

Chapter 1

Measurement

Fractional mathematics is something that people use everyday. If you say “I am going to play for half an hour” or “one-fourth of our class has green eyes,” then you are talking in terms of fractions. Bakers, chefs and even kids use fractional mathematics in the kitchen. You use fractions to measure ingredients and to double recipes. In this chapter, your students will explore fractions, measure the volume and weight of ingredients and practice their measurement skills.

Welcome to the world of real life kitchen mathematics!

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(See *Virtual FoodMASTER CD*)

Measurement Mania
Fractions

Measuring Up

Summary

Students will make chocolate chip oatmeal cookies to practice their measurement skills and fractional mathematics. This lesson is designed to be completed in two days. Day 1: students will measure dry ingredients. Day 2: students will measure liquid ingredients, make cookies and experiment with equivalent fractions.

Objectives

1. Students will recognize the difference between wet and dry volume measures.
2. Students will identify the names of four measuring spoons and four measuring cups.
3. Students will select appropriate volume measurement tools and practice measurement skills.
4. Students will use metric and US customary units to measure weight.
5. Students will demonstrate simple measurement substitutions (understanding of equivalents in measuring).

Academic Content Standards

MATHEMATICS COMMON CORE

Grade 3

- 3.MD.1 Tell and write to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g. by representing a problem on a number line diagram.
- 3.NF.1 Understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size $1/b$

Grade 4

- 4.NF.3a Understand a fraction a/b with $a > 1$ as a sum of fractions $1/b$. a . Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.

NEXT GENERATION SCIENCE STANDARDS

Grade 5

- 5-PS1-4 Conduct an investigation to determine whether the mixing of two or more substances results in new substances.
- 5-PS1.B When two or more substances are mixed, a new substance with different properties may be formed.

SCIENTIFIC INQUIRY:

Day 1: Cups, Spoons and Scales**Materials**

For the teacher: 1 set dry measuring cups, 1 spoon, 1 table knife, 1 set measuring spoons, small to medium size bowl, flour, brown sugar.

For each group: 1 set dry measuring cups, 1 kitchen scale, 1 small bowl (or medium bowl), 2 spoons, 1 table knife (for leveling), 3 gallon-size re-sealable zipper storage bags (labeled 1, 2 & 3), 1 set measuring spoons, 1 cup flour, 1 teaspoon baking powder, 1/2 teaspoon baking soda, 1/2 teaspoon salt, 1 cup chocolate chips (1/2 of a 12-ounce package), 3/4 cup oats, 3/4 cup packed brown sugar. Optional: Plastic trays (to hold ingredients).

Procedure

1. Read *Measuring Up* and complete the Doodle Bugs.
2. Break the class into groups of four and allow groups to gather supplies.
3. Ask each group of students to line their dry measuring cups up from smallest to largest (1/4-cup, 1/3-cup, 1/2-cup and 1-cup). Ask **“Which cup is the smallest?”** and **“Which is the largest?”** Explain to your students that the one-cup represents a whole and the rest of the measuring cups are all parts or fractions of that whole. For example, there are four one-fourth cups in one cup.
4. Demonstrate proper techniques for measuring dry ingredients:
 - Set the one-cup in a small bowl. Instruct students do all their measuring in or over a bowl too. Spoon the flour into the one-cup, until the cup is slightly overflowing. Level off by using the flat edge of a knife to scrape off excess flour.
 - Hold the tablespoon over the small bowl and demonstrate how to measure 1 tablespoon of flour.
 - **Explain that some ingredients need to be packed.** Then demonstrate packing by measuring 1 cup of brown sugar. Spoon sugar into the one-cup measure and then use the back of your spoon to press the brown sugar down into the cup. Continue spooning brown sugar into the bowl and pressing, until the cup is completely full. Use the flat edge of a knife to level off any extra brown sugar. If packed properly, the brown sugar will hold its shape when dumped into a mixing bowl.
 - Discuss volume measurement. **“Did I measure the weight, height or volume of the flour and brown sugar?”** Tell students that at home we usually use volume measurements like measuring cups and spoons. However, when chefs cook for large groups of people, they often measure the weight of ingredients. (Weight measurement is more accurate when cooking large amounts of food). Ask **“What tool can we use to measure weight?”**
 - Show students how to use a scale to measure the weight of ingredients. Place an empty one-half-cup measure on your scale and zero the scale. Remove the one-half-cup from the scale, add flour to the one-half-cup and weigh the cup again. You can explain that by zeroing the scale you made the weight of the cup disappear. Only the weight of the flour in the cup is measured. Record the weight on the board. Be sure to point out the units in both metric and US customary systems, if possible.
5. Students will do *Scientific Inquiry: Cups, Spoons and Scales*. Upon completing this activity, they will have completed the *Kitchen Measurement Facts* tables and measured all the dry ingredients needed for chocolate chip oatmeal cookies.
6. Check to make sure each group’s bags are tightly sealed. Safely store bags for use in *Measure Up: Day 2: Liquid Measurement*.

SCIENTIFIC INQUIRY:

Day 1: Cups, Spoons and Scales (continued)

Teacher Tips:

- Recruiting an extra adult to assist with lab management, setup and/or cleanup will help this activity to run smoothly.
- To reduce messes, place each group's ingredients and kitchen supplies on a cafeteria-style plastic tray.
- You can compare packing brown sugar to building sandcastle towers. When the brown sugar is pack correctly and dumped, it will look like a sandcastle.

SCIENTIFIC INQUIRY:

Day 2: Liquid Measurement

Materials

For the teacher: Oven or toaster oven, 1 liquid measuring cup, 1 small pitcher of water, 1 set measuring spoons, cookie trays, 1 set oven mitts, 1 spatula, wire cooling racks or foil sheets, extra zipper storage bags to store cookies.

For each group: 1 medium bowl (or large bowl), 1 set measuring spoons, 1 stirring spoon, 2 small spoons, 1 cookie sheet, 1 egg, 1/2 cup butter (softened), 1 1/2 teaspoons water, 1/4 teaspoon vanilla extract, storage bags 1, 2, & 3 from *Day 1: Cups, Spoons and Scales*. Optional: eye droppers (to measure liquid ingredients).

Procedure

1. Preheat the oven to 350 degrees Fahrenheit.
2. Demonstrate proper liquid measuring techniques:
 - Place the liquid measuring cup on a flat surface. Measure one cup of water by slowly pouring water from the pitcher into the measuring cup. When the water reaches the one-cup line on the side of the liquid measuring cup, stop pouring. Be sure to fill liquids up to the correct line marked on the side of the cup. Show students that their eyes should be level with the cup when measuring liquid ingredients. Your students may notice that the water surface appears curved. This curved surface is a meniscus. When measuring, match the bottom of the meniscus (or curve) to the correct line on the side of the cup.
 - Hold a tablespoon over the liquid measuring cup or over a bowl. Fill the spoon with water. When the spoon is full, the liquid will stick up above the side of the spoon and look rounded. This curved water surface is a meniscus. You can pour the water back into the pitcher.
3. Show your students that the lines marked on the side of a stick of butter represent tablespoons. Explain that one stick is equal to one-half cup of butter.
4. You or another adult will crack an egg into each group's medium bowl. Be sure to wash your hands after touching raw eggs. Any student that touches a raw egg should wash their hands too. Safely dispose of eggshells.

5. Break the class into their small groups from *Day 1: Cups, Spoons and Scales*.
6. Students will follow the *Day 2: Liquid Measurement* instructions to measure liquid ingredients, mix the liquid and dry ingredients together, and prepared cookie dough.
7. Bake cookies in the pre-heated oven for 12 minutes. (If using a toaster oven, cookies may take longer to bake.)
8. Remove cookies from the oven using oven mitts. Use a spatula to remove the cookies from the tray. Place cookies on wire cooling racks or on sheets of foil.
9. Let cookies cool. Give each student a cookie to taste. Remind students to rate their cookies and complete the last questions in the *Day 2: Cups, Spoons and Scales* worksheet. Your class may choose to take extra cookies home to share with their families or may give extra cookies to other teachers and staff members.
10. While the cookies are baking and cooling, students may complete *While You Wait: Fractional Mathematics*.

Teacher Tips:

- Remember to take extra caution when using the oven or toaster oven. Discuss the dangers of touching the hot oven and hot cookie trays with your students.
- Be sure to take caution with raw eggs. Salmonella, bacteria that cause foodborne illness, may be on the outside shell or inside the egg. Reduce risks by only allowing adults to crack eggs. Anyone who cracks an egg or touches a raw egg must wash his or her hands.
- Recruiting an extra adult to assist with lab management, setup and/or cleanup will help this activity to run smoothly.
- To reduce messes, place each group's ingredients and kitchen supplies on a cafeteria-style plastic tray.
- Students may use eyedroppers to measure liquids into teaspoons and tablespoons. This often helps prevent spills. Be sure eyedroppers are clean.
- You may choose to have your class taste the cookies on Day 2 or save tasting for a third day. If eating cookies on a third day, store cookies in sealed kitchen containers or zipper storage bags. Store any leftovers in sealed containers as well.

WHILE YOU WAIT:

Fractional Mathematics

Materials

For each group: 1 set dry measuring cups, 1 liquid measuring cup, 1 plastic tray, 2 cups of water (in a small pitcher or container).

Procedure

1. While cookies are baking and cooling, students will experiment with equivalent fractions. Students can work in their same groups for this activity.
2. Instruct students to gather additional supplies needed. Remind students to fill cups completely. Ask students **“Why is it important to fill the cup all the way to the top?”**
3. If any groups finishes early, ask them to brainstorm all the different ways you can measure one cup.

Teacher Tips:

- Recruiting an extra adult to assist with lab management, setup and/or cleanup will help this activity to run smoothly.
- To reduce messes, place each group’s supplies on a cafeteria-style plastic tray.
- Extension: Read *More fractions: Eating Fractions* by Bruce McMillan or *The Hershey’s Milk Chocolate Bar Fractions Book* by Jerry Pallotta.
- Extension: use techniques from *Scientific Inquiry: Fractional Mathematics* to explore the number of teaspoons in a tablespoon, the number of tablespoons in one-fourth cup, the number of tablespoons in one cup, the number of cups in a pint, the number of pints in a quart and the number of quarts in a gallon.

Answer Keys

Measuring Up

Doodle Bugs

Circle: **Flour, sugar, salt**

Box: **Brown sugar**

Circle: **Liquid measuring cup**

SCIENTIFIC INQUIRY:

Day 1: Cups, Spoons and Scales

1 cup of flour:	4.4 ounces	125 grams
1 cup of chocolate chips:	6 ounces	170 grams
3/4 cup oatmeal:	2.1 ounces	60 grams
3/4 cup brown sugar:	5.8 ounces	165 grams

Which is heavier? **1 cup of chocolate chips**

One cup of oatmeal weighs **(less)** than 1 cup of brown sugar.

SCIENTIFIC INQUIRY:

Day 2: Liquid Measurement

My cookie looks and tastes: **Answers will vary.**

Did your group do a good job measuring the ingredients? How can you tell?

Answers will vary. Example 1: Yes, we did a good job measuring our ingredients. I can tell because our cookies look and taste very good. **Example 2:** No, our cookies were runny and flat. I think we added too much milk and not enough oats.

WHILE YOU WAIT:

Fractional Mathematics

- 4**
- 2**
- 2**

Proficiency Questions (Workbook)

1. **b** 2. **a** 3. **c** 4. **d** 5. **d** 6. **d**

Proficiency Questions (Virtual CD)

1. **d** 2. **c**