Chemical Reaction Investigations I

**Purpose:** In this activity you will observe a variety of simple chemical reactions and record your observations. Afterwards, you will be able to classify these reaction types.

**Materials per team:**
- 1 test tube rack
- Weighing trays
- Safety Goggles
- 4 test tubes
- Tray with labeled chemicals/solutions

**Reaction 1:** Use a tray to weigh 0.2 g of silver nitrate and carefully dispense the chemical into a clean test tube. Using a wash bottle add de-ionized water to the test tube (about 1/3 full) and mix until the compound dissolves. Place the tube in the rack for use in reaction 2.

- **Observations:** compound dissolved, tube got slightly colder

**Questions**
1. Silver nitrate is an ionic compound. Describe what is occurring when the compound is dissolved in the water.
   - **The compound dissociates (separates) into its constituent ions**
2. Does the dissolving of silver nitrate represent a chemical or physical change?
   - **Physical** - each ion is surrounded by water molecules
3. Write an ionic equation that shows the dissociation of silver nitrate.
   - \( \text{AgNO}_3 (s) \rightarrow \text{Ag}^{+} (aq) + \text{NO}_3^{-} (aq) \)

**Reaction 2:** Obtain a small piece of copper ribbon, rolled into a ball the size of a BB. Drop the copper into the silver nitrate solution and observe. Be patient, the change takes time.

- **Observations:** crystals form, solution turns light blue

**Questions**
1. Identify the reactants for this reaction _______ **AgNO**_3_____ and _______ **Cu** _______
2. Predict what the products of the reaction will be _______ **CuNO**_3_ and _______ **Ag** _______

**Use the space below to write a balanced equation for reaction 2**

- \( 2\text{AgNO}_3 (aq) + \text{Cu} (s) \rightarrow \text{Cu(NO}_3)_2 (aq) + 2\text{Ag(s)} \)

4. What’s going on in this reaction? (this will be addressed in class)
   - Copper replaces silver, single displacement, electron transfer

**Reaction 3:** Use a tray to weigh 1.5 g of ammonium chloride and carefully dispense the chemical into a clean test tube. Using a wash bottle add de-ionized water to the test tube (about 1/2 full) and mix until the compound dissolves. Hold the test tube in your hand. Do you notice a change?
Add 1 full dropper of sodium hydroxide into the ammonium chloride mixture. Carefully smell (by wafting) the test tube. Do you detect any familiar odor?

Observations ______ Smells like Windex or ammonia

Questions

1. Identify the reactants and write the formula for each in the spaces to the left of the arrow below.

\[ \text{NH}_4\text{Cl} + \text{NaOH} \rightarrow \text{NaCl} + \text{NH}_4\text{OH} \] (all aqueous)

2. Predict the products in reaction 3 and write the formula for each in the spaces to the right of the arrow above.

3. Describe what the ions are doing in reaction 3.

   Ions are exchanging partners - double displacement

**Reaction 4:** Use a tray to weigh 0.1 g of iron (III) nitrate and carefully dispense the chemical into a clean test tube. Using a wash bottle add de-ionized water to the test tube (about 1/3 full) and mix until the compound dissolves. Place the test tube in the rack and add 1 dropper full of sodium hydroxide, observe. (save for next reaction)

Observations __ A rust-colored, gel-like precipitate forms

Questions

1. Identify the reactants and products and write the formula for each in the spaces below.

\[ \text{Fe(NO}_3\text{)}_3\text{(aq)} + 3\text{NaOH}_\text{(aq)} \rightarrow \text{Fe(OH)}_3\text{(s)} + 3\text{NaNO}_3\text{(aq)} \]

2. Use a solubility table to determine which of the two products is a precipitate.

   **Iron (III) hydroxide**

3. Write and ionic equation for the formation of the precipitate in reaction 4.

   Net ionic equation is: \( \text{Fe}^{3+\text{(aq)}} + 3\text{OH}^-\text{(aq)} \rightarrow \text{Fe(OH)_3(s)} \)

**Reaction 5:** Add sulfuric acid (drop by drop and mix) to the test tube in reaction 4. Observe and record.

Observations __ iron (III) hydroxide precipitate dissolves

Questions

1. Identify the reactants and products and write the formula for each in the spaces below.

\[ 2\text{Fe(OH)_3(s)} + 3\text{H}_2\text{SO}_4\text{(aq)} \rightarrow \text{Fe}_2\text{(SO}_4\text{)}_3\text{(aq)} + 6\text{H}_2\text{O(l)} \]

**Final task:** balance each of the chemical equations for reactions 2 through 5.