

Name: _____

Lab Partner: _____

Observation in the Chemical Laboratory: Chemical Changes

This experiment is an introduction to chemistry laboratory work. It has three purposes:

1. The starting point in all scientific activities is **careful observation**. In chemistry, you will be constantly watching for changes during laboratory experiments. In this experiment you will begin your training in observation in the chemical laboratory.
2. **Recording data** (measurements and observations) is an absolute must in science. Well-recorded data are the best insurance against careless errors, faulty memory, and lost information, as well as providing an effective means for communicating your findings. In this experiment you will use data tables to record scientific data in a clear and concise manner.
3. Substances undergo two types of changes:
 - a. **Physical Changes** are changes in which the identity of the substance does not change. Examples include grinding coffee beans, and freezing or evaporating water. Coffee is still coffee after grinding and water remains water whether it is in solid, liquid, or gas form.
 - b. **Chemical Changes** are changes in which new substances, with different properties, are formed. An example is burning gasoline (octane). In that reaction, octane and oxygen are converted into carbon dioxide and water vapor.

All of the changes in this experiment are chemical changes. Your observations will allow you to identify **indications of a chemical reaction**.

Procedure:

Part I: Reactions of Iron (III) Chloride, FeCl₃

1. To each of three test tubes, add a small amount of iron (III) chloride (ferric chloride) crystals. The amount added should be **no larger than the head of a wooden match**.
2. To a 4th test tube add a similar amount of potassium thiocyanate (KSCN) crystals.
3. To a 5th test tube add a similar amount of potassium ferrocyanide (K₄Fe(CN)₆).
4. To each of these five test tubes, add 3 mL of distilled water. Carefully agitate the test tubes until all the solids have dissolved.

5. To a 6th test tube, add 3 mL silver nitrate (AgNO₃) solution.

****Caution:** Any AgNO₃ solution that spills on your skin or your clothes may leave a permanent brown-black stain.

6. In the data table provided for part one, record the color of each of the four different solutions you have prepared.

NOTE: You should use the following terms, when applicable, in your data tables:

Clear: Transparent. You can see directly through it (like water, Kool-aid).

Colored/Colorless: Things that are clear are either colored or colorless. Water is **clear** and **colorless**. Kool-aid is **clear** and **colored**.

Precipitate (ppt): A solid that is present in a solution is a ppt. Either appears as visible particles or as cloudiness. Eventually, a ppt will settle to the bottom of the container.

7. Mix pairs of solutions in the following ways and record all your observations in the data table (note any temperature changes by feeling the test tubes with your fingers):

FeCl₃ (#1) + KSCN (#4)

FeCl₃ (#2) + K₄Fe(CN)₆ (#5)

FeCl₃ (#3) + AgNO₃ (#6)

8. Pour the contents of the test tubes down the drain and wash all materials thoroughly.

Data Table I: Reactions of Iron (III) Chloride

Test Tube #	Solution	Color	Reaction with FeCl ₃
1,2,3	FeCl ₃		
4	KSCN		
5	K ₄ Fe(CN) ₆		
6	AgNO ₃		

Part II: Reactions of Nitric Acid (HNO_3)

1. To each of three small test tubes, add 3 mL of nitric acid.

****Caution:** Nitric acid burns skin and is destructive to clothing. Any spilled on your skin may leave a yellow stain. Alert your teacher if any spills occur.

2. Test the reaction of the acid to red and blue litmus paper. To do this, dip a clean stirring rod into one of your test tubes and touch it to a piece of litmus paper.

3. Obtain small pieces of magnesium, tin, and copper.

4. One at a time, add the metal pieces to a different test tube of nitric acid. If there is no immediate reaction, allow it to stand and proceed to the next metal.

5. Discard the contents of the test tubes down the sink. Unreacted metal pieces should **NOT** be washed down the drain. Rather, pick them up with forceps and throw the pieces away.

6. Wash all materials thoroughly.

Data Table II: Reactions of Nitric Acid

Reaction of Nitric Acid with:	Observations
Red Litmus	
Blue Litmus	
Magnesium (Mg)	
Tin (Sn)	
Copper (Cu)	

Part III: Reactions of Ammonium Hydroxide (NH₄OH)

1. Obtain 10 mL of ammonium hydroxide solution in a 50 mL beaker.

****Caution:** Ammonium hydroxide is caustic. If any is spilled on your skin, wash it with large amounts of water and notify your teacher.

2. Test the reaction of ammonium hydroxide to red and blue litmus paper. To do this, dip a clean stirring rod into the solution in your beaker and touch it to a piece of litmus paper.

3. To one test tube, add 3 mL of hydrochloric acid (HCl).

4. To a 2nd test tube, add 3 mL of silver nitrate solution.

5. To a 3rd test tube, place 3 mL of copper (II) sulfate (CuSO₄) solution.

6. To the first test tube, add 3 mL of NH₄OH solution (from your beaker). Mix by carefully agitating the test tube and record your observations.

7. To test tube 2, add **2 drops** of NH₄OH solution and mix. Record your observations.

8. To the same test tube (test tube 2), add a few drops of NH₄OH at a time (agitating after every addition) until 20 drops have been added. Record your observations.

9. To test tube 3, add **2 drops** of NH₄OH solution and mix. Record your observations.

10. To the same test tube (test tube 3), add a few drops of NH₄OH at a time (agitating after every addition) until 20 drops have been added. Record your observations.

11. Discard the contents of the test tubes down the drain and wash all materials thoroughly.

Data Table III: Reactions of Ammonium Hydroxide

Reaction of NH₄OH with:	Observations
Red Litmus	
Blue Litmus	
Hydrochloric acid	
Silver Nitrate (after 2 drops NH₄OH)	
Silver Nitrate (during / after 20 drops NH₄OH)	
Copper (II) Sulfate (after 2 drops NH₄OH)	
Copper (II) Sulfate (during / after 20 drops NH₄OH)	

Questions:

1. How is a chemical change different from a physical change?
2. Provide five examples of physical changes.
3. All of the changes in this experiment were **chemical changes**. List three indications of chemical changes that you noted during this experiment.