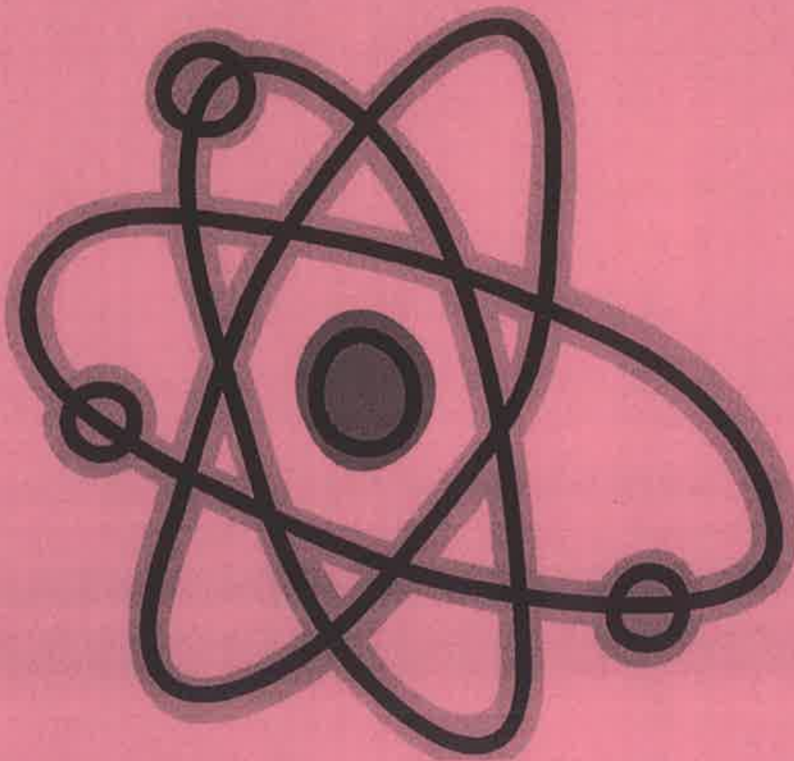
UNIT TWO:



Physical Behavior of Matter and Energy

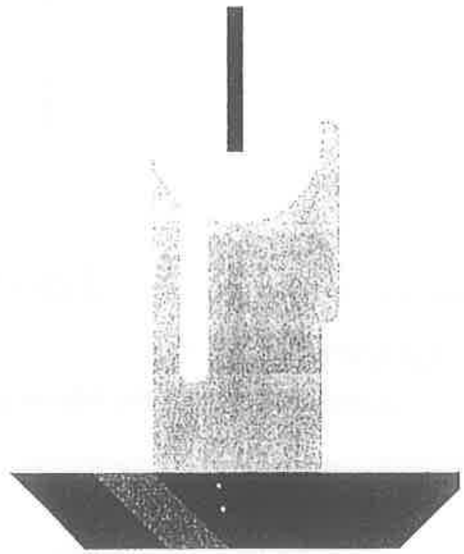
Name:______________________________ Date: __________

QUALITATIVE OBSERVATIONS OF A CHEMICAL REACTION

INTRODUCTION:

Scientists rely heavily on experimentation. A good scientist must observe and interpret what is happening. Observing means you are using the senses such as smelling, seeing, touching, hearing and sometimes tasting.

NEVER TASTE CHEMICALS UNLESS INSTRUCTED TO DO SO BY YOUR TEACHER!



When scientists make observations, they try to be objective. Being objective means putting aside any preconceived notions. Scientists are interested in what *really* occurs, not what they *wish* would occur. After observations are made, scientists must make interpretations. Interpretations are based on previous knowledge and experience. Because people have different experiences, one scientist may interpret observations in one way while another may interpret the same observation differently. When we interpret, we attempt to make sure out of our observations. Scientists never assume that their interpretations are correct until they test them fully and repeatedly. After completing testing, scientists then come to their conclusions. In this investigation, you will make some qualitative observations of chemical reactions.

PURPOSE:

SAFETY:

Make a list of all safety procedures related to this lab.

MATERIALS:

250 mL beaker	Glass square	Metric ruler	Rubber stopper
125 flask	microspatula	microslide	Safety goggles
Candle & matches	string	toothpicks	Aluminum foil

PROCEDURE:

In this experiment, you will be working with an open flame. Tie back long hair and secure loose clothing. Also, wear safety goggles at all times when working in the lab. Be sure all matches and burned materials are completely extinguished before they are discarded. Make sure all observations are recorded in your lab notebook.

1. Note appearance, odor, and feel of the unlighted candle
2. Heat the bottom of the candle and secure it to a glass square on your lab bench. Light the candle and allow it to burn for several minutes. Note any changes. Briefly describe the burning candle.
3. Blow out the flame and immediately place a lighted match in the "smoke" about 2 cm above the wick. See Figure 1. Note the result.

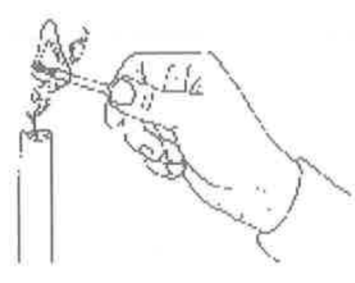


Figure 1

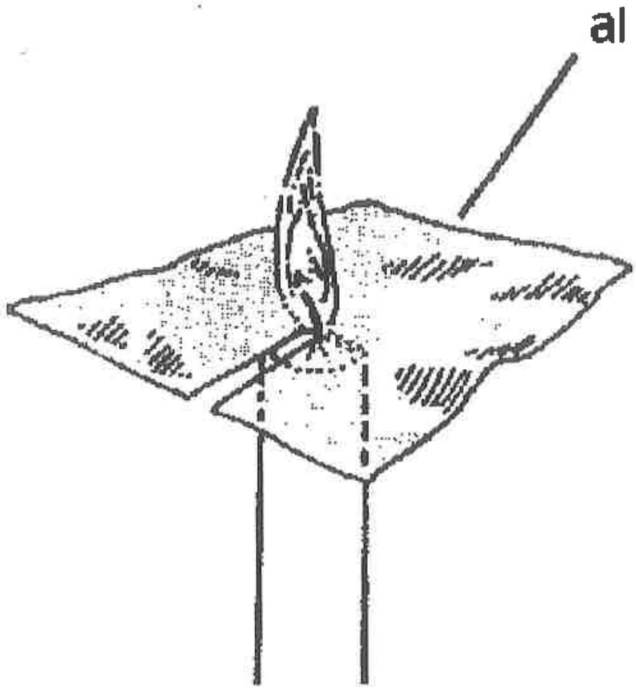


Figure 2

4. Use the microspatula to transfer a small amount of liquid from the bowl of the candle onto a microslide. Try to light it and note the result.

5. Place a toothpick into the soft candle next to the unlighted wick to form a wooden wick. Light the toothpick and note the result.

6. Place a length of string about 4 cm long on the glass square. Try to light it and note the result.

7. Make a slit in a piece of aluminum foil. See Figure 2. Light the candle. Place the foil between the base of the flame and the liquid in the candle bowl. Note the behavior of the flame.

8. Invert a 250 ml beaker over the lighted candle. See Figure 3. Note any substance on the inside of the beaker. Test the liquid with cobalt chloride paper.

9. Invert a 125 ml Erlenmeyer flask over the lighted candle for several minutes. Remove the flask, turn it right side up, and add about 10 ml of the clear limewater solution. Stopper and shake the flask. Note any change in the limewater solution.

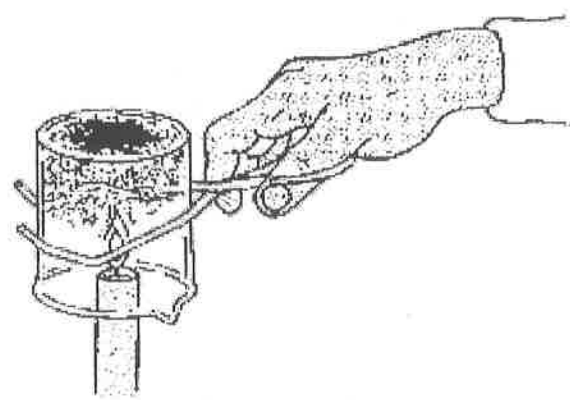


Figure 3

QUESTIONS:

Copy and complete the following questions in your lab notebook.

1. What phases (solid, liquid, gas) are present in the unlighted candle?
2. What phases (solid, liquid, gas) are present in the burning candle?
3. What phase appears to take part in the chemical reaction?
4. What pieces of evidence suggest that a chemical change has occurred?
5. What pieces of evidence suggest that a physical change has occurred?
6. What other observations did you make during this lab?

Name:______________________________ Date: __________

THE HEAT OF FUSION OF ICE

PURPOSE:

INTRODUCTION:

Melting and freezing are behaviors that are characteristic of pure substances and give them their identity. As energy is added, pure solid water (ice) at 0° C changes to liquid water at 0° C. To study this phase change, experimenters use a simple calorimeter, an insulated container composed of two separate chambers that can be used to measure the heat flow between two substances. When thermal heat energy is exchanged between the two chambers, heat will always from the substance with a higher temperature to the substance with a lower temperature. This exchange takes places until both chambers are at the same temperature. By measuring the temperature change and using the formula $Q=mC\Delta T$, an experimenter can calculate the amount of heat absorbed or released during this phase change from solid ice to liquid ice at 0° C.

Unlike most calorimeters that are two chambered, this experiment will use a Styrofoam cup calorimeter with only one chamber. The ice will be placed directly into a measured amount of water. By measuring the temperature change (ΔT) of the water, the quantity of heat changed between the ice and water can be calculated. Using these experimental data, the heat of fusion of ice can then be calculated.

SAFETY:

MATERIALS:

250 mL Beaker, 100 mL graduated cylinder, Hot Plate, Styrofoam cup, Thermometer, Beaker Tongs, Goggles, Water, Ice, Glass Stirring Rod and electronic balance.

PROCEDURE:

1. Place approximately 125 mL of water into a 250 mL beaker and heat it to approximately 60° C. Do not set the hot plate higher than 7. Do not leave the thermometer in the beaker on the hot plate. Periodically check the temperature of the water.
2. Measure exactly 100 mL of heated water in a graduated cylinder and pour into a Styrofoam cu. Record this volume in your data table as V_1. Make sure to record your answer to significance.
3. Measure the temperature of the water and then immediately add ice cubes. Record this data in the data table as T_1. Make sure to record your answer to significance.
4. Using the glass stirring rod, stir the ice water mixture carefully and take temperature readings every minute until the temperature reaches 5° C. The calorimeter should contain ice at all times. If the last of the ice appears to be almost gone, add one ice cube at a time. Continue to stir, adding ice as necessary until the temperature reaches 5° C. Record this final temperature as T_2.
5. Once the temperature has reached 5° C, immediately remove any un-melted ice. Allow any water removed to drain back into the cup. Measure and record the volume of the water in the calorimeter. Record this data as V_2.
6. Make sure all data collected and calculations are included in the observations section.

DATA:

V_1	
V_2	
T_1	
T_2	
M_1	
V_{ICE}	
M_2	
ΔT	
Q_1	
Q_2	
HF_{ICE}	

DATA CALCULATIONS: *SHOW ALL WORK AND UNITS!! RECORD ALL DATA!!*

1. Using the density of water (1 g/ml) find the mass (M1) of the original volume (V_1) of the water. Record in the data table above
2. Determine the volume of the water due to the melted ice (Vice= V_2-V_1. Record in the data table above.
3. Find the mass (M_2) of this volume (Vice) of water. Record in the data table above.
4. Find the change in temperature of the water ($\Delta T = T_2 - T_1$). Record in the data table above.
5. Find the heat (Q_1) lost to the original mass of the water ($Q = mC\Delta T$). Record in the data table above.
6. Find the heat (Q_2) gained by the ice. (Hint where does the heat come from?) Record in the data table above.
7. Using Q_2, determine the heat of fusion (hF ice) of ice (Q=mhf). Record in the data table above.
8. Using the known heat of fusion of ice, calculate the percent error for the experimental heat of fusion of ice (hFice) recorded above.

QUESTIONS

1. What are the possible sources of error in this experiment?
2. How might the use of a true calorimeter reduce some of these errors?
3. In what way does this experiment make use of the Law of Energy Conservation?
4. Define the following terms:
   a. Exothermic
   b. Endothermic
   c. Heat of Fusion
   d. Specific Heat Capacity
5. Is the process of melting endothermic or exothermic? Explain your answer.

Name:____________________________ Date: __________

WORKING WITH THE BUNSEN BURNER

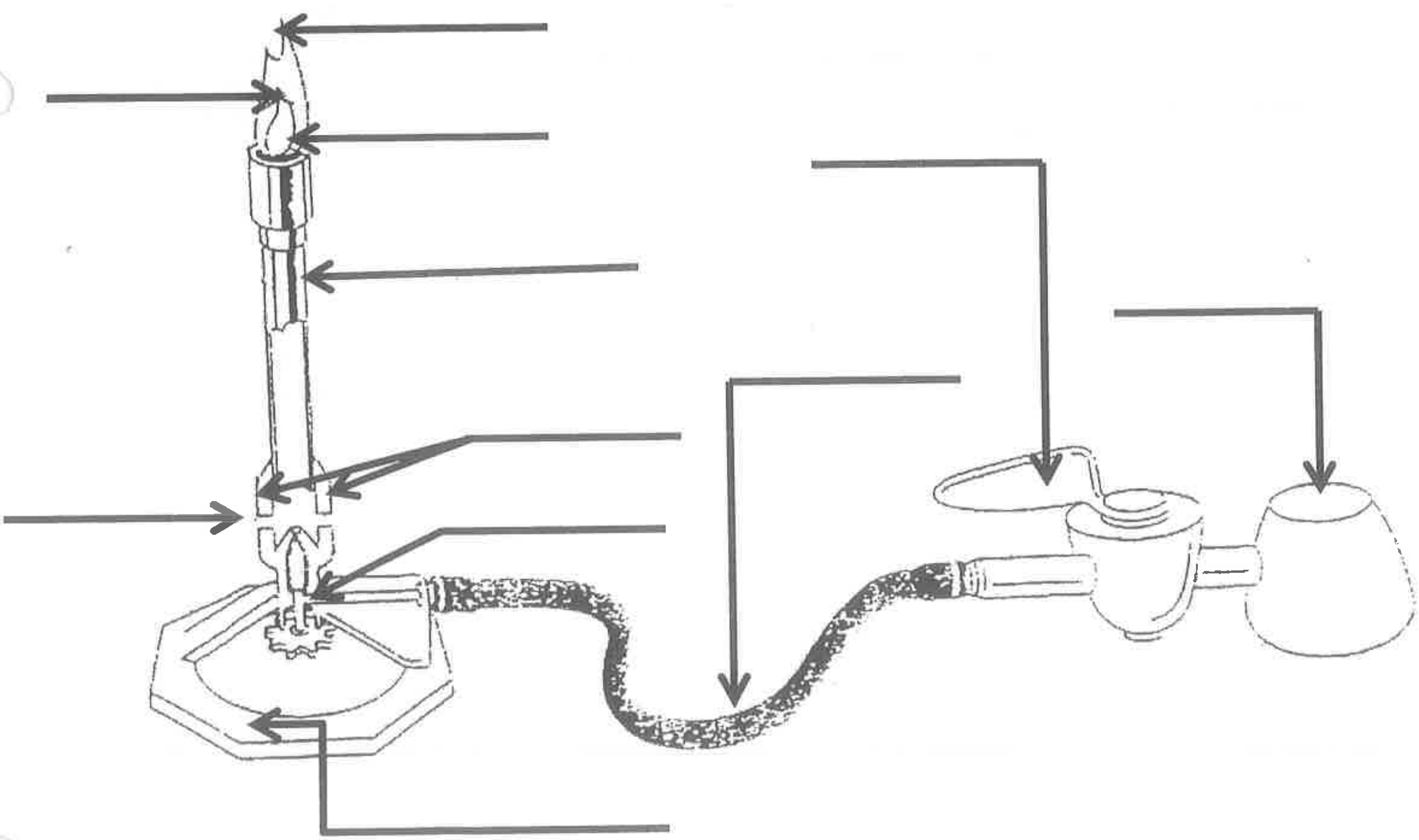
PURPOSE:
To learn how to use the Bunsen burner safely.

INTRODUCTION:
In chemistry class, the main heat source for experimentation is the Bunsen burner. There are a number of safety rules for using the Bunsen burner that must be learned and always practiced. The Bunsen burner provides heat through the use of a controlled combustion reaction.

SAFETY:

MATERIALS:
Bunsen Burner, striker, wire gauze, crucible tongs, forceps, crucible lid, triangular file, test tube and test tube holder.

PARTS OF THE BUNSEN BURNER:



WORD BANK:

Barrel	Air-port	Spud,	Collar	Gas Hose	Gas Valve
Gas Line	Hottest Flame	Reducing Flame	Oxidizing Flame		

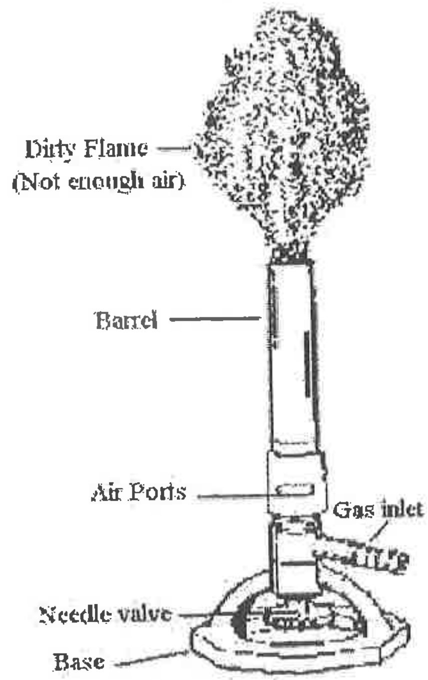
PROCEDURE:

1. Obtain a Bunsen burner and light the burner as instructed.
   a. Connect the hose to the table outlet. Clear the area of all flammable objects (including clothing and your hair!)
   b. Turn the barrel so that the air intake openings are closed, and then open them three full turns.
   c. Close the gas flow valve at the bottom of the burner, and then open it three full turns.
   d. Put on your goggles, open the gas valve on the table and light the burner using a striker.

2. Adjust the spud so that the flame is the approximately 7 to 8 centimeters high (or about 3 inches)

3. Turn the collar in the direction that decreases the air supply. What is the color of the flame at this point?

4. Turn the collar in the direction that increases the air supply. What is the color of the flame at this point?



5. Using the crucible tongs, hold a clean, dry crucible lib in the blue flame for about 15 seconds. Remove the lid from the flame and decrease the air supply to produce a yellow flame. Hold the crucible lid in the yellow flame for about 15 seconds. Record your observations.

6. Adjust the collar to produce a blue flame. Hold the wire gauze with forceps above the flame and slowly lower the wire gauze toward the top of the burner. Glowing regions of the wire gauze indicate the part of the flame that is hot. Determine the hottest part of the flame based on the wire gauze. Record your observations.

QUESTIONS:

1. What is the function of the collar, the barrel and the spud?

2. What causes the flame from the burner to be yellow?

3. What should you do to make a yellow flame into a blue flame?

4. Why did the yellow flame deposit soot on the crucible lid but the blue flame did not?

5. How should a test tube be heated when using a bunsen burner?