Physical and Chemical Changes

A good understanding of material things requires an understanding of the physical and chemical characteristics of matter. Such characteristics are familiar to you, and physical and chemical changes are part of your everyday experience. However, you may not yet have a clear idea of the difference between a physical change and a chemical change. You may not yet know exactly how a chemical change is distinguished from a physical change. The purpose of this experiment is to clarify these important distinctions.

The physical properties of a substance are those properties that can be observed and measured without changing the composition of the substance. In a physical change, only temperature, size, or physical state of a sample of matter is altered.

The chemical properties of a substance are those properties that can only be observed when the substance is undergoing a change in composition. In chemical changes, new substances, of different chemical composition are produced. Readily observable phenomena include the evolution of gas, the production of a color change, the formation of a solid, and the evolution of heat/light. A process in which a chemical change takes place is called a chemical reaction.

Investigation A:

1. Examine a piece of aluminum, Al, foil and identify three physical properties.

a.

b.

c.

2. Measure 20 mL of copper (II) chloride solution, $CuCl_2$, in a small beaker. Identify three physical properties of the solution.

a.

b.

c.

3. Roll the Al foil into a small loose ball and place it in the $CuCl_2$ solution. Wait for 2 or 3 minutes, then describe the results.

Results:

4. Dispose of the solid aluminum in the beaker provided and the liquid in a second beaker. Wash all glassware using “alkanox” soap.

Name **Hr .**

Investigation B:

1. Obtain one piece of each, red and blue litmus paper.

2. Tear each one into three pieces and arrange them on a piece of paper towel.

3. Place one drop of 0.1M hydrochloric acid, HCl, on one piece of each color of paper and record the results.

Results:

4. Repeat step 3 using 0.1 M sodium hydroxide, NaOH.

Results:

5. Repeat step 3 using 0.1 M sodium chloride solution, NaCl.

Results:

6. Dispose of all waste in garbage can.

Investigation C:

1. Formula for volume of a cylinder: $V = \pi r^2 h$. Use the formula to calculate the volume of the cylinder:

volume = _____ cm^3

2. Find the volume of the cylindrical mass using water displacement. Add approx 15 mL of water to the 25 mL graduated cylinder. Gently, drop the cylindrical mass into the water. By how many mL did the water level change in the graduated cylinder?

Volume = _____ mL

3. Find the mass of the cylinder = _____ g

4. Density = mass/volume. Calculate the density of the cylinder using each of the volumes:

Calculated volume: _____ Mass: _____ Density = _____ g/cm^3	Measured volume: _____ Mass: _____ Density = _____ g/cm^3

5. What do you notice about these two, calculated densities?

Investigation D:

1. Examine a small piece of magnesium, Mg, ribbon and identify two physical properties.

a.

b.

2. Using the crucible tongs, hold the piece of Mg ribbon in the outer portion of the Bunsen burner flame (CAUTION!). Describe the results.

Results:

3. Discard waste into the "waste" beaker provided.

4. With the extra time, go back and fill in any missing info from other stations that you've completed.

Investigation E:

1. Obtain a sheet of typing paper. Examine it and identify two physical properties.

a.

b.

2. Using a pair of scissors cut the paper in such a way that you end up with a hole in the paper large enough to slip your entire body through (2 bodies?). Describe the results.

Results:

3. Discard waste into the garbage can.

Investigation F:

1. Using a graduated cylinder, measure out 5 mL of lead (II) nitrate solution, $Pb(NO_3)_2$, and place it in a *clean* test tube. Describe two physical properties.

a.
b.

2. Using a graduated cylinder, measure out 5 mL potassium iodide solution, KI, and place it in a *clean* test tube. Describe two physical properties.

a.
b.

3. Combine the contents of both test tubes. Describe the results.

Results:

4. Pour waste into the beaker provided and wash all glassware using "alconox" soap and a test tube brush.

Investigation G:

1. Select several small crystals of copper (II) sulfate, $CuSO_4$, and identify two physical properties.

a.

b.

2. Using a graduated cylinder, measure 10 mL of distilled water, H_2O, and place it in a test tube. Identify two physical properties.

a.

b.

3. Drop the $CuSO_4$ crystals into the water. Stopper the test tube and shake the contents to promote interaction of particles. Describe the results.

Results:

4. Pour waste into the beaker provided and wash all glassware using "alconox" soap.

Investigation H:

1. Measure out 1.5 grams of sodium hydrogen carbonate, $NaHCO_3$, in a weigh boat. Identify two physical properties.

a.

b.

2. Place the $NaHCO_3$ in a small beaker.

3. Using a graduated cylinder, measure 10 mL of acetic acid, $HC_2H_3O_2$, and identify two physical properties.

a.

b.

4. Check the acidity of each solution with litmus. Record your results. (You may need to moisten the litmus paper before checking the $NaHCO_3$.

5. Pour the acid into the beaker containing the $NaHCO_3$ and allow them to mix. Record your observations.

Observations:

6. Pour waste into the "waste" beaker provided.

Investigation I:

1. Measure out 1.5 g of calcium chloride, $CaCl_2$ in a weigh boat.
2. Measure 25 mL of de-ionized water in a beaker.
3. Record the temperature of the water in in ºF, ºC, and K (Kelvin).

Temperature:

4. Transfer the calcium chloride into the beaker of water. Stir until the salt is completely dissolved.
5. Record the final temperature of the solution in ºF, ºC, and K (Kelvin).

Temperature:

6. Dispose of the waste in the beaker provided.

Investigation J:

1. Record 2 properties of ethyl alcohol, CH_3CH_3OH.

a.

b.

2. Record 2 properties of de-ionized water.

a.

b.

3. Add an ice cube to each container. Record your observations.

Observations:

4. Remove the ice and place it back in the ice beaker.
5. Clean up your lab station.

Investigation K:

1. Measure 20 mL of water in a 100 mL beaker.
2. Transfer the water into a 25 mL graduated cylinder and record the volume.

Volume:

3. Using the “tare” feature on the balance and a beaker, measure the mass of the water.

Mass:

4. Clean your lab station.

Investigation L:

1. Sketch and label each piece of equipment.

2. List what each one is used for. (you may research this on a device)

A: Name:	B:	C:	D:
A: Drawing			
A: Use:			

E: Name:	F:	G:	H:
E: Drawing:			
E: Use:			

I: Name:	J:	K:	L:
I: Drawing:			
I: Use:			

Data Analysis:

For each **investigation** you observe, indicate whether the change was physical or chemical in nature. Give reasons for you answer.

Investigation A:

Investigation B:

Investigation C:

Investigation D:

Investigation E:

Investigation F:

Investigation G:

Investigation H:

Investigation I:

Investigation J:

Investigation K:

Name : _____

Date : _____ Hour : _____

Conclusions:
State in your own words the differences between physical and chemical *properties* and physical and chemical *changes*. Using the lab investigations that you just completed, give at least one example of each.