Chemistry

Scarsdale Alternative School

Bunsen Burner Operation

Objective:
Learn how to operate, control and use a Bunsen burner in the chemistry lab.

Procedure:
See attached lab handouts

Lab Report:
Complete Lab Report Sheet
Conclusion

Due Date:

Experiment 1

Chemistry of Fire

Problem

What is the most efficient flame for a Bunsen burner? How is a Bunsen burner used to heat various substances?

Introduction

The Bunsen burner is the most common source of heat in the chemistry laboratory. Natural gas enters the burner near the base, rises through a barrel, mixes with air, and burns. By proper adjustments the most efficient flame can be obtained.

The typical Bunsen burner contains the parts shown in **Figure 1**. Variations such as a combination collar and barrel are often seen. Look at your burner and identify each of the parts shown in **Figure 1**. Gather the materials given in the list below and begin your investigation of the problem.

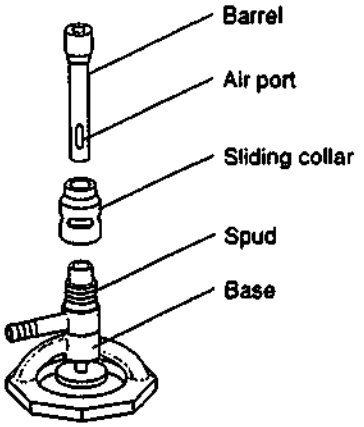

Figure 1
Parts of a Bunsen Burner

Prelaboratory Assignment

- ✓ Read the **Introduction** and **Procedure** before you begin.
- ✓ Answer the Prelaboratory Questions.
  1. Draw a Bunsen burner and label its parts.
  2. What is the proper color for a burner flame?

Materials

Safety goggles
Lab apron
Matches
Tongs
Copper wire
Stirring rod
Thermometer
Hot pad
Bunsen burner
Wire gauze
Test tube and holder
Ring stand and iron ring
Metric ruler
100 mL graduated cylinder
250 mL beaker

Safety 

1. Wear safety goggles and lab apron whenever working in the laboratory.
2. When using a Bunsen burner:
   - ✓ Confine long hair and loose clothing
   - ✓ Never leave a burner unattended
   - ✓ Do not reach over the burner
   - ✓ Make sure no flammables are near the burner
3. When heating test tubes:
   - ✓ Do not point the open end toward any person
   - ✓ Do not heat the bottom of the test tube

Procedure

Part 1 Use of the Burner

Setting the flame

1. Be sure the hose is securely fastened to both the burner and the gas outlet.

2. Strike the match *before* turning on the gas. Turn on the gas to the maximum open position and light the burner.

3. The flame can be adjusted by turning the barrel (or opening the air ports).
   a. If the flame is a yellow color, use the barrel and air ports to adjust it until it is completely blue and shows an inner cone as illustrated in **Figure 2**.

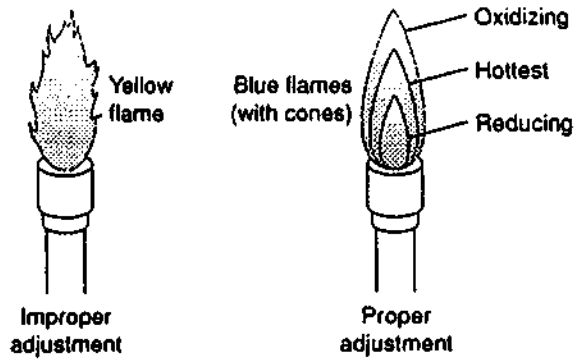

Figure 2
Adjusting a burner flame

b. If the flame is blue without the inner cone, adjust the barrel or air ports until an inner cone is visible.

The hottest part of the flame

4. Use tongs to hold a piece of copper wire and insert it into the flame just above the top of the barrel.

5. Slowly lift the wire up through the flame. Observe and record the color of the copper wire at various heights. The wire is hottest when it glows red. Record which is the hottest part of the flame.

6. Remove the wire from the flame and allow it to cool on a heat resistant surface.

Heating a test tube

7. Half fill a test tube with tap water. Apply heat to the side of the test tube as shown in **Figure 3**. Notice that the top of the test tube is at an angle and pointed away from all people in the area.

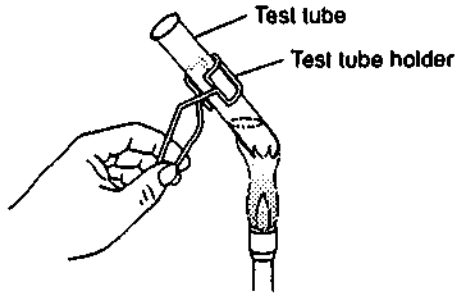

Figure 3
Heating a liquid in a test tube

8. If heat is applied directly to the test tube, the contents will shoot out of the tube or "bump". A slow smooth movement of the tube in and out of the flame should be used to heat the contents evenly. Once the water is boiling, remove the test tube from the flame, discard the water into the sink and set the tube and holder aside to cool.

Heating a larger volume of liquid

9. To heat larger amounts of water use the set-up shown in **Figure 4**. Assemble this apparatus now for use in the next part of your investigation. Place the bottom of the beaker exactly 15.0 cm above the top of the Bunsen burner. Also measure the distance of the ring from the surface of the lab bench as a reference for future adjustments of the ring height.

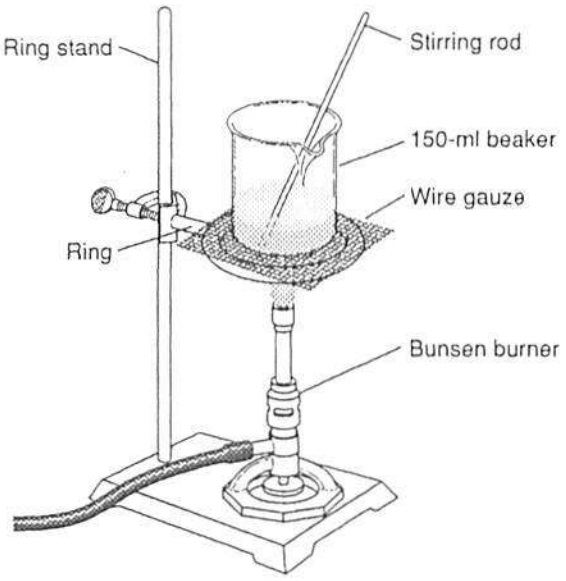

Figure 4
Heating a larger amount of liquid

Part 2 Efficiency of the Bunsen Burner

If you are not using a Report Sheet for this experiment make a Data Table for this section with the headings shown below:

Trial	Volume of water	Height of beaker over burner	Temp Reading 1	Temp Reading 2	Temp Reading 3	Temp Reading 4	Temp Reading 5

1. Use a table to record the data for five trials. Heat each sample for five minutes taking the temperature at one-minute intervals.

2. Light the burner and adjust the flame properly. **Note:** It is important that the burner not be turned off or changed until all five trials have been completed.

3. For each trial do the following:
   a. Measure 80 mL of water using a graduated cylinder and pour it into the beaker.
   b. Place the burner under the beaker and heat the water for five minutes taking the temperature of the water every minute.

c. For each temperature reading:
    1. The water should be stirred with a glass stirring rod just before each reading.
    2. The thermometer should not be used to stir the water, nor should it be allowed to rest on the bottom of the beaker.
    3. The temperature will change very rapidly when the thermometer is first placed in the water. Wait to record the temperature until the rate of change is slow.
    4. Remove the thermometer and carefully place it on the table. Thermometers break very easily! Do not shake these thermometers or wave them in the air.
d. After the last temperature reading remove the burner from under the beaker. Remember not to turn it off!

4. After each trial is complete, carefully remove the beaker (use tongs or hot pad) from the stand and pour the water into the sink. Thoroughly rinse the beaker with cool water to bring it back to room temperature.

5. Lower the ring about 2.5 cm from the previous setting. **Be careful, the ring is hot!** Record the new height accurately on your data table.

6. Repeat steps 2 – 5 for each remaining trial. Be sure to record the data after each measurement.

Cleaning Up

1. Any broken glass should be carefully placed in a labeled container for broken glass.
2. Carefully clean your glassware and return all of your equipment to its proper location.
3. Wash your hands before leaving the laboratory.

Analysis and Conclusions

Complete the **Analysis and Conclusions** section for this experiment either on your Report Sheet or in your lab report as directed by your teacher.

1. Make a graph of temperature versus time. Plot time on the x- axis (horizontal) and temperature on the y-axis (vertical). Place the plots for all of the trials on the same graph. Label each line with the height of the beaker above the burner.
2. Which line shows the most efficient heating of the water? Explain why you chose this line.
3. What are the advantages of using a blue flame instead of a yellow one for heating objects in the laboratory?
4. Where is the hottest part of the blue flame?
5. When heating a substance over a Bunsen burner where should the object be placed for most efficient heating? Why?
6. How does graphing the data help to determine the most efficient height for heating a liquid in a beaker?