Name _____ _____ Date _____

Skills Practice Lab

Laboratory Techniques

The best way to become familiar with chemical apparatus is to handle the pieces yourself in the laboratory. This experiment is divided into several parts in which you will learn how to adjust the gas burner, bend glass, use the balance, handle solids, measure liquids, filter a mixture, and evaporate a solute. Great emphasis is placed on safety precautions that should be observed whenever you perform an experiment and use the apparatus. In many of the later experiments you will rely on these simple laboratory techniques. It is important that you develop a positive approach to a safe and healthful environment in the lab.

Objectives

Observe proper safety techniques with all laboratory equipment.
Use laboratory apparatus skillfully and efficiently
Recognize the names and functions of all apparatus in the laboratory
Develop a positive approach toward laboratory safety.

Safety

Always wear safety goggles and a lab apron to protect your eyes and clothing
Do not touch any chemicals. Never taste any chemicals. If you get chemicals on your skin ask your teacher or reference to the bottle for information on the chemical.
Do not heat glassware that is broken, chipped, or cracked. Use tongs to handle heated glassware and other equipment because hot glassware does not always look hot. Never put hot labware onto a balance or on the lab table. Place hot labware on a ceramic tile.
When using a Bunsen burner, confine long hair and loose clothing. If your clothing catches on fire, stop drop and roll, WALK to the emergency lab shower, or use the fire blanket to put the fire out.
When heating a substance in a test tube, the mouth of the test tube should point away from where you and others are standing. Watch the test tube at all times to prevent the contents from boiling over.
Never put broken glass in a regular waste container. Broken glass should be disposed of separately according to your teacher's instructions.

Part 1 – The Burner

Materials

- Bunsen burner and related equipment
- Copper wire, 18 gauge
- Evaporating dish
- Forceps
- Heat-resistant mat

Procedure

1. Put on goggles and apron.
2. The Bunsen burner is commonly used as a source of heat in the laboratory. Look at **Figure 1** (all figures are at the back of the lab packet) as you examine your Bunsen burner and identify the parts. Although individual Bunsen burners might appear different, all Bunsen burners have a gas inlet located at the base, a vertical tube or barrel in which the gas is mixed with air, and adjustable opening or ports in the base of the barrel. These ports admit air to the gas stream. The gas flow is regulated simply by adjusting the gas valve on the supply line. The burner is always turned off at the gas valve.

CAUTION: Before you light the burner make sure that you and your partner have taken safety precautions against fire: wear goggles, aprons, confine long hair, confine loose clothing, roll up long baggy shirt sleeves, know the locations of fire extinguishers, make sure your lab area is clean and neat, never have flammable chemicals around Bunsen burners.

3. When lighting the burner, partially close the air ports at the base of the barrel , turn the gas full on, hold the sparker or match about 5cm about the top of the burner and proceed to light. The gas flow may then be regulated by adjusting the gas valve until the flame has the desired height. If a very low flame is needed, remember that the ports should be partially closed when the gas pressure is reduced; otherwise the flame may burn inside the base of the barrel. When the flame is improperly burning in this way, the barrel will be very hot, and the flame will produce a poisonous gas, carbon monoxide.
   CAUTION: If the flame is burning inside the base of the barrel, immediately turn off the gas at the gas valve. Do not touch the barrel, because it is extremely hot. Allow the barrel of the burner to cool, and then proceed to relight the burner and decrease the amount of air available to the Bunsen burner.
4. Once you have a flame that is burning safely and steadily, you can experiment by completely closing the ports at the base of the burner.
5. Close the air port and look for a change in the flame (if nothing appears to change then wrap your fingers tightly around the closed ports to prevent air from entering). What effect does this have on the flame?

   _____
   _____

   Using the forceps, hold an evaporating dish in the tip of this flame for about a minute (that means you'll be holding your fingers over the port for ~1min). Place the dish on a heat-resistant tile and allow the dish to cool. Then examine the bottom of the dish. Describe the results and suggest a possible explanation.

   _____
   _____

   Such a flame (sloppy, yellow and luminous) is seldom used in the lab. For laboratory work, you should adjust the burner so that the flame is free of yellow color, nonluminous, and also free of the roaring sound caused by admitting too much air.
6. Regulate the flow of gas so that the flame extends roughly 8cm about the barrel. Now adjust the supply of air until you have a steady flame with a sharply defined, light-blue inner cone. This adjustment gives the highest temperature possible with your burner. Using the forceps, insert a piece of copper wire into the flame just above the barrel. Lift the wire slowly up through parts of the flame. Where is the hottest portion of the Bunsen burner flame located?

   _____
   _____

   Experiment by heating the evaporating dish(clean and dry the outside first) in the nonluminous flame. Did you notice any difference when you heated with the luminous flame?

   _____
   _____

7. Shut off the gas burner. Now think about what you have just observed in steps 4 and 5. Why is the nonluminous flame preferred over the yellow luminous flame in the laboratory?
8. Clean and dry all equipment before leaving the lab. All equipment should be cool before putting away. If you have hot equipment ask your teacher where is should be kept to cool down. Remember to wash your hands thoroughly with soap at the end of each lab period.

Part 2 – Glass Manipulation

Materials

- Triangular file
- Flame spreader
- Glass tubing
- Bunsen burner

1. You will most likely not be bending glass in this class for a lab, however it is a fun technique and a great investigation into the properties of glass.
2. Follow your teacher's demonstration to learn how to cut and bend glass. Each lab partner should attempt to make a nice smooth bend in their glass tubing. Also each ends should be flame polished for smoothness if time allows.
   CAUTION: Hot glass and cold glass look the same. Never grab a piece of glass without approaching it slowly with the back of your hand to insure that it is not hot and you do not burn a sensitive part of your hand.

Part 3 – Handling solids and the balance

Materials

- Weighting paper or weigh boats
- Sodium chloride
- Scoop
- Test tube

Procedure

1. Solids are usually kept in wide-mouthed bottles. A scoop or spatula should be used to dip out the solid. Often your teacher will have previously dispensed chemicals into smaller containers on your table or in the fume hood.
2. When a balance is required for determining mass, you will use an electronic centigram balance. The centigram balance has a readability of 0.01g. This means that your mass readings should all be recorded to the nearest 0.01g. In the chemistry lab there is a difference between a recorded mass of 2g and 2.00g.
3. Before using the balance make sure it is zeroed and also measuring in the correct unit (grams). **Never place chemicals or hot objects directly on the balance pan.** Always use weighing paper, a weighing boat, or a glass container. Place the massing paper (record the mass of the weighing paper) on the balance and zero the balance.
   Mass of weighing paper:_____
4. Using the spatula and the balance measure 4-5g of the mixture. Do not return excess chemicals back to their original container. Contaminants from outside the container can be introduced into the stock bottle.
   Mass of NaCl:_____
   Estimate the uncertainty in the measurement. A good way to do this is to measure your sample on each of the balances. Report this error as well as you "know" the true value of your sodium chloride mass (ex. +/- 0.01g, +/-0.5g, etc.).
   Uncertainty in the mass of NaCl:_____
5. Store your NaCl in a test tube. The chemical can be slid off the weigh paper into a test tube for later use. This is easier to do if you crease the weigh paper. Ask your teacher for a demonstration.
6. Leave your lab area clean and tidy. Wash your hands before leaving the lab area. Clean up all spilled chemicals with the dust pan and hand broom, or with a damp paper towel.

Part 4 – Measuring Liquids

Materials

- Beaker, small
- Beaker, large
- Buret
- Buret clamp and stand
- Graduated cylinder, 100ml
- Pipet
- Water

Procedure

1. For approximate measurements of liquids, a graduated cylinder is generally used. These cylinders are usually graduated in milliliters (mL), reading from the bottom up. They may also have a second column of graduations reading from top to bottom. Examine your cylinder for these markings. Record the capacity and describe the scale of your cylinder in the space below (what does one step up on the scale represent in milliliters?).

   _____
   _____
2. A pipet or a buret is used for more accurate volume measurements. Pipets, which are made in many sizes, are used to deliver measured volumes of liquids. A pipet is fitted with a suction bulb, as shown in **Figure 2** The bulb is used to withdraw air from the pipet while drawing up the liquid to be measured.
   CAUTION: Always use the suction bulb. NEVER pipet by mouth.
3. Burets are used for delivering any desired quantity of liquid up to the capacity of the buret. Many burets are graduated in tenths of milliliters. When using a buret, follow these steps:
   a. Clamp the buret in position on a ring stand, as shown in **Figure 3**
   b. Place a 250mL beaker under the tip of the buret. The beaker serves to catch any liquid that is released.
   c. Pour a quantity of liquid that you want to measure from the liquid's reagent bottle (in this exercise you will use distilled water) into a 50mL beaker. Pour the liquid from the beaker into the top of the buret, being careful to avoid spills.
   d. Fill the buret with the liquid and then open the stopcock to release enough liquid to fill the tip below the stop cock and bring the level of the liquid within the scale. The height at which the liquid stands is then read accurately. Practice this procedure several times by pouring water into the buret and emptying it through the stopcock.
   e. Remember to always read volume measurements from the bottom of the meniscus.
4. After you have taken your first buret reading, open the stopcock to release some of the liquid. Then read the buret again. The exact amount released is equal to the difference between your first and final buret reading. This is how you would measure the volume released from the buret. Another thing you may be asked to do is dispense liquid dropwise. Attempt to open the buret so that liquid is dispensed drop by drop.
5. Measure 10mL of water with the pipet and record the volume. Transfer the water from the pipet to the graduated cylinder, read and record the volume. Are the measurements exactly the same? Estimate the uncertainty of your volume measurements for each instrument.
   Pipet:_____+/-_____
   Graduated cylindert:_____+/-_____
   Buret:_____+/-_____

CAUTION: In many experiments, you will have to dispose of a liquid chemical at the end of a lab. Always ask your teacher about the correct method of disposal. In many instances, liquid chemicals can be washed down the sink's drain by diluting them with plenty of tap water. Toxic chemicals should be handled only by your teacher. All apparatus should be washed, rinsed, and dried. Today you do not need to wash the apparatus since we used distilled water.

Part 5 – Separation of a mixture

Materials

- Beakers
- Bunsen burner
- Evaporating dish
- Filter paper
- Mixture (iron, sulfur and sand)
- Funnel
- Glass stirring rod
- Iron ring
- Ring stand
- Sodium chloride (from Part 3)
- Wire gauze
- Magnet
- Watchglass

Procedure

1. Place 10g of a mixture of iron, sand and sulfur on a watchglass. Add the salt that you measured in Part 3 to the mixture and stir to mix everything together. Remove the iron from the mixture with the aid of a magnet. Transfer the iron to a 50-mL beaker and dispose of the iron in waster container in the fume hood.
2. Transfer the sulfur/salt mixture that remains to a 250-mL beaker. Add 20 mL of water, and stir with a glass stirring rod to dissolve the salt.
3. To remove the sand and some of the sulfur the liquid above the sand can be decanted (poured off without disturbing the solid at the bottom). You should let the mixture settle for a minute before you try to decant it.
4. Place the filter paper in the funnel (shown in **Figure 4**). Place the end of the funnel into an Erlenmeyer flask. Filter the mixture (shown in **Figure 5**), and collect the filtrate (the liquid that passes through the filter). Do not poke at the filter paper to get the water to run through faster; be patient and let the filter paper work at its own pace.
5. Wash the sand residue in the with 5 mL of water, and filter the wash water. Collect the rinse water with the filtrate.
6. The salt can be recovered from the filtrate by pouring the filtrate into an evaporating dish and evaporating it over a low flame nearly to dryness. **Figure 6** shows a correct setup for evaporation. Take the mass of a clean, dry, empty evaporation dish.
   Mass of Empty Evaporation dish:_____+/-_____
7. Remove the flame as soon as you start seeing signs of crystallization. Turn off the burner.
8. Transfer the hot evaporation dish to a cooling tile. Use tongs as demonstrated by your teacher.
9. Once the evaporating dish is cool to the touch, mass the evaporating dish and salt. **Mass of Evaporating dish and dry salt:_____+/-_____**
   Calculate the percent of salt recovered in your separation:

10. All equipment should be clean, dry, and put away in an orderly fashion for the next lab experiment. Be sure the valve on the gas jet is completely shut off. Make certain that the filter papers and sand are disposed of in the trash, not down the sink. Remember to wash your hands thoroughly with soap at the end of each laboratory period.
    CAUTION: Never put equipment away hot. Let equipment cool, even if that means you have to leave it out after the bell. Notify your teacher and make arrangements for getting the equipment put away.

Analysis

1. List the properties that you observed in each of the components of the mixture and list how these properties helped you to separate the mixture.

2. **Examining data** Which of the following measurements could have been made by your balance: 3.42 g of glass, 5.666 72 g of aspirin, or 0.000 017 g of paper? Explain your answer.

3. What immediate action should you take when the flame of your burner is burning inside the base of the barrel?

4. Why are broken glassware and matches, and other laboratory debris not discarded in a wastepaper basket?

5. Why are chemicals and hot objects never placed directly on the balance pan?

SAFETY CHECK

Identify the following safety symbols:

a.  _____

b.  _____

c.  _____

d.  _____

e.  _____

f.  _____

g.  _____

h.  _____

i.  _____

j.  _____

TRUE OR FALSE

Read the following statements and indicate whether they are true or false. Place your answer in the space next to the statement.

_____ **1.** Never work alone in the laboratory.

_____ **2.** Never lay the stopper of a reagent bottle on the lab table.

_____ **3.** At the end of an experiment, in order to save the school's money, save all excess chemicals and pour them back into their stock bottles.

_____ **4.** The quickest and safest way to heat a material in a test tube is by concentrating the flame on the bottom of the test tube.

_____ **5.** Use care in selecting glassware for high-temperature heating. Glassware should be Pyrex or a similar heat-treated type.

_____ **6.** A mortar and pestle should be used for grinding only one substance at a time.

_____ **7.** Safety goggles protect your eyes from particles and chemical injuries. It is completely safe to wear contact lenses under them while performing experiments.

_____ **8.** Never use the wastepaper basket for disposal of chemicals.

_____ **9.** First aid kits may be used by anyone to give emergency treatment after an accident.

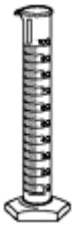
_____ **10.** Eyewash and facewash fountains and safety showers should be checked daily for proper operation.

CHEMICAL APPARATUS

Identify each piece of apparatus. Place your answers in the spaces provided.

a.

b.



c.

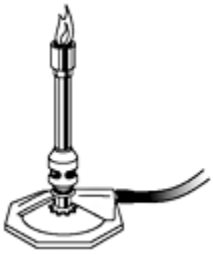
d.

e.

f.

g.

h.



i.

j.

k.

l.

a. _____ **g.** _____

b. _____ **h.** _____

c. _____ **i.** _____

d. _____ **j.** _____

e. _____ **k.** _____

f. _____ **l.** _____

Figure 1

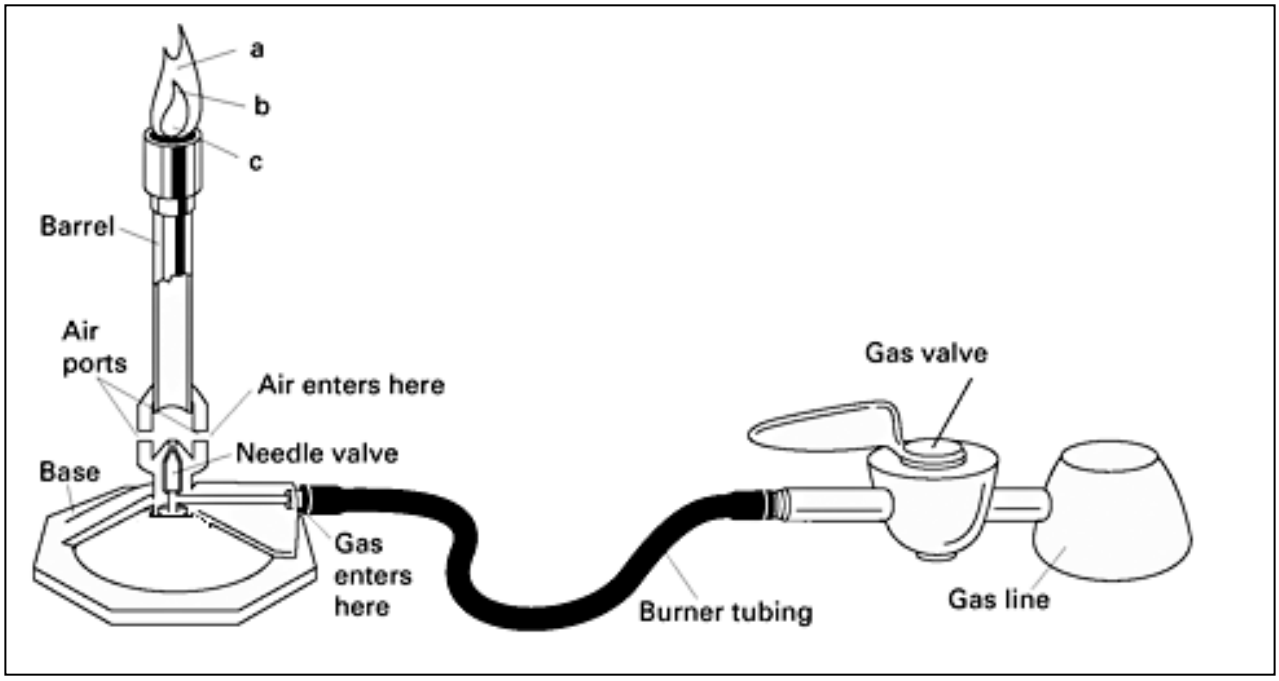


Figure 2

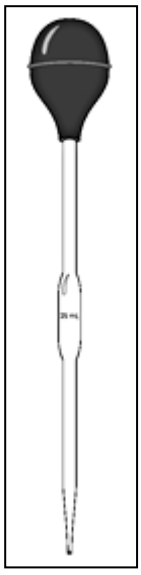


Figure 3

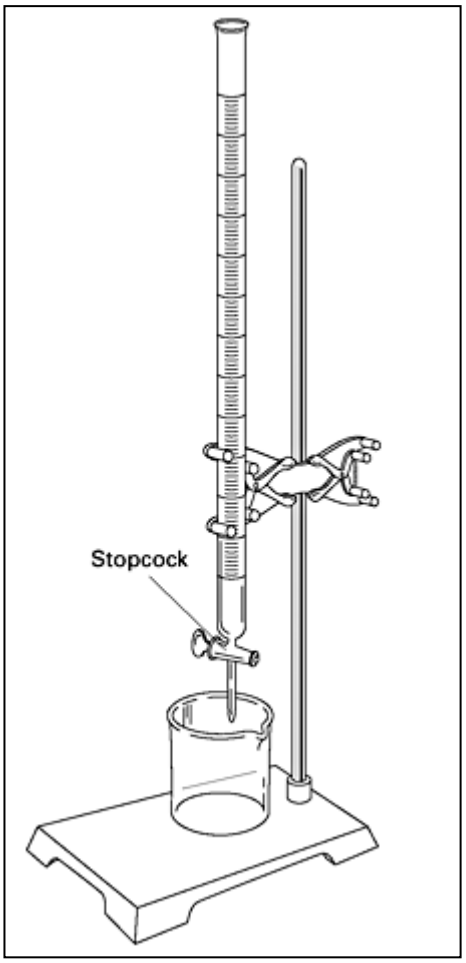


Figure 4

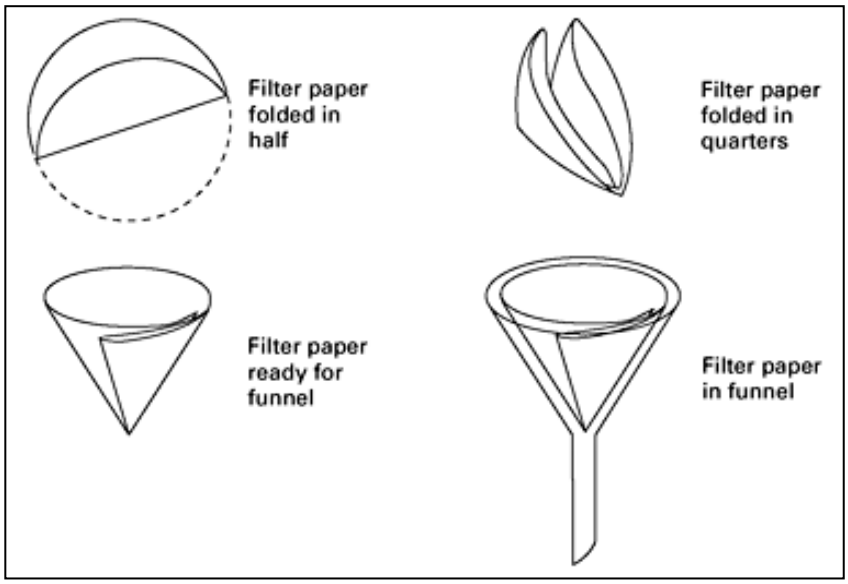


Figure 5

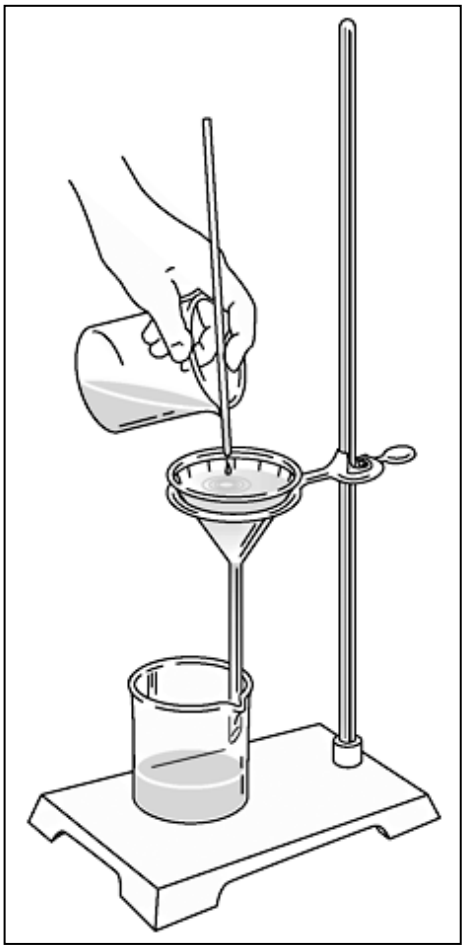


Figure 6