GCC CHM 107LL
Chemical and Physical Changes
Bring 2 empty soda cans for today's lab please

Objectives - In this experiment you will observe and record observations of properties of substances. You will also cause changes to occur and classify these changes as physical or chemical based on evidence provided by your observations.

Introduction

Every pure substance can be described by a unique set of chemical and physical properties. For example, sugar looks, tastes and behaves the same, whether it is from your cupboard or your neighbor's, or Germany. You count on this fact whenever you use sugar and would be surprised if its behavior were different. If you needed to decide whether an unlabeled canister contained sugar or something else, you would take a look at it, feel it, taste it—this is OK in the kitchen, but not OK in chemistry lab! (Of course, to be sure, you should determine a large number of properties. Some sugar-substitutes look and taste remarkably like the real thing but do not behave the same way in the body.) While you may not realize it, you were using a basic principle of chemistry—**that every pure chemical is unique, but every sample of one pure chemical behaves the same way**. Practicing chemists in industry are interested in converting chemicals to better serve the marketplace, and research chemists are interested in making new chemicals. Thus, it is of vital importance for chemists to recognize what changes have occurred, to predict what kinds of changes may occur, and to understand how to control these changes.

Two general types of changes are involved:

Physical changes: These involve only a change in physical state (solid, liquid, gas) but no change in the composition of the individual atoms or molecules present. The chemical formula does NOT change! For example, dissolving sugar in water still results in a sweet taste because the sugar molecules are still present.

Chemical changes: These do change the composition of the substance. The product chemical is different from what you started with, the chemical formula does change. Burning the sugar in a saucepan results in a dark caramel, a substance that is different from the original sugar! Some of the sugar molecules have been converted to caramel molecules!

To determine if a change was physical or chemical, a chemist must observe what happens to the individual atoms or molecules. If they are converted to other kinds of molecules, the change was chemical; if the molecules stay the same, the change was physical. Because we cannot actually look at molecules, chemists rely on evidence that can be observed. If the chemical behaves the same way, it was a physical change. If the chemical behaves differently, it was a chemical change. For example, the particle size and appearance of granulated sugar can be changed by grinding into powdered sugar, but tasting it will convince you that it is still sugar. Changes in appearance can be deceiving. Tests of chemical behavior or reactivity are better indicators of chemical change.

In this experiment, you will cause changes in several pure chemicals. You will observe the changes, and then chemically test the chemicals after the changes occur. Then you will classify the changes as **physical** or **chemical**. Record your observations carefully. Pay special attention to any change in appearance (color, texture) and form (fizzing which indicates a gas given off or cloudiness which indicates a solid precipitate has formed).

For each experiment the following general procedure will be followed:

- Obtain two identical samples of the chemical to be examined.
- Cause a change in the first sample.
- Compare the chemical behavior of the changed first sample to the second unchanged sample.

  If the chemical test results are the SAME for the changed and unchanged samples, then the change was physical.

  If the chemical test results are DIFFERENT for the changed and unchanged samples, then the change was chemical.

Experimental Procedure

Note: You will need 2 dry test tubes for part A. The rest of the tests can be done in clean wet test tubes. When done with a test tube, dump it in the waste jar, then flush with lots of tap water, leave upside down to dry. Do NOT try to dry the test tubes.

Waste disposal*: A waste jar will be provided for all waste generated in this lab.*

A. Copper Carbonate and Heat

CAUTION: Hydrochloric acid (HCl) is corrosive and can burn skin and damage clothing.

1. Place approximately a pea-size amount of copper (II) carbonate, $CuCO_3$, into each of two dry clean test tubes. Record the color of the sample. Hold the test tubes with a test tube clamp, not the crucible tongs.
2. Gently tap the tubes on the bench top so any sample clinging to the sides falls to the bottom.
3. Heat one sample very strongly over a Bunsen burner flame for at least 5 minutes. Keep the test tube moving and pointed away from you. Record the color of the sample after heating.
4. Place the test tube in a beaker and allow it to cool for about 10 minutes.
5. Add 5-6 drops of 2M HCl to each of the two samples. Compare results and record observations.

B. Silver Nitrate, $AgNO_3$, and Copper Metal, Cu(s)

CAUTION: Silver nitrate solution, $AgNO_{3(aq)}$, stains skin and clothing. *Wash any spilled silver nitrate immediately with plenty of water.*

1. Clean a small piece of copper wire with sandpaper just for a few seconds, coil it, and drop it into a small test tube. Add enough 0.1M $AgNO_3$ to completely cover the copper coil. Also add an approximately equal volume of the 0.1M $AgNO_3$ to a second test tube. Wait five minutes and observe the contents of the first test tube carefully.
2. Pour the $AgNO_3$ solution off the piece of copper into a third test tube. Add 3-4 drops of 3M NH_4OH (NH_3 solution) to the solution you poured off the copper coil, and also to the solution that was not in contact with the copper metal. Compare the results.

C. Magnesium Ribbon and Heat

1. Obtain two short strips of Mg ribbon. Record the appearance of the metal.
2. Hold a test tube with a clamp and place one Mg ribbon into the test tube. Carefully add 10 drops of 2M HCl into the test tube containing the Mg ribbon. Record your observations.

3. Grasp one end of the other Mg ribbon with your crucible tongs, and hold the strip directly in the flame of your burner until the magnesium ignites. **DO NOT LOOK directly at the bright flame.** Do not heat the Mg ribbon in the test tube.
4. Collect any combustion product ash on a watch glass (ignoring unburned metal), and record its appearance. As it burns ash will fall down.
5. Put the product ash (not unburned metal) into a test tube and treat it with HCl as in step 2 above. Record your observations.

D. Ammonium Chloride and Heat

1. Cover the bottom of your ceramic evaporating dish with a thin layer of NH_4Cl (ammonium chloride). Support this on a ring stand and wire gauze. Cover the evaporating dish with a watch glass.
2. Heat the bottom of the evaporating dish really well with your bunsen burner for 20 minutes. Turn off your bunsen burner, and let the equipment cool. You should notice a white deposit on the underside of the watch glass.
3. Wait five minutes for the watch glass to cool, then remove it, and scrape a small flake, about ½ a pea sized amount, of the white deposit FROM the WATCH GLASS into a test tube. Dissolve this in a minimum amount of deionized water.
4. In a second test tube, place the same small amount of unheated NH_4Cl FROM the JAR, and also dissolve this in a minimum amount of deionized water.
5. Add two drops of 0.1 M $AgNO_3$ solution to each test tube and compare the results.
6. Scrape the rest of the white deposit from the watch glass into the waste container in the hood.

E. Can Experiment

1. Obtain 2 clean, dry aluminum cans. Get a blue tub and fill almost full with tap water, adding several pieces of ice to make the water cool.
2. Take one can and hold it with crucible tongs upright over a lit Bunsen burner flame for two minutes keeping the can in motion so it does not melt. Immediately turn the can upside down and quickly plunge it into the bucket as deep as you can. Record your observations on your report sheet.
3. Add 10 mL of water into another can, then repeat the procedure in step 2. Heat until steam is coming out of the top of the can. Again quickly invert the can deep into the bucket of cool water. Record your observations in the data table on your report sheet.
4. Put your cans in the hood to recycle or in a recycling bin.

> ***Waste disposal**: Dispose of all waste in the waste container in the hood. Wash and rinse all of your test tubes, shake out any excess water from the inside of each, and dry the outside of each. Make sure the gas in your area is turned off. Use paper towels to wash then wipe up your entire lab bench before leaving lab.*

F. Water and Electricity: DEMO

The electrolysis of water will be demonstrated. A gas is formed in the two tubes. Is the gas steam on both sides OR hydrogen gas on one side and oxygen gas on the other side? Your instructor will demonstrate.

G. Animations http://www.visionlearning.com/library/module_viewer.php?mid=120

Your instructor will show animations to help you answer the questions.

GCC CHM 107LL Report

Chemical and Physical Changes

Name: ___________________________

Partner: __________________________

A. Copper Carbonate and Heat

	Unheated Sample	Heated Sample
Appearance of Sample		
sample + 2M HCl (aq)		

The evidence indicates that heating copper carbonate results in a ____________ change. (physical or chemical)

B. Silver Nitrate and Copper Metal

	Unexposed to $AgNO_3$ solution	Exposed to $AgNO_3$ solution
Appearance of Copper metal		

	Original 0.1M $AgNO_3$	$AgNO_3$ exposed to Cu metal
Appearance of Solution		
sample + 3M NH_4OH		

The evidence indicates that mixing silver nitrate and copper metal results in a _____________ change. (physical or chemical)

C. Magnesium Ribbon and Heat

	Unburned Sample	Burned Sample
Appearance		
sample + 2M HCl (aq)		

The evidence indicates that heating magnesium metal results in a ____________ change.

D. Ammonium Chloride and Heat

	Unheated Sample	Heated Sample on watch glass
Appearance		
sample + $AgNO_3$		

The evidence indicates that heating ammonium chloride results in a __________________ change.

E. Date Table for Can Experiment

Observations of the empty can when placed in the cool water after heating:
Observations of the can with 10 mL of water when placed in the cool water after heating:

F. Water and Electricity

Observations:

Formula for the liquid in the apparatus: ___________________

Is the gas produced steam or hydrogen and oxygen gas? Circle one: H_2O or H_2 and O_2

The observations indicate that the electrolysis of water produces a ______________ (physical or chemical) change.

G. Animation

The chemical formula for ice is ____________.

The chemical formula for water is ______________.

The chemical formula for steam is _______________.

Going between these three states of matter such as freezing water, melting ice, and boiling water are all _____________ changes. (physical or chemical)

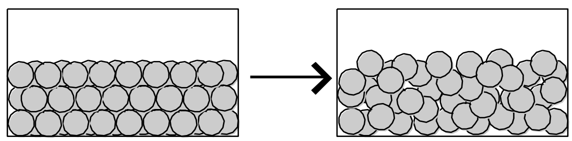
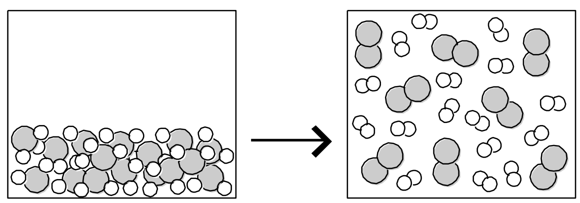
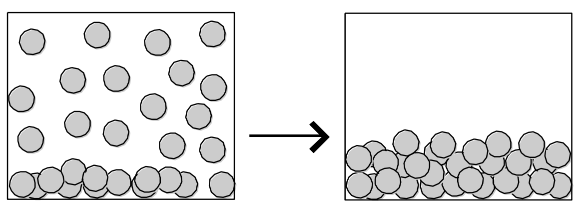
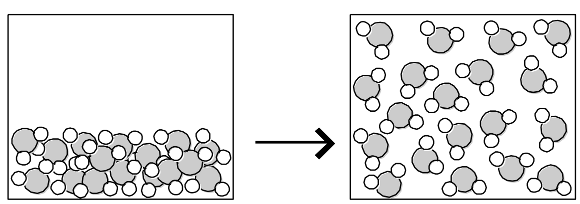
QUESTIONS:

1. A sample of table salt is dissolved in a glass of water. Think about how the water will taste now.

   The process of salt dissolving in water is a ___________________ (physical or chemical) change.

2. Explain the difference in behavior of the heated cans with AND without the water. How is a phase change involved in what you observed for the can with water?

3. For each of the following sets of images, indicate if the change shown is a **chemical** or a **physical** change. The first one has been completed as an example. Each circle represents an atom.

A. These images represent a ____physical____ change.	
B. These images represent a ________________ change.	
C. These images represent a ________________ change.	
D. These images represent a ________________ change.	

4. Give the letter for the set of images in #3 above that represents the descriptions below:

_____ Water boiling: $H_2O(l) \rightarrow H_2O(g)$

_____ The electrolysis of water: $2\ H_2O(l) \rightarrow 2\ H_2(g) + O_2(g)$