Name _____ Date _____ Class _____

LAB 1.1 LABORATORY MANUAL

Laboratory Techniques and Lab Safety

Use with Section 1.4

Chemistry has been developed largely through experimentation. Chemistry courses use laboratory experiences to demonstrate, clarify, and develop principles of chemistry.

Behavior in the laboratory is more structured than in the classroom. Certain rules of conduct pertaining to safety and keeping a clean work environment must be followed at all times. You must also adopt correct procedures for using glassware and other pieces of equipment. General safety rules are summarized at the beginning of this lab manual. However, there often will be more specific safety rules or special procedures to follow when performing an experiment. Your teacher will provide these added instructions before you perform any lab activity. If you are unsure of any procedure, always ask your teacher before proceeding.

In this activity, you will practice some laboratory techniques and apply laboratory safety rules. You will determine the mass of different solid materials, measure the volume of a liquid, and separate mixtures of chemicals. You will also review specific safety rules.

Problem

How can the mass of an object be measured? How can the volume of a liquid be measured? How can a mixture be separated?

Objectives

- **Measure** the mass of solid substances.
- **Measure** a volume of water.
- **Separate** components of a mixture through filtration.

Materials

table salt
sand
distilled water
100-mL graduated cylinder
250-mL beakers (2)
50-mL beakers (2)
balance
ring stand
ring
funnel
scoops (2)
stirring rod
filter paper
weighing paper
water bottle
watch glass

Safety Precautions

- **Always wear safety goggles and a lab apron.**
- **Never eat or taste any substance used in the lab.**

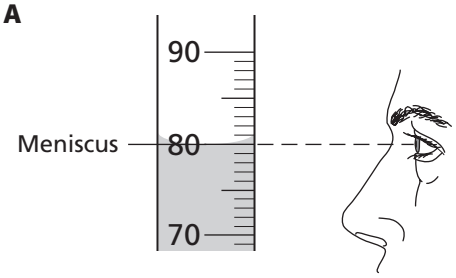
Pre-Lab

1. What is the safety rule concerning working alone in the laboratory?
2. What is the safety rule concerning the handling of excess chemicals?
3. What should you do if you spill a chemical?
4. Read the entire laboratory activity. Hypothesize what safety precautions will be needed to handle the different chemicals and lab equipment in this experiment. Record your hypothesis on page 3.

Procedure

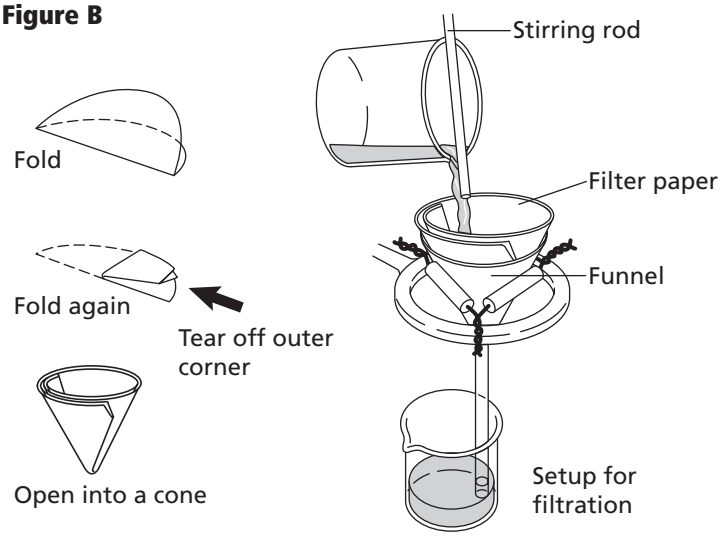
1. Using a scoop, transfer a small amount of table salt to a 50-mL beaker.
2. Measure the mass of a piece of weighing paper to 0.1 g using a laboratory balance. Record this mass in **Data Table 1.**
3. Add about 5.0 g of table salt from the 50-mL beaker to the weighing paper. Record the mass of the weighing paper and table salt to 0.1 g in **Data Table 1.**
4. Transfer the table salt to the 250-mL beaker and place all excess table salt into an appropriate waste container, as indicated by your teacher.
5. Using another scoop, transfer a small amount of sand to the second 50-mL beaker. Using the techniques described in steps 2 and 3, measure out about 5.0 g of sand. Then transfer the sand to the 250-mL beaker containing the table salt.
6. Using a 100-mL graduated cylinder, measure out 80 mL of distilled water. Measure the volume of the water to 0.1 mL by reading at the bottom of the meniscus, as illustrated in **Figure A.** Record the volume of water measured in **Data Table 1.**
7. Pour the water into the 250-mL beaker containing the table salt and sand. Using the stirring rod, gently stir the mixture for 1 minute. Record your observations in **Data Table 2.**
8. Place a clean 250-mL beaker on the base of the ring stand. Attach the ring to the ring stand and set the funnel in the ring so that the stem of the funnel is in the beaker. Adjust the height of the ring so that the bottom of the funnel stem is approximately halfway up the beaker. Fold a piece of filter paper as illustrated in **Figure B.** Place the folded filter cone in the funnel.

Figure A



9. To avoid splashing and to maintain control, you will pour the liquid down a stirring rod. Place the stirring rod across the top of the 250-mL beaker that contains the mixture, as shown in **Figure B.** The stirring rod should rest in the spout and extend several inches beyond the spout. Grasp the beaker with your hand and place your index finger over the stirring rod to keep it in place. Slowly pour the contents of the beaker into the filter cone, allowing the liquid to pass through the filter paper and collect in the beaker.
10. While holding the beaker at an angle, use the water bottle to rinse the beaker and wash any remaining solid from the beaker into the filter cone. Record your observations in **Data Table 2.**
11. Allow the filter cone to drain. Then remove the filter cone and carefully unfold the filter paper. Place the filter paper on a watch glass and record your observations in **Data Table 2.**

Figure B



Hypothesis

_____

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_____

_____

Cleanup and Disposal

1. Place all chemicals in the appropriately labeled waste container.
2. Return all lab equipment to its proper place.
3. Clean up your work area

Data and Observations

Data Table 1	
Mass of table salt + weighing paper (g)	
Mass of weighing paper (g)	
Mass of table salt (g)	
Mass of sand + weighing paper (g)	
Mass of weighing paper (g)	
Mass of sand (g)	
Volume of water (mL)	

- To find the "Mass of table salt," subtract the "Mass of weighing paper" from the "Mass of table salt + weighing paper."
- To find the "Mass of sand," subtract the "Mass of weighing paper" from the "Mass of sand + weighing paper."

Data Table 2	
Step	**Observations**
Step 7	
Step 10	
Step 11	

Analyze and Conclude

1. **Observing and Inferring** Why were the excess reagents not put back into the original reagent bottle?

2. **Comparing and Contrasting** What differences were observed between the mixture of salt and sand in the 250-mL beaker and the same materials after the water was added?

3. **Drawing a Conclusion** Why were the samples of table salt and sand placed into 50-mL beakers prior to weighing?

4. **Thinking Critically**

   a. If one of the pieces of glassware is dropped and breaks, why is it necessary to clean up the broken glass immediately?

   b. If one of the pieces of broken glass is dropped and breaks, why is it necessary to tell the teacher immediately?

5. **Thinking Critically** Why is it necessary to wear safety goggles and a lab apron while performing experiments in the lab?

6. **Error Analysis** What are some possible sources of error in this activity?

Real-World Chemistry

1. Why is eating, drinking, or chewing gum not allowed in a laboratory?
2. Why must you always wash your hands after working in a laboratory?
3. Why do you never work alone in a chemical laboratory?