Experiment 3 Name: _____

CLASSI 9 F ICATION OF MAT 52 Te R AND HOMOGENEOUS AND HETEROGENEOUS MIXTURES

Classification of Matter

A **pure substance** is matter with definite and constant composition with distinct chemical properties. They are either elements or compounds.

> **Elements** are composed of one type of atom such as copper (Cu), helium (He), or oxygen (O_2). Note that there are seven elements which exist as diatomic molecules in their natural state.
>
> **Compounds** are composed of two or more different atoms that are chemically-bound such as water (H_2O), methyl alcohol (CH_3OH), and calcium nitrate ($Ca(NO_3)_2$).

A **mixture** is composed of two or more substances that are not chemically bound such as salad dressing or salt water. Note that mixtures may not be uniformly mixed and are classified as either homogeneous and heterogeneous.

> **Homogeneous mixtures**, which are also called solutions, are uniformly mixed throughout and have consistent properties throughout the sample. For example, a salt-water mixture is homogeneous because it has the same composition and properties all throughout.
>
> **Heterogeneous mixtures** are not uniformly mixed throughout and have properties that vary within the sample. For example, an oil-water mixture is heterogeneous, having separate oil and water layers and a water and sand mixture is heterogeneous because the sand will settle at the bottom of a container.

The **solubility** of a substance is related to whether or not the substance dissolves in a liquid, such as water. A substance is **soluble** if some or all of the substance dissolves in a liquid. When a substance is soluble and fully dissolved, it forms a homogeneous mixture. If none of the substance dissolves, then the substance is **insoluble** in that liquid and forms a heterogeneous mixture.

For example, Nickel (II) Chloride is a green compound, that when placed in water, the water begins to turn green. Since the water turns green, it means that some of the Nickel (II) Chloride is dissolved even if some green crystals are sitting in the bottom of the container. Therefore, Nickel (II) Chloride is soluble in water. Please note that a compound does not need to fully dissolve to be soluble in a liquid.

General Rules for Gravity Filtration

Filtration is used to separate two substances such as solid particles from a liquid using a filter. Gravity filtration uses the force of gravity to draw the liquid through the filter. The liquid is able to pass through the filter, but the solids are too big and left behind. The liquid that is collected at the bottom of the flask is known as the **filtrate.**

Grab an Erlenmeyer flask and a glass funnel.

Place the glass funnel in the neck of the flask with the stem pointing down.

Fold a piece of filter paper into quarters and place it into the funnel.

Open the filter paper on one side, forming a pocket.

Pour a little bit of liquid (i.e. water) into the pocket to keep the filter paper in the funnel.

Pour the sample into the pocket of the filter paper and allow it to drip through the filter and funnel into the flask.

PROCEDURE

A. Physical Appearance of Elements

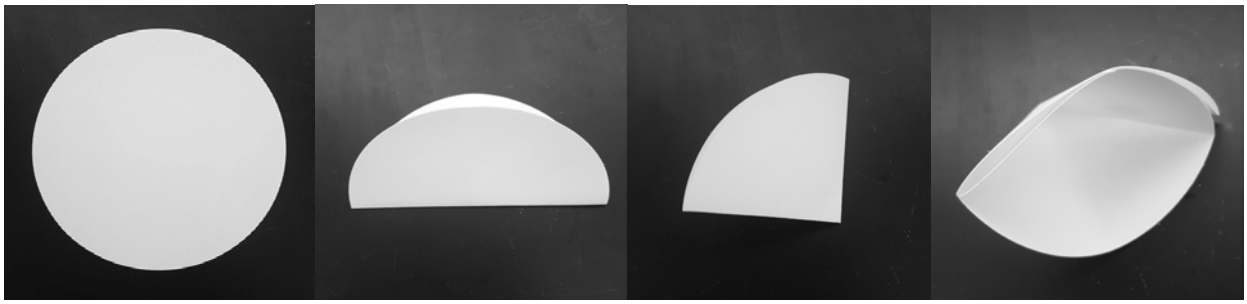
Observe the physical state and color of following elements: cobalt, neon, silicon, sulfur, and tin. Classify each as metal, non-metal, or metalloid. Record your observations on your data sheet.

B. Homogeneous and Heterogeneous Mixtures

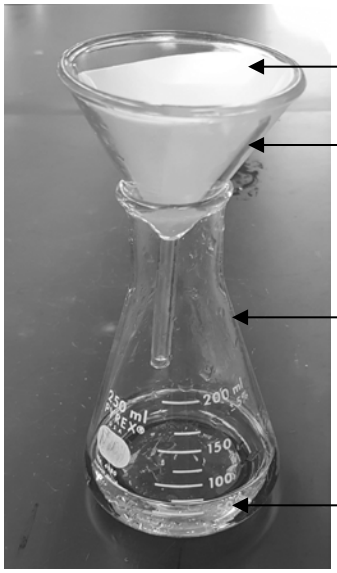
Perform the following steps for each of the following substances (one at a time):

a. Sodium chloride (NaCl)
b. Iron (III) Chloride ($FeCl_3$)
c. Calcium carbonate ($CaCO_3$)
d. Carbon (C)

1. Weigh 0.10 g of **one** of the above substances and place it in a 100 mL or 150 mL beaker.
2. Add approximately 40 mL of tap water to the beaker and put in a magnetic stir bar.
3. Place the beaker onto the middle of the stir/hot plate and turn the stirrer on to a medium speed. **Do NOT turn on the heat.** Continue stirring for 5 minutes.
4. Grab an Erlenmeyer flask, a glass funnel, and one piece of filter paper.
5. Place the glass funnel in the neck of the flask with the stem pointing down.
6. Fold a piece of filter paper into quarters and place it into the funnel. Open the filter paper on one side, forming a pocket (see diagram on next page).



7. Place the filter paper corner side down into the funnel. Make sure the corner is all the way into the funnel. **Pour a little bit of water into the pocket to keep the filter paper in the funnel**.



8. After stirring for 5 minutes, turn off the stir plate, take the beaker off the stir plate, and remove the stir bar using the magnetic retrieving wand.

9. Slowly pour the mixture from the beaker into the pocket of the filter paper and allow it to drip through the filter paper and funnel into the flask. You may need to rinse the beaker with a small amount of water to remove all of the mixture.

Make sure you do not fill the funnel above the top of the filter paper.

10. Record your observations.

Note: Begin stirring the next sample while the previous one is filtering to save you time and improve efficiency

11. Dispose of filtrate and filter papers in the appropriate waste containers and clean the funnel, flask, beaker, and stir bar between compounds.

12. Repeat steps 1-11 for the other three substances using a new piece of filter paper each time.

C. Solubility in Water

1. **Solids**. Into each of two test tubes, add 20 drops of distilled water. Using a spatula, add a pinch of magnesium hydroxide ($Mg(OH)_2$) to one and a pinch of copper (II) chloride ($CuCl_2$) to the other. Shake and observe if the solid dissolves in water (forms a homogeneous mixture) or not (forms a heterogeneous mixture). Record as soluble or insoluble, respectively.

2. **Liquids**. Into each of two test tubes, add 20 drops of the coloured water. Add a 20 drops of acetic acid to one and 20 drops of hexane to the other. Shake and observe the solubilities. The liquids are soluble if they mix completely without forming layers. They are insoluble if they do not mix and form separate layers.

   Notes
   1. Most things take time to dissolve. Give your sample time to dissolve. However, not everything dissolves in water.
   2. Shaking the test tube encourages mixing. Hold the test tube using the thumb and index finger of one hand near the top of the test tube. Gently shake back and forth. You can also tap the side of the test tube near the bottom with a finger from the other hand.
   3. **A homogeneous mixture is transparent and a heterogeneous is translucent or opaque (cloudy) or layered.**
   4. The food colouring added to make the coloured water will not affect the solubility of hexane or acetic acid in water, it was added to make it easier to see if layers form.

CLEAN-UP

- Dispose of wastes and filter paper in the designated waste containers.
- Wash all glassware used. Return materials where they belong. Shake off excess water from washed test tubes and return to the test tube racks on your work station.

Name: _____ **Date:** _____
Partner's Name: _____

CLASSIFICATION OF MATTER AND HOMOGENEOUS AND HETEROGENOUS MIXTURES

DATA AND OBSERVATIONS

A. Physical Appearance of Elements

Element	Symbol	Color and Physical State (Solid/Liquid/ Gas)	Classification (Metal/Nonmetal/ Metalloid)
Cobalt			
Neon			
Silicon			
Sulfur			
Tin			

B. Homogeneous and Heterogeneous Mixtures

a. Sodium Chloride (NaCl) Mixture

Mass of the NaCl _____

Colour of the NaCl _____

Colour of the water before mixing _____

Colour of the NaCl mixture before filtration _____

Colour of the Filtrate (liquid in the bottom of the flask) _____

Is the NaCl and water mixture Homogeneous or Heterogeneous? _____

b. Iron (III) Chloride ($FeCl_3$) Mixture

Mass of the $FeCl_3$ _____

Colour of the $FeCl_3$ _____

Colour of the water before mixing _____

Colour of the $FeCl_3$ mixture before filtration _____

Colour of the Filtrate (liquid in the bottom of the flask) _____

Is the $FeCl_3$ and water mixture Homogeneous or Heterogeneous? _____

c. Calcium Carbonate ($CaCO_3$) Mixture

Mass of the $CaCO_3$ _____

Colour of the $CaCO_3$ _____

Colour of the water before mixing _____

Colour of the $CaCO_3$ mixture before filtration _____

Colour of the Filtrate (liquid in the bottom of the flask) _____

Is the $CaCO_3$ and water mixture Homogeneous or Heterogeneous? _____

d. Activated Carbon (C) Mixture

Mass of the C _____

Colour of the C _____

Colour of the water before mixing _____

Colour of the C mixture before filtration _____

Colour of the Filtrate (liquid in the bottom of the flask) _____

Is the C and water mixture Homogeneous or Heterogeneous? _____

C. Solubility in Water

	Chemical	Soluble/Insoluble
Solids	magnesium hydroxide	
	copper (II) chloride	
Liquids	acetic acid	
	hexane	

POST-LAB EXERCISES

1. Classify as element or a compound.

   a. sodium, Na _____

   b. Magnesium chloride, $MgCl_2$ _____

   c. nitrogen, N_2 _____

   d. carbon dioxide, CO_2 _____

   e. copper (I) nitrate, $CuNO_3$ _____

2. Classify as a homogeneous mixture or a heterogeneous mixture.

   a. Raw egg _____

   b. Lemonade with pulp _____

   c. mouthwash _____

   d. rubbing alcohol _____

   e. Cheese pizza _____

3. Are the following soluble or insoluble?

    a. Olive oil is mixed with balsamic vinegar to form a salad dressing.

    b. Sugar is dissolved in water to make a simple syrup.

    c. A sample of swamp water contains water and dirt.