

# LABORATORY 1

## Measuring Techniques



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## Measuring Techniques

Proper measuring techniques must be emphasized to ensure success in food preparation. There are differences when measuring liquid and dry ingredients, and the student must learn these techniques as soon as possible in order to be successful in food preparation. The objective of this laboratory exercise is to introduce the student to proper measuring techniques.

### VOCABULARY

boiling point  
conduction heat  
convection heat

meniscus  
opaque  
simmering

solvent  
solute

### MEASURING TECHNIQUES

The American Standards Association has defined the capacities of various measures, but not all measuring equipment has been standardized to meet these specifications. Variations of 5%, more or less than standard, are allowable.

#### I. NONMETRIC MEASURE OF VOLUME

##### A. DRY MEASURES

A set of dry measuring cups includes measures for 1/4 cup, 1/3 cup, 1/2 cup, and 1 cup (there are some manufacturers that make 2/3 cup and 3/4 cup measures). These measures are used for dry ingredients and solid fats. Ingredients vary in the way they pack down, lump, or cling to the measuring cup. Use the following guidelines when measuring:

1. All-purpose flour, cake flour, granulated sugar, and confectioner's sugar should be lightly spooned into the appropriate size dry measuring cup. **Do not shake or pat down.** Use a straight-edged spatula or knife to level off ingredients (Fig. 1.1).

*FIG. 1.1:* Spoon dry ingredients lightly into cup and level off with a straight-edged spatula.



2. Nuts, coconut, and bread crumbs should be spooned into the cup and packed down lightly.
3. Brown sugar should be spooned into the dry measure cup and packed down firmly with spatula and spoon.
4. Solid fats include hydrogenated shortening, lard, margarine, and butter. The solid fat should be packed into the dry measure with firm pressure. Butter and margarine should be at room temperature before being measured.

## B. SMALL AMOUNTS OF INGREDIENTS

1. Baking powder, baking soda, salt, and spices are used in such small amounts that they must be measured in small capacity measures of 1 tablespoon or less.
2. Ingredients should be stirred and free of lumps.
3. The desired measure is dipped into the ingredient and leveled off.
4. Usually, the measuring spoons are found as 1/8 teaspoon, 1/4 teaspoon, 1/2 teaspoon, 1 teaspoon, 1/2 tablespoon, and 1 tablespoon.

## C. LIQUIDS

1. Oil, honey, milk, molasses, water, melted fat, and other liquid ingredients should be measured in a graduated, transparent liquid measure with a pour spout.
2. Fill the measure to the desired graduation and check it by holding the measure at eye level so the bottom of the meniscus—the curved, upper surface of the liquid—matches the desired line on the side of the measure (Fig. 1.2).
3. Opaque liquids (such as milk and honey) that do not show a meniscus are measured by aligning the top of the liquid with the line on the measure.
4. Many liquids, especially oil and honey, tend to cling to the sides of the cup. To obtain an accurate transfer of the liquid, it is essential that the inside of the cup be scraped out with a rubber spatula. **Hint: spray measuring cup with cooking spray before measuring molasses or honey. This will make removal of the ingredient more efficient.**

FIG. 1.2: Read the measure by holding it at eye level so the bottom of the meniscus matches the desired line on the side of the measure.



## D. OTHER MEASURING ADVICE

1. If the recipe specifies 3 teaspoons of baking powder, the tablespoon measure should be used to make the measurement. To measure 3 separate teaspoons introduces greater error in measurement.
2. When the recipe specifies less than 1 cup of liquid, and the measurement is made in a 2-cup graduated measure, there is also a greater chance of error.
3. It is important to use the measuring utensil that is closest in size to the amount of ingredient for greater accuracy.

## EQUIVALENT MEASURES

1 tablespoon = 3 teaspoons  
1/8 cup = 2 tablespoons  
1/4 cup = 4 tablespoons  
1/3 cup = 5 tablespoons + 1 teaspoon  
1/2 cup = 8 tablespoons  
2/3 cup = 10 tablespoons + 2 teaspoons

3/4 cup = 12 tablespoons  
1 cup = 16 tablespoons or 1/2 pint  
1 pint = 2 cups  
1 quart = 4 cups or 2 pints  
1 gallon = 4 quarts

## II. TO LEARN CORRECT TECHNIQUES FOR MEASURING INGREDIENTS

### A. FLOUR (ALL-PURPOSE OR CAKE)

#### 1. Method 1

- a. Fill 1/2 cup dry measure by dipping into canister of flour.
- b. Level with spatula.
- c. Weigh flour on gram scale and record weight in Table 1.1.
- d. Repeat.

#### 2. Method 2

- a. Place 1/2 cup dry measure on a piece of waxed paper of 12 square inch.
- b. Sift flour directly into the cup until the cup overflows. Do not let the sifter touch the cup.
- c. Level flour with the edge of the spatula.
- d. Weigh flour and record weight in Table 1.1.
- e. Repeat.

#### 3. Method 3

- a. Stir flour in canister to lighten.
- b. Carefully spoon flour 1 tablespoon at a time into 1/2 cup dry measure.
- c. Level flour with the edge of the spatula.
- d. Weigh flour and record weight in Table 1.1.
- e. Repeat.

Table 1.1 EVALUATION OF THE WEIGHT OF 1/2 CUP OF FLOUR			
Method	Trial 1	Trial 2	Standard Weight*
1			
2			
3			

\*All purpose: 1/2 cup, sifted: 58.0 g; 1/2 cup, spooned: 62.5 g; cake flour: 1/2 cup, sifted: 48.0 g; 1/2 cup, spooned: 55.5 g.

Source: *Handbook of Food Preparation: Food and Nutrition Section*, 9th edition, 1993, American Home Economics Association, p. 182.

### QUESTIONS

1. Which method of measuring flour yields the best check? Why?
2. What would cause a difference in weight from the standard?
3. How would you substitute all-purpose flour for cake flour in a recipe? Would this substitution work for all type of baked products?

## B. SUGAR: GRANULATED AND BROWN

### 1. Method 1

- Fill a 1/4 cup dry measure with granulated sugar by dipping it into the canister.
- Level the sugar with the edge of the spatula.
- Weigh sugar and record in Table 1.2.
- Repeat.

### 2. Method 2

- Fill a 1/4 cup dry measure with brown sugar by spooning sugar into cup.
- Level the sugar with the edge of the spatula.
- Weigh sugar and record in Table 1.2.
- Repeat.

### 3. Method 3

- Fill a 1/4 cup dry measure with brown sugar by pressing the sugar into the measuring cup.
- Level the sugar with the edge of the spatula.
- Weigh sugar and record in Table 1.2.
- Repeat.

Table 1.2 EVALUATION OF THE WEIGHT OF 1/4 CUP OF SUGAR			
Method	Trial 1	Trial 2	Standard Weight*
1			
2			
3			

\*Light brown sugar, packed: 1/4 cup = 50 g; dark brown sugar, packed: 1/4 cup = 50 g; granulated sugar: 1/4 cup = 50 g.

Source: *Handbook of Food Preparation: Food and Nutrition Section*, 9th edition, 1993, American Home Economics Association, p. 195.

## QUESTION

- How does the method for measuring brown sugar differ from that of measuring granulated sugar?

## C. LIQUID

### 1. Method 1

- Fill a liquid measuring cup with water to 1/4 cup mark.
- Place a cup on a level surface and position yourself at eye level with the water before attempting to read the water level (Fig. 1.2).
- Transfer all the water from the measuring cup to a 100-mL graduated cylinder and read the volume in milliliters.
- Record the volume in Table 1.3 and repeat.
- Repeat Steps a through d, but use milk.

## 2. Method 2

- Fill a 1/4 cup dry measure with water.
- Place measure on a level surface and position yourself at eye level with the water before reading the water level.
- Transfer all the water from the cup to a 100-mL graduated cylinder and read the volume in milliliters.
- Record the volume in Table 1.3 and repeat.

Table 1.3 EVALUATION OF LIQUID MEASUREMENTS			
Method of Measurement	Trial 1	Trial 2	Standard Volume*
1			
2			

\*1 cup liquid measure = 236 mL; 1/4 cup liquid measure = 59 mL.

Source: *Handbook of Food Preparation: Food and Nutrition Section*, 9th edition, 1993, American Home Economics Association, p. 180.

## QUESTIONS

- Was there a visual difference between the water and milk when they were measured, and why?
- What is the error that occurs when using a dry measure for measuring liquids?

## D. FATS

### 1. Method 1

- Fill a 1/4 cup dry measure with a solid fat.
- Using a rubber spatula, press fat into the cup making sure there are no air pockets.
- Level off with a straight-edged spatula.
- Carefully, remove fat from cup with a rubber spatula and weigh.
- Record weight in Table 1.4 and repeat.

### 2. Method 2

- Melt solid fat in a saucepan over **low heat**.
- Take a 1 cup liquid measuring cup and pour melted fat up to the 1/4 cup measure mark.
- Weigh and record the weight in Table 1.4 and repeat.

Table 1.4 EVALUATION OF THE WEIGHT OF 1/4 CUP HYDROGENATED FAT			
Method	Trial 1	Trial 2	Standard Measure*
1			
2			

\*Hydrogenated shortening, solid: 1/4 cup = 46 g.

Source: *Handbook of Food Preparation: Food and Nutrition Section*, 9th edition, 1993, American Home Economics Association, p. 175.

## **QUESTIONS**

1. What precautions should you take for measuring fats?
2. Account for the differences in weight of the fats.
3. Why is it important to allow fats, such as butter and margarine, to come to room temperature before measuring and mixing?

### **III. WATER AND THERMOMETRY**

1. Most of the changes brought about by foods by cooking take place in a watery medium (moist heat).
2. Water absorbs heat from the hot unit through the cooking utensil and transfers this heat to the food.
3. When water boils, convection heating currents surround the food; therefore, even and quick cooking of the food occurs.
4. Water sets its limit to how hot it gets ( $100^{\circ}\text{C}$  or  $212^{\circ}\text{F}$ ), while fat can go to higher extremities.
5. The intensity of the heat is measured by a thermometer (either in  $^{\circ}\text{F}$  or  $^{\circ}\text{C}$ ).

#### **A. FACTS ON USING A THERMOMETER**

1. The bulb must be completely covered with hot liquid.
2. The bulb should not touch the sides or bottom of the utensil.
3. There are  $100^{\circ}$  between the boiling point and the freezing point of water on the centigrade scale.
4. There are  $180^{\circ}$  between the boiling point and the freezing point of water on the Fahrenheit scale.
5. Therefore,
  - a.  $1^{\circ}\text{C} = 1.8^{\circ}\text{F}$
  - b.  $^{\circ}\text{C} = (^{\circ}\text{F} - 32) \div 1.8$
  - c.  $^{\circ}\text{F} = (^{\circ}\text{C} \times 1.8) + 32$

#### **B. LEARN TO RECOGNIZE COMMONLY USED TEMPERATURES**

Heat water to each temperature specified in Table 1.5 and note its appearance.

Table 1.5 EVALUATION OF COMMONLY USED TEMPERATURES			
Term	Description	$^{\circ}\text{F}$	$^{\circ}\text{C}$
Room		77.0	25
Lukewarm		98.6	37
Scalding*		149.0	65
Simmering		185.0	85
Boil slowly		212.0	100
Boil rapidly		212.0	100

\*The temperature varies with material being scalded.

### **QUESTIONS**

1. Explain what happens when water boils.
2. Name some instances when scalding temperature is used in food preparation.
3. What happens when salt is added to boiling water? If sugar is added?

### **C. DETERMINING THE ACCURACY OF LABORATORY OVENS**

1. Take an oven thermometer and calibrate your ovens. Place the rack in the middle of the oven. Use 350°F as a standard to go by.
2. Record oven temperature: \_\_\_\_\_

### **QUESTIONS**

1. Why is it important that the temperature of the oven be exact?
2. In what position would you place the oven rack to cook food in a conventional oven for:
  - a. a two-layer cake?
  - b. a tube cake pan?
  - c. a cookie sheet pan?
  - d. a roasted whole turkey?
3. What is a convection oven? What temperature adjustment is made when using such an oven? Is the rack adjustment the same for the products mentioned in Question 2 for the convection oven?

## **IV. APPLICATION OF MEASURING TECHNIQUES: COOKIES**

### **OBJECTIVES**

1. To practice proper measuring techniques involving dry and liquid measuring.
2. To familiarize the student with reading a recipe and becoming acquainted with certain culinary terms.



## A. CHOCOLATE CHIP COOKIES

1/3 cup shortening	3/4 cup + 1 tablespoon all-purpose flour
1/4 cup granulated sugar	1/4 teaspoon baking soda
1/4 cup light brown sugar, packed	1/4 teaspoon salt
1 large egg	3 oz. semisweet chocolate chips
1/4 teaspoon vanilla extract	

1. Preheat oven to 375°F. Make sure oven rack is in the middle position.
2. **Sift** together flour, salt, and baking soda; set aside.
3. In a medium-sized bowl, **cream** together shortening, granulated sugar, brown sugar, egg, and vanilla for 2 minutes.
4. Add flour mixture to creamed mixture; **mix** only until flour is combined.
5. **Stir** in chocolate chips. Chill dough in freezer for 5–10 minutes. (This helps the dough from not overspreading during baking.)
6. Drop dough by rounded teaspoonfuls about 2 inches apart onto ungreased baking sheet.
7. Bake for 8–10 minutes, or until edges start to brown slightly. Remove pan from oven, and allow cookies to cool for 2 minutes on the pan.
8. With a spatula remove cookies from pan and place on a wire rack to cool.

## B. CHOCOLATE CHIP COOKIES (LOWER-FAT VERSION)

1/2 cup granulated sugar minus 1 tablespoon	1 cup + 2 tablespoons all-purpose flour
1/4 cup light brown sugar, packed	1/2 teaspoon baking soda
1/4 cup butter or margarine at room temperature	1/4 teaspoon salt
1 teaspoon vanilla	1/4 cup miniature semisweet chocolate chips
1 egg white	

1. Preheat oven to 375°F. Make sure that the rack is on the middle position in the oven.
2. Sift together, flour, salt, and baking soda; set aside.
3. In a medium-sized bowl, **cream** together butter, granulated and brown sugar, egg white, and vanilla for 2 minutes.
4. Stir in flour mixture until just combined. Stir in chocolate chips. Chill dough for 5–10 minutes in the freezer.
5. Drop dough by rounded teaspoonfuls about 2 inches apart onto an ungreased baking sheet.
6. Bake for 8–10 minutes, or until edges are lightly brown.
7. Remove pan from oven and allow cookies to cool for 2–3 minutes before removing with a spatula to a cooling rack.

## C. OATMEAL COOKIES (BASIC RECIPE)

1/2 cup all-purpose flour	1/2 cup light brown sugar, packed
1/2 teaspoon baking powder	1 large egg
1/4 teaspoon salt	1½ cups quick cooking oatmeal
3/4 teaspoon cinnamon	1/4 cup chopped walnuts or pecans
1/4 cup + 3 tablespoons milk	1/4 cup sweetened coconut
1/4 cup + 2 tablespoons shortening	1/4 cup chopped raisins or dates

1. Adjust the rack to the middle of the oven. Preheat oven to 375°F.
2. Sift together flour, baking powder, salt, and cinnamon into a medium-sized bowl.
3. Add shortening, brown sugar, milk, and egg to flour mixture and beat until smooth.
4. Add oatmeal and mix thoroughly.
5. Add walnuts, coconut, and raisins and mix until combined.
6. Drop dough by teaspoonfuls onto a greased cookie sheet.
7. Bake for 12–15 minutes. When cookies appear dry and the edges are light brown, remove them from oven. Cool slightly and then remove cookies from the sheet onto a cooling rack.

#### **D. OATMEAL SPICE COOKIES (LOW-FAT VERSION)**

2 <sup>1</sup> / <sub>4</sub> cups quick cooking oatmeal	1/8 teaspoon nutmeg
2 tablespoons orange juice	3 tablespoons margarine or butter, softened
1 cup all-purpose flour	3 tablespoons canola oil
1/2 teaspoon baking soda	3/4 cup dark brown sugar, packed
1/2 teaspoon baking powder	1 tablespoon molasses
1/4 teaspoon salt	1 large egg white
1/4 teaspoon cinnamon	2 teaspoons vanilla extract
1/8 teaspoon cloves	2 tablespoons granulated sugar—for shaping cookies

1. Preheat oven to 350°F. Spray two baking sheets with vegetable spray; set aside. Adjust racks in the oven to be one at the top and the other at the bottom.
2. Stir together oats and orange juice in a medium-sized bowl; set aside.
3. Sift together flour, baking soda, baking powder, salt, cinnamon, cloves, and nutmeg onto a sheet of wax paper; set aside.
4. In a large mixing bowl, with mixer at medium speed, beat margarine and oil until well blended and smooth.
5. Add brown sugar, molasses, egg white, and vanilla and beat until smooth and fluffy.
6. Blend in flour mixture.
7. Using a wooden spoon, mix in oatmeal mixture until thoroughly incorporated.
8. Shape dough into 1 inch balls, and place 3 inches apart onto baking sheets. Flatten cookies using the bottom of a glass that has been lightly greased and dipped in the 2 tablespoons of granulated sugar. Dip the glass in sugar each time after flattening each cookie.
9. Place pan in preheated oven. After 4 minutes, change the position of the baking sheets and bake cookies for another 4–5 minutes.
10. Let cookies stand on sheets for 3–4 minutes. Using a spatula, transfer cookies to cooling racks and let stand until completely cooled.

#### **E. SNICKERDOODLES**

2 <sup>3</sup> / <sub>4</sub> cups all-purpose flour	1 tablespoon light corn syrup
1/2 teaspoon baking soda	1 <sup>1</sup> / <sub>2</sub> teaspoons vanilla extract
1/2 teaspoon cream of tartar	1 large egg
1/4 teaspoon salt	2 tablespoons granulated sugar
1 cup minus 1 tablespoon granulated sugar	1 <sup>1</sup> / <sub>2</sub> teaspoons cinnamon
1/4 cup butter, softened	

1. Preheat oven to 375°F. Adjust racks one at the top of oven, the other at the bottom. Spray two baking sheets with cooking spray; set aside.
2. Sift together flour, baking soda, cream of tartar and salt; set aside.
3. Combine sugar (1 cup minus 1 tablespoon) and butter in a large mixing bowl, and beat with a mixer at medium speed until well blended. Add corn syrup, vanilla, and egg; beat well. Gradually, add flour mixture (in three additions) to sugar mixture, beating just until combined. Cover and chill for 10 minutes.
4. Combine 2 tablespoons sugar and cinnamon, and blend well in a small dish.
5. Shape dough into 30 balls. Roll balls in sugar mixture. Place balls 2 inches apart onto baking sheets. Flatten balls with bottom of glass. Bake cookies for 4 minutes; then rotate pans by changing their positions in the oven and bake for another 4 or 5 minutes (cookies will be slightly soft). Cool cookies on baking sheets for 2 minutes. Remove cookies from pans and place on wire cooling racks.

#### **F. BROWNIES**

2 oz. unsweetened chocolate	1/2 teaspoon vanilla extract
1/3 cup shortening	1/2 cup + 2 tablespoons all-purpose flour
1 cup granulated sugar	1/2 teaspoon salt
3/4 teaspoon instant coffee granules	1/2 cup semisweet chocolate chips
2 large eggs	1/2 cup walnuts, chopped (optional)

1. Preheat oven to 350°F. Make sure that the rack is in the middle position.
2. Grease an 8 × 8 × 2 cubic inch pan.
3. Melt chocolate and shortening in a 2-quart saucepan over **low heat**. Stir constantly with a wooden spoon. As soon as the mixture has melted, remove it from heat and cool.
4. Mix in sugar, eggs, instant coffee granules, and vanilla.
5. Stir in remaining ingredients. Spread in pan.
6. Bake for 30 minutes or until brownies start to pull away from the sides of the pan (if using a toothpick to test for doneness, the toothpick should have some moist crumb attached to it when removed). **Do not overbake or the brownies will be dry.**
7. Cool slightly. Cut into bars 2 × 1½ inches. Place bars on cooling racks.

### **GENERAL QUESTIONS**

1. How should brown sugar and solid fat be measured? Explain why these ingredients must be measured in this way.
2. What does it mean to “cream?”
3. Why should the oven rack be in the middle position when baking the cookies? Why were the cookies (low-fat oatmeal and snickerdoodles) rotated in the oven mid-way during their baking?
4. If a glass baking dish was used for making the brownies, what change in the baking temperature would there be?
5. It is assumed that a conventional oven is used for the recipes in this unit. What changes in temperature and time would there be if a convection oven was used? How should rack position be addressed in the convection oven?
6. Why were the cookies placed on cooling racks?
7. How important is exact oven temperature to baking quality?