Physical and Chemical Changes

One of the basic areas of interest for chemists is the study of the regrouping of atoms to form new substances. In order to determine if such a chemical change has occurred, there should be a change in the properties of the reactants which can be observed. The reaction, for example, of two colorless solutions to produce a mixture of two new colorless solutions could be quite difficult for us to observe. It would be much easier to follow the course of a reaction if one of the following occurred:

1. An unexpected color change occurred during the reaction.

2. One of the new materials was a gas which was insoluble in the solution and escaped to the atmosphere as bubbles.

3. One of the new materials was a precipitate which settled out of solution.

4. A characteristic odor either appeared or disappeared.

5. The temperature of the mixture changed significantly. This would indicate an energy transfer during the reaction. If the temperature increased, the reaction would be exothermic. If the temperature decreased, the reaction would be endothermic.

Other changes which only involve changes in form or appearance are called physical changes. These do not produce new substances but only change the physical properties of the material; for instance, when wheat is ground to make flour or when water is frozen to make ice.

EXPERIMENTAL PROCEDURE:

In each of the following reactions, make enough observations to enable one to determine if a chemical or physical change has occurred. These should include temperature, odor, and sight observations, at least. The properties of any gases should be listed. These should be compared to the descriptions of the gases previously listed on the pre-study sheet.

Remember to discard all heavy metal wastes and organic wastes in the appropriate container. Your instructor will provide specific instructions for today's lab.

Lab #3

DATA SHEET

NAME _____SECTION_____

EXPERIMENT	OBSERVATIONS	**CONCLUSION:** Indicate whether a chemical or physical change has taken place. Indicate whether or not a gas has formed. If a gas has formed, identify it by name.
1. Heat a few salt crystals (KCl) in a test tube over a Bunsen Burner		
2. Place a few crystals of potassium chlorate ($KClO_3$) and a very small pinch of manganese dioxide (MnO_2) in a dry test tube. Rotate to mix, then gently heat over a Bunsen Burner flame.		
3. Add a small piece of copper metal to 2 mL concentrated nitric acid (HNO_3).		
4. Burn a wood splint in air.		
5. Mix 2 mL of nickel sulfate solution ($NiSO_4$) with 2 mL of sodium sulfate (Na_2SO_4) solution.		

6. Add a small piece of magnesium ribbon to 2 mL of copper sulfate solution, ($CuSO_4$).		
7. Add 2 mL of salt (KCl) solution to 2 mL of silver nitrate solution ($AgNO_3$).		
8. Add 0.5 g of sodium acetate ($NaC_2H_3O_2$) to 5 mL of distilled water in a test tube. Shake. Take the temperature of the solution before shaking and after shaking.		
9. Place 5 mL of dilute hydrochloric acid (HCl) in a large test tube. Place a thermometer in the acid and then add 5 mL of sodium hydroxide solution (NaOH). Read the temperature before and after adding the NaOH.		
10. a) Gently heat a few crystals of $CuSO_4 \cdot 5H_2O$ in a test tube. b) Allow to cool, then add 2 drops of distilled water.	a) b)	a) b)
11. Place a small piece of calcium carbide (CaC_2) in a medium test tube. Add 5 mL of distilled water. Collect any gas given off in a large test tube inverted over the smaller one.		
12. Burn the gas generated in step number 11, above.		

13. Drop a piece of zinc in 5 mL of dilute HCl.		
14. Mix 5 mL of dilute HCl with 0.5 g of Na_2CO_3 (sodium carbonate).		
15. Mix 3 mL of iron chloride ($FeCl_3$) solution with 6 drops of potassium thiocyanate (KSCN) solution.		

Lab #3

PRESTUDY

NAME_____ SECTION_____

Chemical and Physical Changes

1.(3 points) Classify the following as chemical or physical changes:

a. Making a mixture of cinnamon and sugar. _____

b. Mixing red paint with a yellow substance to form blue paint. _____

c. Making bread from scratch. _____

d. Burning wood in a fireplace. _____

e. Adding sugar to your coffee. _____

f. Placing an egg in a hot frying pan. _____

2.(7 points) Look up the properties of the following gases in the Handbook of Chemistry and Physics, the Merck Index, your text book, or any other suitable reference. Fill in the following table:

Gas	**Supports Combustion**	**Burns**	**Odor**	**Color**
(a) oxygen - O_2				
(b) nitrogen - N_2				
(c) hydrogen - H_2				
(d) nitrogen dioxide - NO_2	No	No		
(e) carbon dioxide - CO_2				
(f) sulfur dioxide - SO_2	No	No		
(g) acetylene - C_2H_2				

Supports combustion means that it must be present in order for burning of other substances to take place.

If a substance has an odor or color, describe it.