dish, but keep lit. Record your observations.

4. Flame test your crystals. Record the color of the flame.

5. Rinse out and invert your graduated cylinders.

6. DO NOT RINSE OUT YOUR EVAPORATING DISH. YOU NEED THE CONTENTS FOR RXN #12.

**Reaction 12**: Sodium Chloride, NaCl reacts with lead(II) nitrate, Pb(NO3)2

1. Dissolve the crystals in the evaporating dish with a small amount of distilled water ~5mL. You may stir with a glass stirring rod.
2. When dissolved, pour this solution into a test tube.
3. To this test tube add 10 drops of Pb(NO3)2. Record your observations
4. Place the contents in a designated waste container as instructed by your teacher. Wash your test tube and invert to dry.
5. Wash your evaporating dish.
6. Clean your lab station and sponge off your lab bench.

**Balanced Equations**

**Reaction #10**

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**Reaction #11**

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**Reaction #12**

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