PART 5 MEASURING LIQUIDS

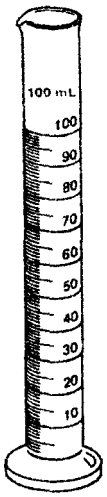


Figure 1-6

APPARATUS

graduated cylinder	pipet	buret clamp
ring stand	buret	beaker, 50 mL, 250 mL

MATERIALS

water

PROCEDURES

1. For approximate measurements of liquids, a graduated cylinder, as shown in Figure 1-6, is generally used. These cylinders are usually graduated in milliliters (mL). Such a graduated cylinder may read from 0 to 10 mL, 0 to 25 mL, 0 to 50 mL, or more, from bottom to top. It may also have a second row of graduations reading from top to bottom. Examine a cylinder for these markings.

2. For more accurate measurements, either the pipet or the buret is used. Pipets are made in many sizes and are used to deliver measured volumes of liquids. A pipet is fitted with a suction bulb used to withdraw air from the pipet while drawing up the liquid to be measured. See Figure 1-7. **Always use the suction bulb—NEVER pipet by mouth.**

3. Burets, fitted with either a stopcock, a pinch clamp, or a glass bead, are used for withdrawing any desired quantity of liquid to the capacity of the buret. Many burets are graduated in tenths of milliliters. See Figures 1-8 and 1-9. When using a buret, follow these steps:
   a. Clamp the buret in position on a ring stand. See Figure 1-10.
   b. Place a beaker, 250-mL, at the bottom of the buret. The beaker serves to catch any liquid that will be drawn off.
   c. Using a 50-mL beaker, obtain a quantity of the liquid you want to measure from the liquid's reagent bottle. (NOTE: In this first trial you will be using water.) Remember to carefully check the label of the reagent bottle before removing any liquid.

CAUTION
Safety goggles, gloves, and apron should be worn whenever you measure chemicals. Never pour a liquid directly from its reagent bottle into the buret. You should first pour the liquid into a small beaker (50-mL) that is easy to handle. Then pour the liquid from the small beaker into the buret. This simple method will prevent unnecessary spillage. Never pour any unused liquid back into the reagent bottle.

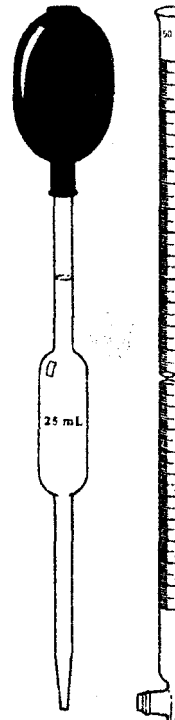


Figure 1-7

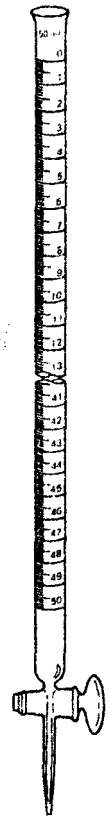


Figure 1-8

Figure 1-9

   d. Fill the buret with the liquid and then draw off enough liquid to fill the tip below the stopcock and bring the level of the liquid down to the scale. The height at which the liquid stands is then read accurately. Practice this procedure several times by pouring water into the buret.

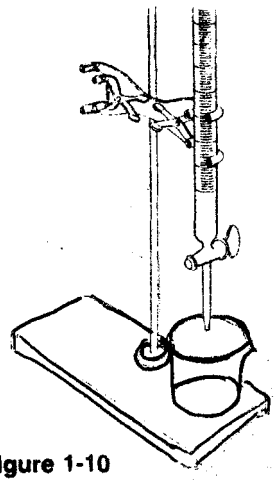


Figure 1-10

4. Observe that the surface of such a liquid is slightly curved, concave if it wets the glass, and convex if it does not wet the glass. Such a curved surface is called a meniscus. If the liquid wets the glass, you read to the bottom of the meniscus, as shown in Figure 1-11. Your eye must be looking along the horizontal line AC at the bottom of the curve. If you look along the line BC or DC, you will get an incorrect reading. Locate the meniscus when reading the water level in the buret.

5. After you have taken your first buret reading, as directed, open the stopcock and draw off as many milliliters of the liquid as you wish. The exact amount drawn off is equal to the difference between your first and final buret readings. Practice measuring liquids by measuring 10 mL of water, first using a graduated cylinder, then a pipet, and finally a buret.

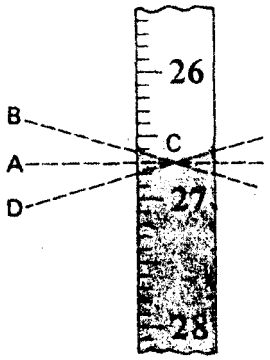


Figure 1-11

6. At the end of this part of the experiment, the equipment you store in the lab locker or drawer should be clean, dry, and arranged in an orderly fashion for the next lab experiment.

CAUTION
In many experiments you will have to dispose of a liquid chemical at the end of a lab. Always ask your teacher for the correct method of disposal. In many instances liquid chemicals can be washed down the sink's drain by diluting them with plenty of tapwater. Very toxic chemicals should be handled only by your teacher. All apparatus should be washed, rinsed, and dried.

7. Remember to wash your hands thoroughly at the end of this part of the experiment.

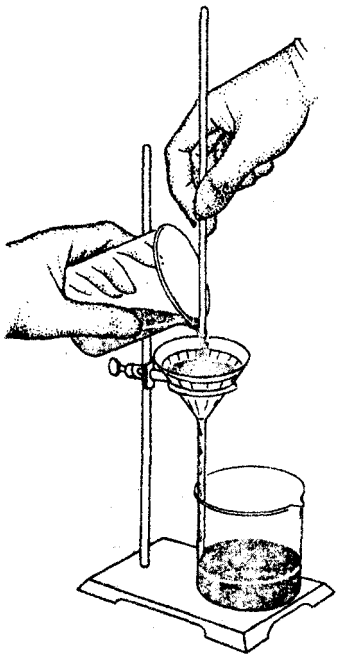
PART 6 FILTRATION

APPARATUS

ring stand	filter paper	stirring rod
iron ring	ceramic-centered wire gauze	burner and tubing
evaporating dish	two beakers, 250 mL	sparker
funnel	wash bottle	

MATERIALS

sodium chloride	fine sand	water



PROCEDURES

1. Sometimes liquids contain particles of insoluble solids, either present as impurities or as precipitates formed by the interaction of the chemicals used in the experiment. If they are denser than water, they soon sink to the bottom. Most of the clear, supernatant (swimming above) liquid may be poured off without disturbing the precipitate. Such a method of separation is known as decantation. See Techniques and Safety Sketches in the front of the manual for the proper techniques for decanting.

2. Fine particles, or particles that settle slowly, are often separated from a liquid by filtration. Support a funnel on a small ring on the ring stand as shown in Figure 1-12, with the stem of the funnel just touching the inside wall of the beaker. Use a beaker to collect the filtrate.

3. Fold a circular piece of filter paper along its diameter, and then fold it again to form a quadrant. See Figure 1-13. Separate the folds of the filter, with three thicknesses on one side and one on the other; then place in the funnel. The funnel should be wet before the paper is added. Use your plastic wash bottle. Then wet the filter paper with a little water and press the edges firmly against the sides of the funnel so no air can get between the funnel and the filter paper while the liquid is being filtered. *EXCEPTION: A filter should not be wet with water when the liquid to be filtered does not mix with water.* Why?

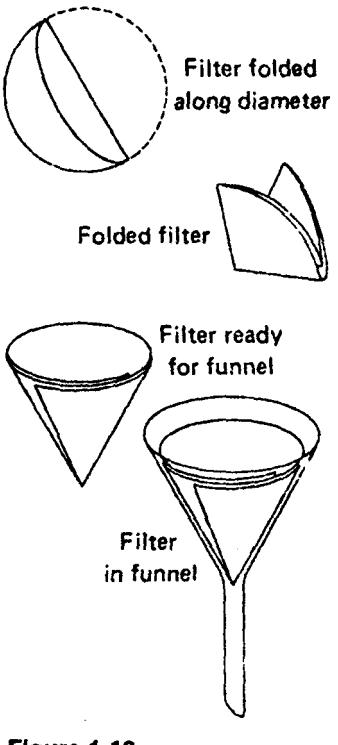


Figure 1-13

4. Dissolve 2 or 3 g of salt in a beaker containing 50 mL of water, and stir into the solution an equal bulk of fine sand. Then filter out the sand by pouring the mixture into the filter, observing the following suggestions:
   a. The filter paper should not extend above the edge of the funnel. It is better to use a filter disc that leaves about 1 cm of the funnel exposed.
   b. Do not fill the filter. It must never overflow.
   c. Try to establish a water column in the stem of the funnel, thus excluding air bubbles, and then add the liquid just fast enough to keep the level about 1 cm from the top of the filter.
   d. When a liquid is poured from a beaker or other container, it may adhere to the glass and run down the outside wall. This may be avoided by holding a stirring rod against the lip of the beaker, as shown in Figure 1-12. The liquid will run down the rod and drop off into the funnel without running down the side of the beaker.

   The sand suspended from the liquid is retained on the filter paper. What property of the sand enables it to be separated from the liquid by filtration?

   What does the filtrate contain?

5. The salt may be recovered from the filtrate by pouring the filtrate into an evaporating dish and evaporating it nearly to dryness. See Figure 1-14 for the correct setup.

CAUTION
When using the burner, make certain that you confine loose clothing and that long hair is securely tied back. Wear your safety goggles, apron, and gloves!

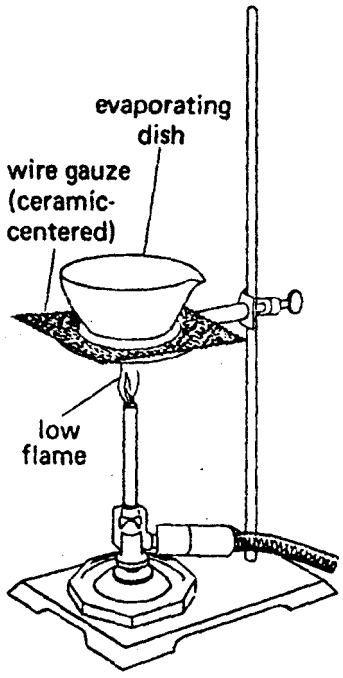


Figure 1-14

6. Remove the flame as soon as the liquid begins to spatter. Shut off the gas burner. What property of salt prevents it from being separated from the water by filtration?

7. At the end of this part of the experiment, all equipment you store in the lab locker or drawer should be completely cool, clean, dry, and arranged in an orderly fashion for the next lab experiment. Check to see that the valve on the gas jet is completely turned off. Make certain that filter papers and sand are thrown into waste jars or containers and not down the sink! Wash your hands thoroughly before leaving the lab.

Liquids

1. Remove the stopper and hold it between your fingers as shown in Figure N.
2. Wearing goggles, hold the test tube or graduated cylinder at eye level and pour the liquid slowly until the desired volume has been transferred. Read the volume of the liquid from the bottom of the meniscus, as in Figure N.
3. Replace the stopper in the reagent bottle. If any liquid runs down the outside of the bottle, rinse it with water before returning it to the shelf.
4. **Diluting Acids.** *The acid is added to the water, and never the reverse.* The acid should be poured slowly down the stirring rod and the solution continually stirred as shown in Figure N. *Diluting an acid produces heat.* Therefore, it is important to add the acid slowly and to stir the solution.

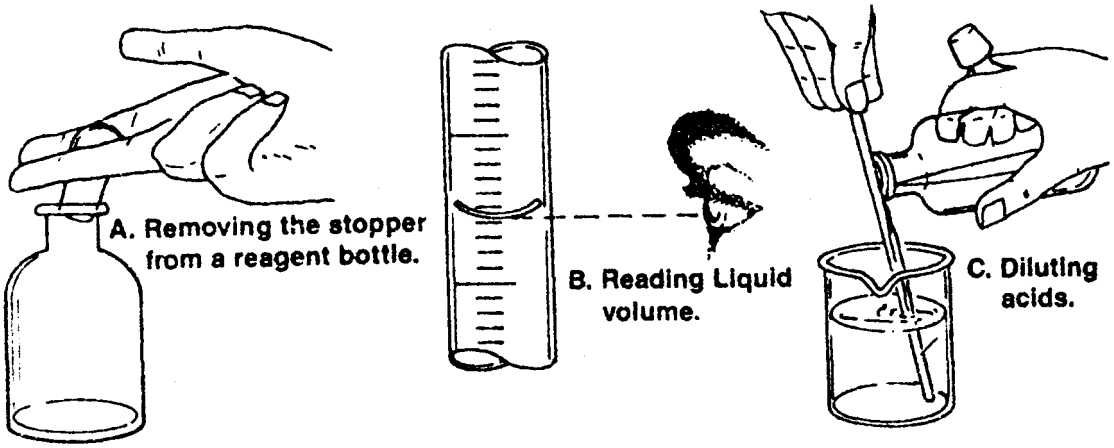


FIGURE N. Transferring liquids.

DECANTING AND FILTERING TECHNIQUES

It is often necessary to separate a precipitate from a liquid. The most common process of separation used in laboratories is filtration. First the major portion of the liquid is decanted, or separated from the precipitate by carefully pouring off the liquid leaving the solid material. To avoid splashing and to maintain control, the liquid is poured down a stirring rod, as shown in Figure E. The solution is then filtered by pouring it through filter paper that catches any remaining precipitate. (See Figure F.) The solid may be rinsed with distilled water to remove any solvent particles. The rinse water should also be decanted and filtered.

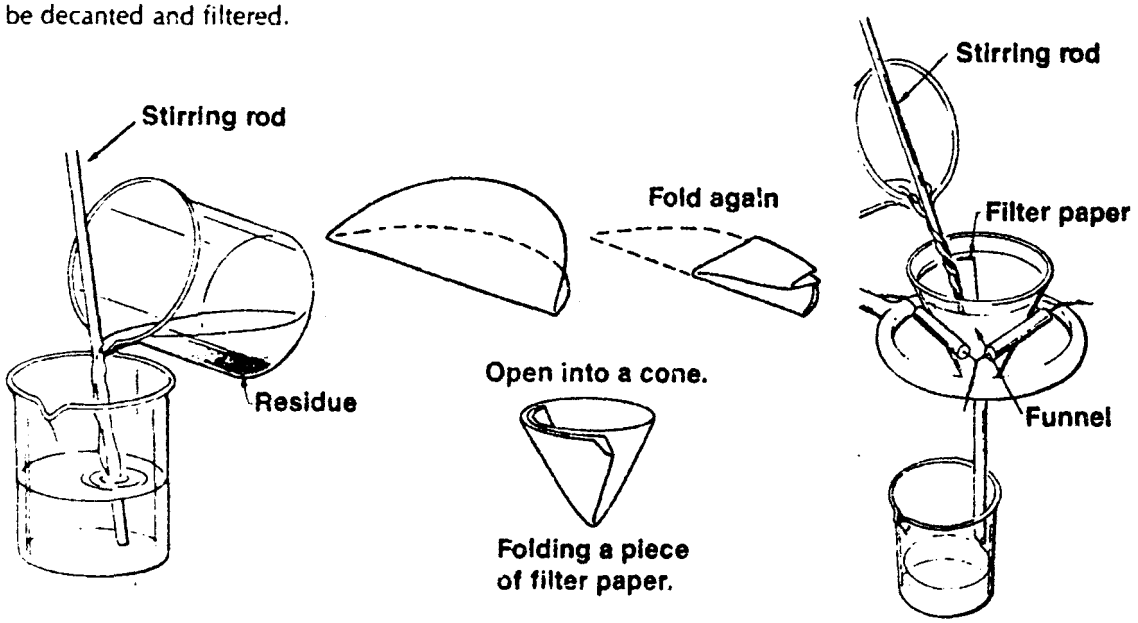


FIGURE E. Decanting a liquid from the precipitate.

FIGURE F. Apparatus set-up for filtration.