

**LAB:** #1

**DATE:** 11<sup>th</sup> September, 2007

**TITLE:** Physical and Chemical Properties/Changes

**OBJECTIVES:** 1. To observe the physical and chemical properties of several substances.  
2. To decide whether certain observed changes are physical or chemical.  
3. To experience several methods of separating mixtures.

**MATERIALS:**

1. ring stand, ring, gauze	12. Bar Magnet
2. burner	13. Distilled water
3. stirring rod	14. Table sugar (sucrose)
4. magnesium ribbon	15. 100 mL beaker
5. Table salt (sodium chloride)	16. 250 mL beaker
6. spatula	17. sand
7. baking soda (sodium hydrogen carbonate)	18. evaporating dish
8. filter paper, funnel	19. vinegar
9. Silver Nitrate	20. test tube holder
10. Iron and Sulphur	21. 3 test tubes/ rack
11. lab coat and goggles	22. 6 M hydrochloric acid

**PROCEDURES:**

*A. The Physical Properties of Matter*

Obtain samples of the following compounds and record in your data section their physical states, colors and odors 9WAFt their odors to your nose—don't inhale directly above the sample):

Name	Chemical Formula
Table Salt	NaCl
Baking Soda	NaHCO <sub>3</sub>
Sucrose	C <sub>12</sub> H <sub>22</sub> O <sub>11</sub>
Sand	SiO <sub>2</sub>
Magnesium	Mg
Vinegar	HC <sub>2</sub> H <sub>3</sub> O <sub>2(aq)</sub>

*B. Physical and Chemical Changes*

1. Approximately 20ml vinegar was obtained in a 150 mL beaker. One scoop of baking soda was tossed into the vinegar. A burning splint was then quickly placed near the mouth of the beaker. Observations were recorded in the data section.
2. a.) Approximately 40 ml 3M HCl (concentrated hydrochloric acid) was obtained in a test tube.  
  
b.) A 2 cm sample of magnesium ribbon was placed into the test tube containing the hydrochloric acid. Observations were recorded in the data.

3.
  - a.) A small scoop of sucrose was placed into each of 2 test tubes.
  - b.) Distilled water was added to one of the tubes. The tube was flicked to mix as it was shown in class and observations were recorded in the data section.
  - c.) The second test tube containing sucrose was placed into a test tube holder and it was heated gently in a burner flame.
  - d.) The tube was observed carefully for changes. The tube was periodically removed from the flame and it was checked (waft) for any odor generated.
  - e.) The residue was heated in the test tube more vigorously for 1-2 minutes. The tube was removed from the flame and placed in a test tube rack to cool.
4.
  - a.) Approximately 1-2g sand and 1-2g table salt were combined into a dry, clean 100mL beaker. 30mL of tap water was added and the mixture was stirred with a glass rod. Observations were recorded.
  - b.) The mixture was filtered as shown in class. A piece of filter paper was folded in quarters. The paper was then opened to form a cone with one thickness of paper on one side and three thicknesses on the other. The filter paper was placed in a glass funnel and the funnel was then placed in a ring support attached to a ring stand.
  - c.) A 150mL beaker was placed below the funnel and the salt/sand/water mixture was poured into the funnel. The liquid that passed through was called the *filtrate*.
  - d.) 10mL of the filtrate was poured into an evaporating dish. The dish was set on a square of wire gauze supported by an iron ring attached to the ring stand. Using a gas burner and keeping the face away from the evaporating liquid, the dish was heated gently until the filtrate completely evaporated.
  - e.) The dish was allowed to cool. While the dish was cooling, the filter paper was removed from the funnel and both the dry residue in the evaporating dish and the wet residue on the filter paper were examined. Observations were recorded. The filter paper was then discarded into the waste basket.
5. 2 to 3 drops of silver nitrate solution were placed in each separate piece of paper. One piece of the paper was placed in a locker (dark) and the other was exposed in the sunlight. After 5 minutes, the two pieces of paper were observed and data was recorded.
6. 5g of iron filings and 8g of sulphur powder were placed in a mortar. The elements were grinded together with a pestle. The result substance was spread on a piece of paper and it was observed. A bar magnet was placed over the paper and observed as well.

### OBSERVATIONS, RESULTS, DATA:

Name	Chemical Formula	Physical State	Color	Odor
Table Salt	NaCl	Solid	white	Mild
Baking Soda	NaHCO <sub>3</sub>	solid	white	Mild
Sucrose	C <sub>12</sub> H <sub>22</sub> O <sub>11</sub>	solid	white	Mild sweet
Sand	SiO <sub>2</sub>	solid	brown	Odorless
Magnesium	Mg	solid	Dark grey	Odorless
Vinegar	HC <sub>2</sub> H <sub>3</sub> O <sub>2(aq)</sub>	liquid	Clear(transparent)	Pungent

### PHYSICAL PROPERTIES OF OBSERVED COMPOUNDS

Mixture	Observations
Baking Soda and Vinegar	<ul style="list-style-type: none"><li>- mixture fizzed</li><li>- white foam was produced</li><li>- burning splint at the top of the beaker out after about a minute</li></ul>

### CHANGES OBSERVED IN BAKING SODA/VINEGAR MIXTURE WITH LIGHTED SPLINT

Compounds	Observations
Hydrochloric acid (HCl) and Magnesium (Mg)	<ul style="list-style-type: none"><li>- mixture fizzed</li><li>- magnesium strip turned silver colored</li><li>- magnesium strip dissolved/disappeared</li><li>- white gas evolved</li></ul>

### THE REACTION OF HYDROCHLORIC ACID AND MAGNESIUM

Sucrose Test Tube #	Observations
#1- Water and Sucrose Solution	<ul style="list-style-type: none"><li>-sucrose particles dissolved in water.</li><li>- few sucrose particle visible after stir</li><li>-transparent solution formed.</li></ul>
#2- Heated Sucrose	<ul style="list-style-type: none"><li>-sucrose began to melt</li><li>-turned light brown color</li><li>-sweet odor detected</li><li>-after 1-2 mins of heating, sucrose bubbled, turned black color</li></ul>

### REACTIONS OF SUCROSE WITH WATER AND HEAT

<b>Mixture/Solution</b>	<b>Process</b>	<b>Observations</b>
Sand, salt and water	none	-salt dissolves in water -some sand particles settle at bottom, others float in suspension -mixture is murky
Sand, salt and water	filtration	-residue is sand -filtrate is salt water
Salt water	evaporation	-solute is salt -solvent is water -water evaporates -salt is left in dish -salt is white forming a layer or crust

OBSERVATIONS OF THE MIXTURE AND SEPARATION OF SALT, SAND AND WATER

<b>Residue/Solute</b>	<b>Observations</b>
Sand (residue)	-brown color -large and small particle sizes - moist -grain-like composition
Salt (solute)	-white color -tiny particle sizes -particles stucked together to form crust -dry -crystal-like composition

COMPARISON OF SALT SOLUTE AND SAND RESIDUE

<b>Compound</b>	<b>Condition</b>	<b>Change</b>
Silver Nitrate	Dark (locker)	None
Silver Nitrate	Exposed to light	-turned copper brown color -black edges around brown -paper was dry

REACTIONS OF SILVER NITRATE IN LIGHT AND DARK CONDITIONS

<b>Compounds</b>	<b>Change after grinding</b>	<b>Change with magnet</b>
Iron filings and Sulphur powder	- poweders mix together - turns olive green color	- iron filings attract to magnet - sulphur powder remains unchanged

## OBSERVATIONS OF IRON FILINGS AND SULPHUR POWDER AFTER GRINDING AND MAGNET ATTRACTION

**DISCUSSION:** In this lab the physical and chemical properties of given substances were investigated along with the determination of chemical/physical changes observed in certain mixtures. Separating methods were also used to separate certain mixtures. As a result, these three objectives were completed successfully.

In the first experiment, a 2cm magnesium ribbon was added to 4ml 3M of hydrochloric acid. The resulting reaction caused the mixture to fizz and dissolved the magnesium strip. This was found to be a chemical change due to the fact that an acid (HCl) reacted with a metal (Mg). From the reaction the magnesium dissolved due to the production of hydrogen (white gas visible) in the test tube; moreover, the magnesium was converted into aqueous magnesium chloride and thus no solid was visible after the reaction. The second experiment, in which 2 test tubes were filled with sucrose, one also with water and the other heated, showed two distinct characteristics of table sugar. When water and the sucrose were stirred it was observed that the sucrose molecules dissolved into the water. This physical change occurred due to the fact that the sugar, acting as a solute, dissolved into the solvent, water, in turn forming a homogenous mixture that was uniform throughout. Also, the fact that no chemical means is needed to separate such a solution proves that it was a physical change occurring. Secondly, when the sucrose was heated it was observed that after a certain amount of time, the sucrose melted and turned color. This was due to the fact that sucrose has a low melting point and it reached this point in the experiment thus causing it to change state. This was seen as a physical change as well due to the fact that the identity of sucrose was not changed chemically, only its state.

As the third experiment was conducted, a mixture of sand, salt and water was combined and separated to observe any sort of change. When the three substances were combined it was found that the salt dissolved in the water while the sand remained the same. The salt again, acted as a solute and the water as a solvent thus producing a homogenous solution and a physical change in the salt; however, because the sand did not dissolve into the water, it was concluded that the sand particles floating in the water formed a suspension (mixture in which each substance keeps its own identity and characteristics). When filtration was performed the sand was left on the filter paper a residue while the filtrate of salt water was found in the beaker. The sand particles were too large to fit in the spaces of the filter paper and thus could not pass into the beaker, but the filtrate of salt and water, because it was a liquid solution, it passed with ease. After evaporation was complete, the solvent was evaporated and only the salt was left in the dish. This was so because the water had a lower boiling point than salt and thus evaporated into the atmosphere and left the salt to collect in the dish. This was found to be another physical change due to the fact that salt was returned to its original state.

The next experiment involved the reaction of silver nitrate with both light and dark conditions. The silver nitrate in the dark did not show any change at all, but the one exposed to sunlight showed significant chemical change. The fact that it turned copper brown and black edges proved that silver nitrate is very sensitive to light. Because the light hit the silver nitrate it reacted with positive silver ions reducing them to silver metal. This caused the darkened areas on the paper that were observed.

Lastly, when iron filings and sulphur powder were mixed it produced an olive green powder. This physical change occurred due to the fact that there was no reaction between

sulphur and iron filings thus both remained unchanged but mixed. When the magnet was passed over the powder all iron filings, due to their metallic attraction to magnetic fields, all iron filings attached themselves to the magnet leaving only sulphur powder again.

Sources of error may have included the fact that the wafting of certain substances for odors were faulty in the view that the scent was so mild it could not be detected easily with olfactory senses; moreover the actual process or reaction of silver nitrate with light was not observed in step by step detail resulting in some uncertainty or poor clarity in results. Nevertheless, the conclusions were reliable due to the fact that each experiment was carried out in a systematic and precise way. Also, the fact that all results matched theoretic values and prior knowledge of the reactions occurring proved their acceptability in the lab.

**CONCLUSION:** All objectives were achieved successfully as several experiments were conducted to prove their reactions and changes. The first reaction with baking soda and vinegar was a chemical change due to the fact that the solution fizzed forming a new one and gas evolved thus outing the splint. The second reaction of HCl and Mg was chemical as well because magnesium dissolved and hydrogen gas evolved (both results of a chemical reaction between magnesium and HCl). The third conclusion drawn was the fact that sucrose mixed with water was a physical change. This was so because even though the sucrose dissolved it did not change chemically and could have been separated from the water back to its original form; moreover, when sucrose was heated it was another physical change as it changed state but remained the same compound, sucrose.

Physical changes were also observed in the sand, salt and water mixture. The salt was ultimately extracted from the water through evaporation proving it was a physical change. After this, when the silver nitrate was placed in the sunlight a chemical change occurred as light reacted with silver ions thus changing the color of silver nitrate. Lastly, a final physical change was observed in the grinding of iron filings and sulphur powder because when the magnet attracted iron filings it showed that the iron did not change its identity but only mixed in with the sulphur powder.