

Introduction to the Chemistry Lab

This lab is to introduce you to the laboratory environment and equipment. The best way to become familiar with the equipment you will use in the chemistry laboratory is to handle it yourself. In this experiment you will learn how to adjust the laboratory burner, heat liquids, handle liquids and solids correctly, and filter a mixture.

I. The Laboratory Gas Burner

Objective: To learn to operate and use a laboratory gas burner.

Materials and Equipment: Paper matches, straight pins, copper wire, laboratory burners, rubber tubing, tongs, and evaporating dish.

Procedure: When different mixtures of gas and air are burned Laboratory gas burners will produce various kinds of flames. The most common laboratory gas burner is the Bunsen burner. The Bunsen burner has an adjustable vent for air flow. Examine your laboratory burner. Observe how the air vents can be adjusted. Connect your burner to the gas supply nozzle with a short piece of rubber hose, and close the air vents. Gas flow to the burner is controlled by the main gas valve. The flame you get when the air vents are closed is called a luminous, or cool, flame. It is seldom used for laboratory work. Using a pair of tongs hold an evaporating dish in the upper part of the luminous flame for 10-20 seconds and examine the dish surface.

Open the air vents slowly to admit air to the flame. Air drawn into the burner tube by the rapidly moving stream of gas mixes with the gas before entering the combustion region at the top of the burner. As air is introduced, the appearance of the flame changes from a sooty, luminous yellow to an almost invisible, non-luminous blue. Regulate the gas and air flow to give a steady flame that extends about 6 to 8 cm (1.5 to 2 inches) above the barrel of the burner and has a sharply defined blue inner cone. Holding a 10 cm piece of copper wire with tongs, insert the wire into the flame just above the top of the barrel. Lift the wire slowly upward in the flame, and hold the wire in the hottest part of the flame, at the top of the inner cone, for about 30 seconds.

The interior of the inner cone is unburned gas. To demonstrate this, turn off the burner without adjusting the air vents. Insert a straight pin through the stem of a paper match just below the match head, and hang the match in the center of the burner barrel. Turn on the gas, light the burner (careful not to accidentally light the match), and note what happens.

You can adjust the intensity of the flame by changing the gas flow and air vents simultaneously. You will learn how to control the burner flame by trial and error. For most laboratory work, you should adjust the burner so that the flame is free of yellow color and free of the roaring noise caused by admitting too much air. If the gas flow to the burner is too great or too much air is permitted to enter the vents, the flame will separate from the tip of the barrel, burn noisily, and eventually go out. To remedy this you should reduce both the gas flow and air flow to achieve the desired flame intensity. Occasionally, a burner will “strike back,” and the gas-air mixture will burn inside the barrel. When this happens, the burner is noisy, and the burner barrel becomes very hot. You should turn the gas off immediately and allow the burner to cool before you attempt to relight it. **Caution: Never leave a lit burner unattended. Always turn the burner off at the main gas valve when you have finished using it.**

II. Heating Methods

Objective: To learn correct and safe procedures for heating liquids in the laboratory.

Materials and Equipment: Matches, laboratory burner, medium test tube, test tube holder, 250 mL beaker, ring clamp, ring stand, wire gauze, test tube rack, and tap water.

Procedure: Heating a liquid in a test tube. Adjust the burner to give a gentle blue flame. Grasp a test tube, one third filled with water, with a test tube holder. Hold the test tube in a slanting position in the flame, and gently heat the tube a short distance below the surface of the liquid. **Caution: Never point the open end of a test tube you are heating toward yourself or anyone else working nearby. Never heat the bottom of the test tube.** Rock the tube back and forth through the flame as it is being heated, and bring the water to a boil. After the water has boiled, place the test tube in a test tube rack to cool.

Procedure: Heating a liquid in a beaker. Fasten a ring clamp securely to a ring stand. Place a 250 mL beaker, one third filled with water, on wire gauze resting on the ring. The wire gauze should be positioned so that it is in the hottest region of the flame for the fastest heating. For a slower rate of heating, reduce the intensity of the burner flame. **Caution: Never heat plastic beakers or graduated cylinders in a burner flame.**

III. Handling Liquids and Solids

Objective: To learn the correct way to transfer liquids and solids.

Materials and Methods: Wide-mouthed bottles containing free running table salt and caked table salt, 250 mL beakers, glass rods, spatula, bottle containing tap water, and watch glass.

Procedure: Transferring liquids. Small volumes are easily transferred with a dropper pipet. A large volume of a liquid is transferred from one container to another by directing its flow with a stirring rod.

Procedure: Transferring solids. Solid chemicals are usually stored in wide-mouthed screw-cap bottles. If the solid chemical flows freely, it can be poured or scooped out of the bottle. If the material has caked and does not flow freely, it must be loosened by shaking or broken into smaller pieces with a spatula so that it can be scooped out. Whenever the bottle cap is removed from the container, place it on the bench so that it cannot become contaminated. When you are finished with a chemical, replace the cap on the original container. **Caution: Do not return any unused chemical to its original container.**

IV. Filtration

Objective: To separate insoluble particles from a liquid by filtration.

Materials and Methods: Blackboard chalk, filter papers, ring stand, ring clamp, filter funnel, Buchner funnel, filter flask, glass rod, mortar and pestle, 250 mL beaker, water aspirator, and wash bottle filled with tap water.

Filtration is the separation of an insoluble solid from a liquid by pouring the mixture onto a barrier that allows the liquid but not the solid to pass through. The barrier is usually a piece of paper. The rate of liquid flow through the filter paper is assisted by gravity or vacuum.

Procedure: Gravity Filtration. Prepare a filter paper circle for gravity filtration by folding it in half and then in quarters. Now open the paper to form a cone with one thickness of paper on one side and three thicknesses on the other. Put the paper in a filter funnel, and place the funnel in a ring clamp on a ring stand above a 250 mL beaker. Moisten the filter paper with a small volume of water, and gently press the paper against the sides of the funnel to give a snug fit. If the correct size of filter paper is used, the top edge of the cone will be just below the rim of the filter funnel. The tip of the filter funnel should touch the inside surface of the collecting beaker and extends about an inch below the rim of the beaker. Pour the mixture to be filtered into the funnel; take care to stay below the top edge of the filter paper. The filtered liquid or filtrate is collected in the beaker, while the solid particles are retained in the filter paper cone.

Grind a small piece of chalk, about $\frac{1}{4}$ inch long, to a fine powder using a mortar and pestle. Transfer the powdered chalk to a 250 mL beaker, and add about 75 mL of water. Stir the mixture with a glass rod to make a suspension. Separate the chalk from the water by gravity filtration of 25 mL of the suspension. Carefully remove the filter paper and its contents from the filter funnel. Open the filter paper and allow the chalk to dry in the air.

Procedure: Vacuum filtration. Vacuum filtration is done using a Buchner funnel and filter flask. The funnel is fitted into the flask by means of a one-holed rubber stopper or sleeve of appropriate size. The side arm of the filter flask is attached to a water aspirator with a short length of thick walled rubber tubing.

Place a piece of filter paper of the correct size on the Buchner funnel, turn the aspirator on, and wet the filter paper with water. The filter paper should become securely fixed to the perforated base of the funnel. Using the same technique as in gravity filtration, transfer about 20 mL of the chalk suspension to the Buchner funnel. Continue to pull air through the chalk for a few minutes to dry it. When filtration is complete, detach the hose from the aspirator before turning it off to avoid drawing water into the trap.

Introduction to the Chemistry Lab Laboratory Report

1. Describe the burner flame when the air vents are closed.
2. When you hold an evaporating dish in the upper part of a luminous flame, what do you observe? Suggest a reason for your observation.
3. Where is the hottest region of the non-luminous flame?
4. What do you observe when the end of the copper wire is held in the hottest part of the burner flame for about 30 seconds?
5. Why doesn't the match head ignite when it is inside the blue inner cone?
6. What can happen to the flame if the gas flow is too great or too much air enters the air vents?
7. List the safety precautions you must take when heating a liquid in a test tube.
8. Why must a beaker containing a liquid be placed on wire gauze above a burner flame and not directly over the flame?
9. Explain why you must never boil a liquid in a plastic beaker above a burner flame.
10. How would you transfer a small volume of liquid?
11. When pouring a liquid from a bottle, why would it be recommended that you continuously hold the stopper from the bottle between your fingers and not set it down?
12. Describe a convenient way to transfer a very small amount of a solid chemical from a reagent bottle to another vessel.
13. Explain the term suspension. What is the composition of the suspension in this experiment? Explain the term filtrate. What is the composition of the filtrate in this experiment?
14. Why must the end of the filter funnel touch the inside wall of the collecting beaker in filtration?
15. If the filtrate in your experiment is not as clear as tap water, what is a possible explanation?