Chapter 1: Weights & Measures

MASS MEASUREMENTS

Did you know that we use weights and measures every day?

People use weights and measures all the time. Whether you are stepping onto the scale at the doctor's office, measuring a cup of milk, or going to math class, you are using weights and measures on a daily basis.

In cooking there are many measurements that are converted. We can convert from one unit of measure to another, or even between ***metric*** and ***household*** measurements. Understanding how to convert measurement is very important when following recipes.

Recipes in the United States typically call for volumetric measurements. However, mass is typically used to measure dry ingredients. ***Mass*** is the quantity of matter an object contains, and volume is the amount of space the object takes up. It is possible to have an equal volume of two different substances, but not have an equal mass. This is because the physical property of the two substances is not the same. ***Density*** is a physical property that compares the mass of a substance to the volume it occupies.

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

The greater the mass in a unit of volume, the greater the density will be. Gases will have lower densities because gas molecules are widely separated, while solid and liquid particles are not.

When measuring ingredients in a recipe it is important to use the correct measurement for each ingredient. ***Dry ingredients*** refer to the

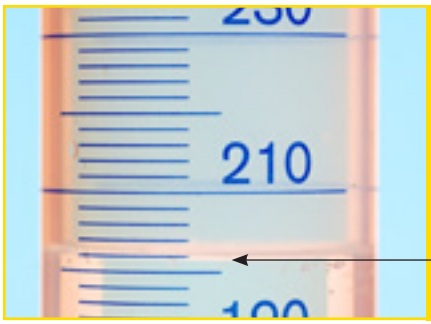
	Metric System	US Household Measurement
Length	Meters	Yards
Mass	Kilogram	Pounds
Volume	Liters	Gallons

ingredients in a recipe that may be combined before adding to another mixture in the recipe. Examples include flour, sugar, salt, spices, and herbs. To determine whether a recipe is asking you to mass an ingredient, look for key words that refer to mass such as pounds, ounces, or grams. You can mass these items with a triple beam balance or basic kitchen scale. To mass a dry ingredient, you should place an empty bowl on the balance and measure the bowl's mass. Once you have the bowl's mass, you can add the ingredient's mass to the bowl. Leaving the bowl on the balance, set the riders to the desired mass and add the ingredient until the scale is balanced. You can also set the scale to zero once you place the bowl on the scale to tare the scale. When the scale is set to zero, it will only weigh the item you place on the scale and not the bowl. Tarring the scale will allow for greater accuracy during measurement.

The ***accuracy*** of a measurement is how much that measurement differs from a known, true value. For example, if a "10g" brass mass from a standard set of masses is measured on a reliable scale and is found to be 10g, than the mass is accurate, but, if it is found to be 9.8g, it is not. Percent error can be calculated to determine accuracy of a measurement.

A graduated cylinder (left) is more accurate than a beaker (right).

Precision is how reliable the measuring device is and how reproducible its measurements are. A 100 milliliter beaker is not as precise as a 100 milliliter graduated cylinder. One hundred milliliters measured in a beaker will vary slightly every time the beaker is used. The graduated



*Measure the **meniscus** at eye level from the bottom of the curve.*

cylinder has more graduations and will be more precise.

Volumetric measurements are used to measure liquid ingredients ranging from small to large. Some examples include milliliters, fluid ounces, teaspoons, and cups. They are made using measuring cups and spoons as well as larger capacities, like gallon or quart. These measurements are based on the amount of fluid ounces that can occupy a given amount of space.

When measuring liquids, it is important to use the liquid measuring cup on a flat surface. To determine the amount being measured, you should look for the ***meniscus***. The meniscus is the curved upper surface of the liquid. You should measure the meniscus at eye level from the bottom of the curve. Measuring from the meniscus will give you the most accurate measurement for the amount of liquid in the cup.

No matter what method you are using to measure ingredients, it is very important to use exact amounts. There is a huge difference between 8 fluid ounces (one cup) and 8 dry ounces. Liquid measuring cups measure fluid ounces in volume, not weight.

We use these to measure foods, like oil and water. For example, 2 cups of flour, which by volume is equivalent to 16 fluid ounces, will only weigh about 8 ounces. You will learn more about measuring in *Food Explorations Lab I* of this chapter.

Even food labels can be considered a form of measurement. The Nutrition Facts label, which can be found on most food packages, provides the nutritional content per standard serving. The items listed on the label are either measured in calories, grams, or milligrams. Since we don't typically use these types of measurements when cooking, we convert them to volumetric measurements. We use cups and spoons instead of grams or ounces. We can also determine how many calories are in a gram. This gives a better understanding of the number of calories we get from that nutrient. Each macronutrient amount can be converted to calories based on how many calories per gram they are worth. To convert grams to calories you must multiply the grams of that macronutrient by calorie/gram amount. The table below provides an example of how to complete this calculation.

You will learn more about food labels in *Food Explorations Lab II* of this chapter. Let's find out how to use these tools of measurement every day!

Total Calories	Grams of Fat	Calories per gram	Total Calories from Fat	Fat Calorie Calculation	Percent Fat Calculation
200 calories	13g	9 calories	117 calories	13g x 9cal = 117cal	$\frac{117\text{cal}}{200\text{cal}} = 0.585$ 0.585 x 100 = 58.5%

Think About It

Food Explorations Lab I

1. Give one example of a weight or measurement that you may make in a day.

   (Multiple answers possible) buying clothes (sizes), distance/time to and from school, time at school each day, measuring ingredients in a recipe, etc.

2. The measurements used for dry ingredients are _____mass_____ measurements.

3. The measurements used for liquid ingredients are _____volumetric_____ measurements.

4. If two substances have the same mass but different volumes, than their _____density_____ must be different.

Food Explorations Lab II

1. Food labels may be considered a form of _____measurement_____.

2. Describe the purpose of food labels.

   Food labels provide consumers with information about the nutrient content of food.

3. Describe how the grams of a macronutrient found on a food label can be converted to its calorie content.

   To convert grams to calories you must multiply the grams of that macronutrient by its calorie/gram amount.