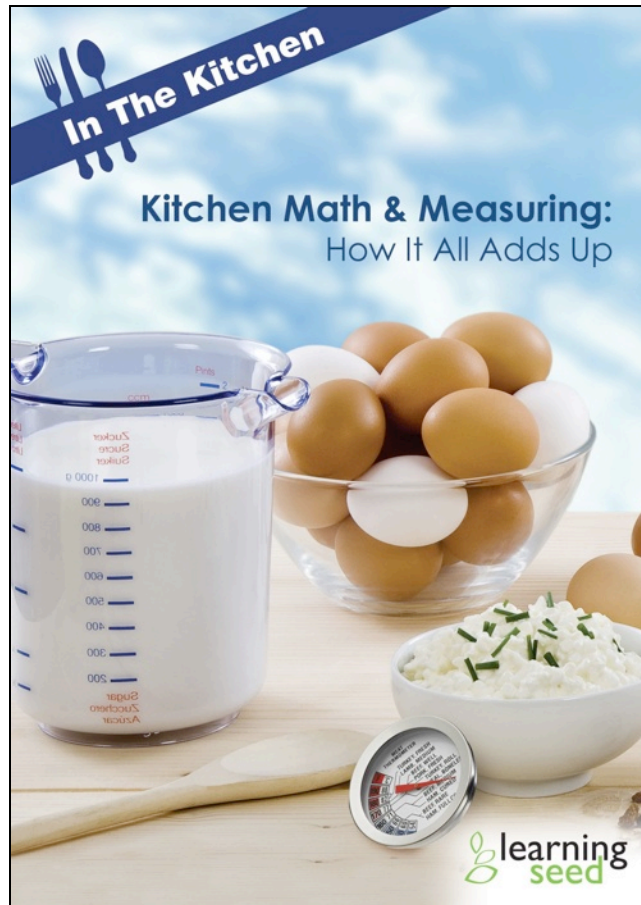


# Kitchen Math and Measuring

## How It All Adds Up



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#### Closed Captioning

This program is closed-captioned.

# Summary

Explore the world of measuring and math from the perspective of the chef. In this program, we not only show you which tools to use, and how to use them, we also demonstrate how math can make your recipes do exactly what you need them to.

We'll step inside the kitchen to learn:

- Tools and methods used for measuring ingredients
- How and why we measure heat
- Equivalent measures for the U.S. and Metric systems
- How to double and halve recipes

A recipe is designed to give the same results every time. You'll know you're reading a well-written recipe when it includes:

- Measures of ingredients
- Number of servings
- Cooking Methods
- Measurement of heat
- Measurements of time
- Step-by-step instructions

# Kitchen Tools for Measuring Ingredients

## Measuring Spoons

Standard U.S. measuring spoons come in the following sizes:

- 1 tablespoon (tbsp) = 15 milliliters (mL)
- 1 teaspoon (tsp) = 5 milliliters (mL)
- 1/2 teaspoon (tsp) = 2.5 milliliters (mL)
- 1/4 teaspoon (tsp) = 1.25 milliliters (mL)
- 1/8 teaspoon (tsp) is about .5 milliliters (mL)

In countries that use the metric system—that is, most countries other than the U.S., metric measuring spoons are the same **size** as US measuring spoons – they are just labeled a little differently. Metric spoons are measured in milliliters, or mL, as shown above.

**TIP:** Don't confuse tablespoons and teaspoons that measure, with the tablespoons and teaspoons in your silverware drawer! Silverware sets are engineered for eating -- not accuracy.

## Measuring Ingredients

Measuring spoons measure both liquid and dry ingredients.

### Measuring Liquid Ingredients:

When pouring a liquid, like vanilla extract, into a measuring spoon, hold the spoon level until the liquid reaches the brim.

Fill the spoon over a sink, counter, or small bowl. If extra liquid spills over, you haven't messed up your recipe.

### Measuring Dry Ingredients:

For a dry ingredient, like baking powder, insert your spoon into the container and pull back against the rim. That levels off the spoon to just the right amount.

## Measuring Cups

### Dry Ingredients

Dry ingredients are often measured with nested measuring cups. These include:

- 1 cup (c) = 8 ounces (oz) = 250 milliliters (mL)
- 1/2 cup (c) = 125 milliliters (mL)
- 1/3 cup (c) is about 75 milliliters (mL)
- 1/4 cup (c) is about 50 milliliters (mL)

### Measuring Dry Ingredients

Instead of pouring ingredients into cups, use a scoop or a spoon to fill them, so the ingredient, like flour, doesn't get packed down.

Fill the cup to the brim. Then level off any extra with a spatula.

Sometimes a recipe may ask for something more specific than a cup... maybe a sifted cup... a heaping cup... or a packed cup. What does these mean?

Sifting is a method of breaking up clumps and adding air to flour.

One cup of sifted flour may weigh 5%-10% less than a cup of flour straight from the container. The result of using sifted flour is lighter cakes and pastries.

#### **Be sure to read the recipe carefully.**

If it says one cup flour, sifted, first measure the flour and level it off. *Then* use a sifter to sift it into your mixing bowl. Measure first, sift second.

If a recipe calls for one cup of sifted flour, first sift it into the measuring cup, and *then* level it off. To measure a heaping cup, pile the ingredient into the measuring cup, but don't level it off. Just pour it directly into your mixing bowl.

For light packing, use a clean hand or a spoon to lightly press the ingredient into the measuring cup. This removes air pockets to provide a more accurate measure. Lightly packed cups are used with bulky ingredients, like breadcrumbs.

For firm packing, push down on the ingredient until you can't fit anymore in the cup. Then level it off.

## Liquid Ingredients

Graduated cups are used to measure liquid ingredients. These come in sizes as small as one or two cups, and usually go all the way to a quart -- the equivalent of four cups.

Measuring cups for liquids are usually made of plastic or glass so you can align the liquid inside with the measurements printed on the outside. Measurements are in cups, ounces, liters and fractions of those amounts.

Liquid measuring cups are also a bit larger than the amount they're meant to measure, so you can move the cup without spilling the liquid. There's also a spout for easy pouring.

## Measuring Liquid Ingredients

When measuring liquids, get down to eye level so you can see the graduated scale printed on the side. The liquid clings to the side of the cup and has a dip in the middle called the meniscus. The meniscus is the curved upper surface of liquid in a container.

To be exact, you should measure liquids in a graduated cup from the *bottom* of the meniscus.

### **TIP: Measuring Peanut Butter**

- To measure ingredients that are neither dry nor liquid, like peanut butter, spray a little cooking oil on the inside of a nested measuring cup.
- Use a rubber spatula to scoop the peanut butter out of its container and into the cup.
- Pack down the peanut butter to remove any air pockets and level it off.
- Use a spatula to scoop the peanut butter into your mixing bowl, and watch how easily it slides out.

You can use the same technique for other ingredients like butter or shortening.

Another way to measure solid fat, like shortening or butter, is through water displacement.

Displacement is the volume of water pushed aside when an object is completely submerged in liquid. In this case, our object is shortening, a fat frequently used in baking.

Water is used for displacing fats and oils because oil and water don't mix.

Even though shortening is a solid, use a liquid measuring cup when using the displacement method so you can see inside and use the measurements printed on the outside.

### **The displacement method requires some simple math:**

Say you want to measure a half cup of shortening. The first number is half cup. The second is the amount of water needed to allow the shortening to float. One cup should do it.

A half cup plus one cup is a cup-and-a-half. That is the number to aim for when measuring this amount of shortening in water.

Choose a measuring cup large enough for both the required amount of shortening and the water used to displace it.

### **To measure $\frac{1}{2}$ cup of shortening by displacement:**

- Start with 1 cup of water.
- Use a spatula to add shortening to the water.
- Keep adding shortening until the water level reaches the target measurement of  $1 \frac{1}{2}$  cups.

## **Measuring Weight**

Scales measure the weight of food in ounces when using the U.S. standard system. For the metric system, scales measure grams. Scales allow more accuracy than measuring cups.

Digital scales are more accurate than mechanical scales.

# Kitchen Tools for Measuring Heat

Every stove-top has a thermostat to regulate the amount of heat generated inside the oven. Thermostats usually measure up to a temperature of 500°F or 260°C.

Cooking thermometers, also called meat thermometers, come in a manual dial, an oven-safe mercury model, or digital models. Most measure between 0°F and 250°F or between -18°C and 121°C.

Beware of undercooked meat and egg dishes! If a food's internal temperature is between 40°F and 140°F or between 4°C and 60°C, it may contain harmful bacteria, like e-coli. This can result in food poisoning.

When cooking meat, fish or chicken, remember that color and juiciness can only help determine doneness: a cooking thermometer is the best guide.

<b>Rare</b>	135°F-140°F	57°C-60°C
<b>Medium rare</b>	140°F-145°F	60°C-63°C
<b>Medium</b>	150°F-160°F	65°C-71°C
<b>Well-done</b>	165°F+	74°C+

**TIP:** Insert the thermometer probe 2" into the meat, away from the bone. Bone heats up much faster than meat, so putting the probe too close to the bone could give a false temperature reading.

## Thermometers for deep-frying foods and candy making

For deep-frying foods, an oil or deep-fry thermometer shows when fat reaches the right temperature for cooking -- between 325°F and 375°F or between 163°C and 190°C.

Candy thermometers come in digital, dial or bulb models. Candy cooks at very high temperatures, so the thermometer starts at 100°F or 38°C degrees and can go as high as 550°F or 288°C.



# Recipe Math

Before you touch a utensil, though, you need to **wash your hands!**

## To properly wash your hands:

- Use soap and hot water
- Wash your palms, the backs of your hands and between your fingers
- Twist your fingertips into your palm or use a brush to clean under your nails
- Dry your hands with a single-use paper towel

**TIP:** Wash your hands for at least 20 seconds. One way to make sure you do this is to recite the alphabet or sing the Happy Birthday song.

**TIP:** Sticks of butter make it quick and easy to measure butter when baking. One stick of butter is 4 oz. or  $\frac{1}{2}$  cup. Most sticks have tablespoon measurements on the wrapper.

## Sugar Cookie Recipe (makes 48 cookies)

2  $\frac{3}{4}$  cups all-purpose flour  
1 teaspoon baking soda  
 $\frac{1}{2}$  teaspoon baking powder  
1  $\frac{1}{2}$  cups white sugar  
1 teaspoon vanilla extract  
1 cup softened butter  
1 egg

Combine flour, baking soda and baking powder. In a separate bowl, cream sugar, vanilla extract, and butter. Add egg and mix, then add flour mixture.

Preheat oven to 375°F or 191°C. Bake for 10 minutes.

To **double** a recipe, **multiply** all ingredient measurements by two.

### **Sugar Cookie Recipe** (makes 96 cookies)

- 5 ½ cups all-purpose flour
- 2 teaspoon baking soda
- 1 teaspoon baking powder
- 3 cups white sugar
- 2 teaspoons vanilla extract
- 2 cups softened butter
- 2 eggs

Combine flour, baking soda and baking powder. In a separate bowl, cream sugar, vanilla extract, and butter. Add egg and mix, then add flour mixture.

Preheat oven to 375°F or 191°C. Bake for 10 minutes.

To **halve** a recipe, **divide** all ingredient measurements by two.

### **Sugar Cookie Recipe** (makes 24 cookies)

- 1 ¼ + 2 tbsp all-purpose flour
- ½ teaspoon baking soda
- ¼ teaspoon baking powder
- ¾ cups white sugar
- ½ teaspoon vanilla extract
- ½ cup softened butter
- 1 ½ eggs

Combine flour, baking soda and baking powder. In a separate bowl, cream sugar, vanilla extract, and butter. Add egg and mix, then add flour mixture.

Preheat oven to 375°F or 191°C. Bake for 10 minutes.

### **Half of an egg?!**

**TIP:** Eggs yield 3 tablespoons of liquid - egg yolk and white beaten together.

Break yolk with white. Measure the egg in tablespoons. Since we need ½ an egg for this recipe, we need half of 3 tbsp, or 1 ½ tbsp.

# Kitchen Math and Measuring

## Matching Quiz

Match the words in the first column to the best available answer in the second column.

- |       |  |                         |
|-------|--|-------------------------|
| _____ | These utensils come in 1 tbsp, 1 tsp, 1/2 tsp, 1/4 tsp and sometimes 1/8 tsp.                  | 1) meniscus             |
| _____ | A method of breaking up clumps and adding air to flour.  | 2) measuring cups       |
| _____ | An ingredient pushed into the measuring cup or spoon until no more will fit, then leveled off. | 3) lightly packed       |
| _____ | The amount of space that an object or substance occupies.                                      | 4) measuring spoons     |
| _____ | These utensils come in 1 cup, 1/2 cup, 1/3 cup and 1/4 cup.                                    | 5) displacement         |
| _____ | A tool used to measure the temperature of food.  | 6) volume               |
| _____ | A bulky ingredient, like breadcrumbs, lightly pressed into measuring cup or spoon.             | 7) firmly packed        |
| _____ | The curved upper surface of liquid in a container.   | 8) sifting              |
| _____ | The volume of water pushed aside when an object is completely submerged in liquid.             | 9) heaping              |
| _____ | A measurement of an ingredient that is not leveled off.  | 10) cooking thermometer |

# Kitchen Math and Measuring

## Matching Quiz

- 4 These utensils come in 1 tbsp, 1 tsp, 1/2 tsp, 1/4 tsp and sometimes 1/8 tsp. 1) meniscus
- 8 A method of breaking up clumps and adding air to flour. 2) measuring cups
- 7 An ingredient pushed into the measuring cup or spoon until no more will fit, then leveled off. 3) lightly packed
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- 2 These utensils come in 1 cup, 1/2 cup, 1/3 cup and 1/4 cup. 5) displacement
- 10 A tool used to measure the temperature of food. 6) volume
- 3 A bulky ingredient, like breadcrumbs, lightly pressed into measuring cup or spoon. 7) firmly packed
- 1 The curved upper surface of liquid in a container. 8) sifting
- 5 The volume of water pushed aside when an object is completely submerged in liquid. 9) heaping
- 9 A measurement of an ingredient that is not leveled off. 10) cooking thermometer

# Kitchen Math and Measuring

## Fill-in-the-Blank Exercise

### **Sugar Cookie Recipe** (makes 48 cookies)

2  $\frac{3}{4}$  cups all-purpose flour  
1 teaspoon baking soda  
 $\frac{1}{2}$  teaspoon baking powder  
1  $\frac{1}{2}$  cups white sugar  
1 teaspoon vanilla extract  
1 cup softened butter  
1 egg

Combine flour, baking soda and baking powder. In a separate bowl, cream sugar, vanilla extract, and butter. Add egg and mix, then add flour mixture.

Preheat oven to 375°F or 191°C. Bake for 10 minutes.

Fill in the blanks based on the recipe above.

### **Sugar Cookie Recipe** (makes \_\_\_\_\_ cookies)

\_\_\_\_\_ all-purpose flour

\_\_\_\_\_ baking soda

1 teaspoon baking powder

\_\_\_\_\_ white sugar

2 teaspoons vanilla extract

2 cups softened butter

\_\_\_\_\_ eggs

Combine flour, baking soda and baking powder. In a separate bowl, cream sugar, vanilla extract, and butter. Add egg and mix, then add flour mixture.

Preheat oven to 375°F or 191°C. Bake for \_\_\_\_\_.

# Kitchen Math and Measuring

## Fill-in-the-Blank Exercise Answer Key

### **Sugar Cookie Recipe** (makes 48 cookies)

2  $\frac{3}{4}$  cups all-purpose flour  
1 teaspoon baking soda  
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Combine flour, baking soda and baking powder. In a separate bowl, cream sugar, vanilla extract, and butter. Add egg and mix, then add flour mixture.

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Fill in the blanks based on the recipe above.

### **Sugar Cookie Recipe** (makes 96 cookies)

5  $\frac{1}{2}$  cups all-purpose flour

2 teaspoons baking soda

1 teaspoon baking powder

3 cups white sugar

2 teaspoons vanilla extract

2 cups softened butter

2 eggs

Combine flour, baking soda and baking powder. In a separate bowl, cream sugar, vanilla extract, and butter. Add egg and mix, then add flour mixture.

Preheat oven to 375°F or 191°C. Bake for 10 minutes.

# Kitchen Math and Measuring

## Multiple Choice

Circle the best answer for each question.

<p>1. Liquid measurements should be measured from the _____ of the meniscus.</p> <p>a) top b) bottom c) side d) distance</p>	<p>6. To halve a recipe, _____ measurements by _____.</p> <p>a) multiple; 2 b) divide; 2 c) multiple; 4 d) divide; 4</p>
<p>2. An egg yields _____.</p> <p>a) 3 teaspoons b) 1 1/2 tablespoons c) 3 tablespoons d) 4 tablespoons</p>	<p>7. Measuring cups for liquids are usually made of _____.</p> <p>a) metal b) plastic c) glass d) B and C</p>
<p>3. Cooking thermometers, also called meat thermometers, come in a:</p> <p>a) manual dial b) oven-safe mercury model c) digital model d) all of the above</p>	<p>8. Measuring cups come in 1 cup, 1/2 cup, _____ and _____.</p> <p>a) 1/3 cup; 1/4 cup b) 1/3 cup; 1/5 cup c) 1/4 cup; 1/5 cup d) 1/4 cup; 1/8 cup</p>
<p>4. _____ are more accurate than _____.</p> <p>a) Digital scales; mechanical scales b) Mechanical scales; digital scales c) Scales; measuring cups d) A and C</p>	<p>9. _____ is a method of breaking up clumps and adding air to flour.</p> <p>a) Shaking b) Sifting c) Shifting d) Shelling</p>
<p>5. The volume of water pushed aside when an object is completely submersed in liquid:</p> <p>a) weight b) area c) displacement d) none of the above</p>	<p>10. When pouring a liquid, like vanilla extract, into a measuring spoon, fill the spoon over:</p> <p>a) the sink b) a small bowl c) your mixing bowl d) A and B</p>

# Kitchen Math and Measuring

## Multiple Choice Answer Key

<p>1. Liquid measurements should be measured from the _____ of the meniscus.</p> <p>a) top <b>b) <u>bottom</u></b> c) side d) distance</p>	<p>6. To halve a recipe, _____ measurements by _____.</p> <p>a) multiple; 2 <b>b) <u>divide; 2</u></b> c) multiple; 4 d) divide; 4</p>
<p>2. An egg yields _____.</p> <p>a) 3 teaspoons b) 1 ½ tablespoons <b>c) <u>3 tablespoons</u></b> d) 4 tablespoons</p>	<p>7. Measuring cups for liquids are usually made of _____.</p> <p>a) metal b) plastic c) glass <b>d) <u>B and C</u></b></p>
<p>3. Cooking thermometers, also called meat thermometers, come in:</p> <p>a) manual dial b) oven-safe mercury model c) digital model <b>d) <u>all of the above</u></b></p>	<p>8. Measuring cups come in 1 cup, 1/2 cup, _____ and _____.</p> <p>a) <b><u>1/3 cup; 1/4 cup</u></b> b) 1/3 cup; 1/5 cup c) 1/4 cup; 1/5 cup d) 1/4 cup; 1/8 cup</p>
<p>4. _____ are more accurate than _____.</p> <p>a) Digital scales; mechanical scales b) Mechanical scales; digital scales c) Scales; measuring cups <b>d) <u>A and C</u></b></p>	<p>9. _____ is a method of breaking up clumps and adding air to flour.</p> <p>a) Shaking b) <b><u>Sifting</u></b> c) Shifting d) Shelling</p>
<p>5. The volume of water pushed aside when an object is completely submerged in liquid:</p> <p>a) weight b) area c) <b><u>displacement</u></b> d) none of the above</p>	<p>10. Where should you not fill a spoon over when measuring a liquid, like vanilla extract?</p> <p>a) the sink b) a small bowl c) <b><u>your mixing bowl</u></b> d) A and B</p>



# Glossary of Terms

<b>Cooking Thermometer</b>	a tool used to measure the temperature of food.
<b>Displacement</b>	the volume of water pushed aside when an object is completely submersed in liquid.
<b>Firmly Packed</b>	an ingredient pushed into the measuring cup or spoon until no more will fit, then leveled off.
<b>Heaping</b>	a measurement of an ingredient that is not leveled off.
<b>Lightly Packed</b>	a bulky ingredient, like breadcrumbs, lightly pressed into measuring cup or spoon.
<b>Meniscus</b>	the curved upper surface of liquid in a container. Measurements should be made from the bottom of the meniscus.
<b>Scale</b>	a machine used to measure the weight of food.
<b>Sifting</b>	a method of breaking up clumps and adding air to flour.
<b>Volume</b>	the amount of space that an object or substance occupies.