

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Remember that happiness is a way of travel- not a destination.**  
**--Roy M. Goodman**

**Title: Hot and Cold**

In this lab activity you will study the energy associated with physical and chemical changes. This energy is usually in the form of heat flowing out of or into a physical reaction or chemical reaction.

The experiments consist of observing nine phenomena. During each phenomenon, you will make qualitative rather than quantitative observations. You will measure neither the quantity of heat involved nor the exact temperatures. Instead you will use your sense of touch to determine the transfer of heat energy to and from various physical and chemical changes.

**Materials**

acetone in dropper bottles	spatula of NaOH
alcohol in dropper bottles	2 spatulas of $\text{NH}_4\text{Cl}$
concentrated sulfuric acid in dropper bottles	spatula of $\text{Ba}(\text{OH})_2$
6 M HCl in dropper bottles	spatula of $\text{CaCO}_3$
6 M NaOH in dropper bottles	spatula of anhydrous $\text{CuSO}_4$

**It is incredibly important that you wear SAFETY GOGGLES**

**Procedure**

1. **Before** you come to the lab, make sure you have prepared your lab notebook. In this case all you need to do is prepare a table to collect observations from each of the activities that you will do.
2. As you perform each of the following activities, use your sense of touch to discover whether heat is released or absorbed during the reactions. After each phenomenon, record your findings. **Note: make sure that the substances are well mixed before making your observations.**

- Phenomenon -1: Moisten some cotton with alcohol and spread it on the back of your hand.
- Phenomenon -2: Moisten some cotton with acetone and spread it on the back of your hand.
- Phenomenon -3: Fill a test tube 1/10 with water then add a spatula of NaOH to the water.
- Phenomenon -4: Fill a test tube 1/10 with water then add a spatula of ammonium chloride ( $\text{NH}_4\text{Cl}$ ) to the water.
- Phenomenon -5: Fill a test tube 1/10 with water then add about 20 drops of concentrated  $\text{H}_2\text{SO}_4$ .
- Phenomenon -6: Add about 20 drops of 6 M NaOH to a test tube followed by about 20 drops of 6 M HCl.
- Phenomenon -7: Add a spatula of  $\text{CaCO}_3$  to a test tube followed by about 20 drops of 6 M HCl.
- Phenomenon -8: Add a spatula of  $\text{NH}_4\text{Cl}$  and to this add a spatula of  $\text{Ba}(\text{OH})_2$ .

Phenomenon -9: Add a spatula of anhydrous  $\text{CuSO}_4$ . Add water drop-wise (use your dropper pipette).

**Data:**

## **Analysis**

Each experimental phenomenon which you have just investigated has involved a “system” (**i.e.** the situation under investigation) and a set of “surroundings” (**i.e.** everything else outside the situation). For example, for phenomenon -1 *the alcohol evaporating* is the system and everything else, including you, are the surroundings. For each experimental phenomenon please indicate what is the “system” and what are the most important “surroundings”. In addition, also indicate whether there was heat flow from the surroundings into the system (endothermic) or from the system to the surroundings (exothermic).