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

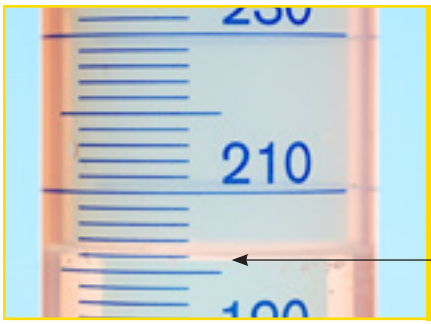
	Metric System	US Household Measurement
Length	Meters	Yards
Mass	Kilogram	Pounds
Volume	Liters	Gallons

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.

Food Explorations Lab I:

Mastering Measurements

STUDENT LAB INVESTIGATIONS

Name: _____

Lab Overview

During this investigation, you will be asked to measure substances using household measurement tools and scientific measuring tools. You will compare the values you obtain to the expected values and calculate percent error. Relative densities of measured substances will also be compared.

Lab Objectives

In this lab, you will learn how to…

1. Identify measurement tools for mass and volume.

2. Properly use measurement tools to obtain accurate measurements.

3. Identify measurement tools that provide the most precise measurements.

4. Identify factors that can impact the accuracy of a measurement.

5. Use mass and volume measurements to compare relative densities of the measured substances.

You will work in a group to perform a series of measurements. The goal of the investigation is to identify measurement tools, learn precise methods of measurement, and identify factors that can impact accuracy.

Lab Safety: Before beginning ANY investigation you should put on your safety goggles and apron. Always wash your hands following completion of an investigation. When handling food, you should also wash your hands prior to beginning an investigation.

Lab Questions

1. Which of the methods below will produce the most accurate measurement for the dry ingredient flour? (Circle your answer.)

Spooned Method

Dipped Method

Sifted Method

Prediction #1: I predict the _____ method will provide the most accurate measurement of flour because…

2. Which of the below tools will produce the most precise measurement for liquid ingredients? (Circle your answer.)

Liquid Measuring Cup
(Cups and Fluid Ounces)

Dry Measuring Cups
(1 cup, ¾ cup, ½ cup, ¼ cup)

Graduated Cylinder
(mL)

Prediction #2: I predict the _____ will provide the most precise measurement of liquid ingredients because…

Observation of Measurement Types & Accuracy

MATERIALS

Assignment A – Method Accuracy

1 ½ cups flour in a plastic bag
1 set dry measuring cups
1 triple beam balance
1-2 sheets wax paper
1 strainer (wide mesh)
1 medium bowl
1 plastic knife
1 plastic spoon

Assignment B – Tool Precision

1 cup cooking oil in a plastic cup
1 cup water in a plastic cup
1 set dry measuring cups
1 liquid measuring cup
1 graduated cylinder
1 triple beam balance

Obtain your assignment from you teacher. Record your group's assignment below.

My group's assignment is: _____

ASSIGNMENT A: PROCEDURE

MEASUREMENT METHOD ACCURACY - WEIGHING & MEASURING DRY INGREDIENTS

Use three different methods to measure ½-cup of flour: **Dipped Method**, **Sifted Method**, and **Spooned Method**.

1. Before you begin, place the ½-cup dry measuring cup on your balance. Using the balance, find the mass of the measuring cup.

Mass of ½-cup Measuring Cup = _____g

2. Measure flour using the **Dipped Method**:

   a. Dip the ½-cup dry measuring cup directly into the container of flour, filling it to overflowing with flour.

   b. Level with the flat edge of a plastic knife over wax paper and mass the cup plus flour on the balance. Calculate the mass of the flour as follows:

Mass of Flour = Mass of Cup and Flour – Mass of Cup

   c. Record the volume (cups) and mass (grams) of flour in Table A under the "Mass in grams" column.

   d. Place the flour back into the plastic bag.

3. Measure flour using the **Spooned Method**:

   a. Stir the flour in a medium bowl or the bag with a spoon.

   b. Spoon flour gently into a ½-cup dry measuring cup. Level with the flat edge of a plastic knife over wax paper and mass the cup plus flour on the balance. Calculate the mass of the flour as follows:

   Mass of Flour = Mass of Cup and Flour – Mass of Cup

   c. Record the volume (cups) and mass (grams) of flour in Table A under the "Measured Mass (grams)" column.

   d. Place the flour back into the plastic bag.

4. Measure flour using the **Sifted Method**:

   a. Measure ½ cup of flour using the ½-cup dry measuring cup.

   b. Pour the flour into a strainer (½ cup).

   c. Sift onto wax paper by gently tapping the strainer against the palm of your hand.

   d. Spoon flour gently into the ½-cup dry measuring cup. Level with the flat edge of a plastic knife over wax paper and mass the cup plus flour on the balance. Calculate the mass of the flour as follows:

   Mass of Flour = Mass of Cup and Flour – Mass of Cup

   e. Record the volume (cups) and mass (grams) in Table A.

   f. Place the flour back into the plastic bag.

5. Share your data with the other student groups to complete Table B.

Table A: Dry Ingredient Measurements

Method	Measured Volume (cups)	Measured Mass (grams)
Sifted Flour	½ cup	57g
Spooned Flour	½ cup	59g
Dipped Flour	½ cup	62g

6. Using the *Common Weights and Measures* chart, calculate the actual flour mass (grams) per ½ cup (volume):

$$\frac{115\text{g per cup}}{2} = 57.5\text{g per } \tfrac{1}{2} \text{ cup}$$

ASSIGNMENT B: PROCEDURE

MEASUREMENT TOOL PRECISION - WEIGHING & MEASURING LIQUID INGREDIENTS

Use the following steps to measure ¼ cup of water and cooking oil using three types of measurement tools: **Liquid Measuring Cup**, **Graduated Cylinder**, and **Dry Measuring Cup.**

1. Before you begin, measure the mass of your liquid measuring cup and record its mass below.

   Mass of Liquid Measuring Cup: _____ **grams.** This mass will need to be subtracted from the mass of the liquid.

2. Next, place the dry measuring cup on your balance and record its mass below.

   Mass of Dry Measuring Cup: _____ **grams.** This mass will need to be subtracted from the mass of the liquid.

3. Next, place the graduated cylinder on your balance and record its mass below.

   Mass of Graduated Cylinder: _____ **grams.** This mass will need to be subtracted from the mass of the liquid.

4. Measure water using three types of measuring tools:

   a. Place the liquid measuring cup on a level surface.

   b. Measure out ¼ cup of water in the liquid measuring cup. Be sure to take the ¼ cup measurement at the lowest point of the meniscus (curved upper surface of the liquid).

   c. Mass the water.

   Mass of Water = Mass of Water and Cup – Mass of Cup

   d. Record the volume (ounces) and mass of the water in the column labeled "Water Volume" in Table B.

   e. Repeat steps a through d using a dry measuring cup.

   f. Repeat steps a through d using a graduated cylinder.

5. Measure cooking oil using three types of measuring tools:

   a. Place the liquid measuring cup on a level surface.

b. Measure out ¼ cup of cooking oil in the liquid measuring cup. Be sure to take the ¼ cup measurement at the lowest point of the meniscus (curved upper surface of the liquid).

c. Mass the cooking oil.

Mass of Oil = Mass of Oil and Cup – Mass of Cup

d. Record the volume (ounces) and mass of the cooking oil in the column labeled "Oil Volume" in Table B.

e. Repeat steps a through d using a dry measuring cup.

f. Repeat steps a through d using a graduated cylinder.

6. Share your data with the other student groups to complete Table B.

Table B: Liquid Ingredient Measurements

Measuring Tool	Water Volume (ounces)	Water Mass (grams)	Oil Volume (ounces)	Oil Mass (grams)
Liquid Measuring Cup		67.3g		56.5g
Dry Measuring Cup		57.3g		52.7g
Graduated Cylinder		59.3g		52.3g

Use the *Common Weights and Measures* chart to complete 7-8.

7. Calculate the actual water mass (grams) per ¼ cup (volume):

$$\frac{236.5\text{g per cup}}{4} = 59.1\text{g}$$

8. Calculate the actual oil mass (grams) per ¼ cup (volume):

$$\frac{210\text{g per cup}}{4} = 52.5\text{g}$$

Calculation of Accuracy:

1. Using the *Common Weights and Measures* chart, calculate the % error in Tables B and D.

Example:

First determine the actual mass of your ingredient per ½ cup (volume). Flour masses 115g per cup. Let's say you massed 1 cup of spooned flour and it was 120 grams. To find percent error, subtract 115g (actual flour mass) from 120g (spooned flour mass). Your error is 5g.

$$|120g - 115g| = 5g$$

To find percent error, divide your 5 grams (error) by your spooned flour measure of 120 grams (5g ÷ 115g = 0.04). Then, multiply that value by 100 (0.04g × 100 = 4%). Your percent error is 4%.

$$\frac{5g}{115g} = 0.04$$

$$0.04 \times 100 = 4\%$$

Table C: Dry Ingredient % Error Calculation

Method	Calculations	% Error
Sifted Flour	$\lvert 57g - 57.5g \rvert = 0.5g$ $\frac{0.5g}{57.5g} = -0.009$ $0.009 \times 100 = 0.9\%$	0.9%
Spooned Flour	$\lvert 59g - 57.5g \rvert = 1.5g$ $\frac{1.5g}{57.5g} = 0.026$ $0.026 \times 100 = 2.6\%$	2.6%
Dipped Flour	$\lvert 62g - 57.5g \rvert = 4.5g$ $\frac{4.5g}{57.5g} = 0.078$ $0.078 \times 100 = 7.8\%$	7.8%

Table D: Liquid Ingredient % Error Calculations

Method	Water Calculations	Water % Error	Oil Calculations	Oil % Error
Liquid Measuring Cup	$\lvert 67.3g - 59.1g \rvert = 8.2g$ $\frac{8.2g}{59.1g} = 0.139$ $0.139 \times 100 = 13.9\%$	14.0%	$\lvert 55.6g - 52.5g \rvert = 3.1g$ $\frac{3.1g}{52.5g} = 0.06$ $0.06 \times 100 = 6.0\%$	6.0%
Dry Measuring Cup	$\lvert 57.3g - 59.1g \rvert = 1.8g$ $\frac{1.8g}{59.1g} = 0.03$ $0.03 \times 100 = 3.1\%$	3.1%	$\lvert 52.7g - 52.5g \rvert = 0.2g$ $\frac{0.2g}{52.5g} = 0.004$ $0.004 \times 100 = 0.4\%$	0.4%
Graduated Cylinder	$\lvert 59.3g - 59.1g \rvert = 0.2g$ $\frac{0.2g}{59.1g} = 0.003$ $0.003 \times 100 = 0.3\%$	0.3%	$\lvert 52.3g - 52.5g \rvert = 0.2g$ $\frac{0.2g}{52.5g} = 0.004$ $0.004 \times 100 = 0.4\%$	0.4%

2. Using the % error, determine which measurement method was the most accurate for measuring flour. Why did they differ? Which method masses the most, which masses the least?

   The sifted ½ cup of flour yielded the most accurate measurement. The Common Weights and Measures chart stated 1 cup of flour should equal 115g per cup. The sifted ½ cup of flour weighed approximately 57g per ½ cup, or 114 grams per cup. In addition, the percent error of the sifted flour was calculated to be 0.9%, the least of the 3 methods. The spooned flour was the next most accurate method of measurement.

3. If 1 cup of sifted flour has a mass of 77 grams, and 1 cup of dipped flour has a mass of 3 ¾ ounces, which has a greater mass? Explain the mass difference.

   The dipped flour weighs more because air is now present in the sifted flour increasing the volume while decreasing the mass. There are approximately 28.35 grams in one ounce, so 77 grams is equal to about 2 ¾ ounces of flour. Dipped flour masses the most. Sifted flour massed the least. This is because when flour is sifted or spooned, it becomes less dense. The dipped flour has a greater mass.

4. Which measurement tool (dry versus liquid measuring cup) was the most precise for measuring cooking oil and water? Explain why the tools would yield different results.

   The liquid measuring cup was the most precise because it allows the oil to be poured to exactly the right amount. The dry measuring cup does not allow you to measure the exact amount without spilling oil.

5. Explain why equal volumes of cooking oil and water would have different masses. Which liquid has the greater density?

Equal volumes of cooking oil and water would have different masses because of differences in density. Water is more dense than oil.

6. Infer the affect sifting has on the measured flour's density. Explain why.

Sifting forces air molecules in place of flour molecules resulting in a decrease in the flour's density because air weighs less than flour.

7. If you need ½ a gallon of water, but only had a four-cup liquid measure, how many cups would you need to use? How many tablespoons? How many fluid ounces? Use the Common Weights and Measures chart as a guide.

Cups: 2

Tablespoons: 16 tablespoons x 4 cups x 2 cups = 128tbsp

Fluid Ounces: 8 fluid ounces x 4 cups x 2 cups = 64oz

8. If you are making zucchini muffins (several times the recipe) for a bake sale at school, how would you measure your dry ingredients (e.g. flour)? Liquid ingredients (e.g. cooking oil)? Why? (*HINT:* What measurement methods were the most accurate? Which measurement tool(s) were the most accurate?)

   Dry Ingredients: These should be measured using dry measuring cups if the recipe calls for volumetric amounts. When measuring flour, the sift method should be used. If the recipe calls for weight, these should be measured using a scale.

   Liquid Ingredients: These should be measured using a graduated cylinder.

9. Apart from the tools and methods used, what other factor(s) may have impacted your ability to obtain accurate measurements?

   Human error (e.g. spilling liquid), precision of measurement instrument (may vary by manufacturer), accuracy of method used, and use of measurement tools that will hold greater quantities than being measured (e.g. using a 1 cup measure to measure $\frac{1}{2}$ cup).

10. In your own words, describe why it is important for scientific measurement tools to be precise and be used properly to give accurate measurements.

    (Multiple answers possible)

    It is important for scientific measurement tools to be precise and be used properly because there is little room for error in science. For example, one small difference when mixing chemicals can lead to injury or an incorrect result.

TEACHER EDITION

Food Explorations Lab II:
Label Logic

STUDENT LAB INVESTIGATIONS

Name: _____

Lab Overview

In this investigation, your group will use the information on Nutrition Facts labels of two potato chip products to determine which one provides the best nutrition for your body. You will calculate the mass of each macronutrient in three servings of the chips, measure these masses using *representative* ingredients, and convert the measured amounts to a common household volume measurement (teaspoons). You will also calculate the calories in the foods that are from each macronutrient (i.e. fat, carbohydrate, protein).

Lab Objectives

In this lab, you will learn how to…

1. Read a Nutrition Facts label.
2. Compare and contrast the nutritional differences between two snacks based on calories, carbohydrate, fat, sugar, sodium, and fiber content.
3. Select healthier food choices using Nutrition Facts labels.

Lab Safety: Before beginning ANY investigation you should put on your safety goggles and apron. Always wash your hands following completion of an investigation. When handling food, you should also wash your hands prior to beginning an investigation.

Lab Question

According to the Nutrition Facts label, which snack (Classic Potato Chips or Baked Potato Chips) has the best nutrition profile?

Prediction: The _____ chips have the best nutrition profile because…

Understanding Food Label Measurements & Weights

MATERIALS

1 small cup of salt *(represents sodium)*
1 small cup of sugar *(represents carbohydrates)*
1 small cup of softened butter *(represents saturated fat)*
1 small cup of olive oil *(represents unsaturated fat)*
1 set of measuring spoons
1 triple beam balance
4 small empty cups

PROCEDURE

1. Read the Nutrition Facts labels below.

SNACK #1: CLASSIC POTATO CHIPS

Nutrition Facts
Serving Size 1 oz.

Amount Per Serving

Calories 150	Calories from Fat 90
	% Daily Value
Total Fat 10g	**16%**
Saturated Fat 1g	**6%**
Polyunsaturated Fat 4.5g	
Monounsaturated Fat 4.5g	
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 180g	**7%**
Potassium 330g	**9%**
Total Carbohydrate 15g	**5%**
Dietary Fiber 1g	**4%**
Sugars 0g	
Protein 2g	

SNACK #2: ★ BAKED POTATO CHIPS

Nutrition Facts
Serving Size 1 oz.

Amount Per Serving

Calories 120	Calories from Fat 30
	% Daily Value
Total Fat 3g	**5%**
Saturated Fat 0.5g	**3%**
Polyunsaturated Fat 1.5g	
Monounsaturated Fat 1g	
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 160g	**7%**
Potassium 290g	**8%**
Total Carbohydrate 21g	**7%**
Dietary Fiber 2g	**8%**
Sugars 2g	
Protein 2g	

2. Find Total Calories, Total Carbohydrates (grams), and Total Fat on each label. Calculate their amounts for 3 servings and record your findings in Table A. (*HINT:* Multiply each by 3.)

3. Draw a circle around *Serving Size* on each Nutrition Facts label.

4. Draw a square around *Saturated Fat* on each Nutrition Facts label.

   a. How much *Saturated Fat* is in 3 servings of each snack? Record this number of grams in Table B.

   b. Use the balance and measure the mass of an empty plastic cup. Add the calculated mass of Saturated Fat to the mass of the cup.

Mass of cup _____g + Mass of Saturated Fat _____g =

Total Mass of Saturated Fat_____g

   c. Place the riders on the balance to equal the Total Mass. Add the softened butter (representing *Saturated Fat*) to the plastic cup until the scale balances.

   d. Measure the gram amount of 3 servings of Saturated Fat using measuring spoons (teaspoon). Record your findings in Table B.

NOTE: Softened butter is being used to represent Saturated fat in this investigation, however butter is only one type of saturated fat in the diet. Some other sources include tropical oils (palm and coconut).

5. Underline the *Unsaturated Fats* on the Nutrition Facts label for the Classic Potato Chips.

   a. How many grams of *Unsaturated Fats* are in 3 servings of each snack? Record this number of grams in Table B.

NOTE: You should choose foods that are have higher amounts of unsaturated fats compared to saturated fats. In general, unsaturated fats are healthier than saturated fats.

   b. Use the balance and measure the mass of an empty plastic cup. Add the calculated mass of *Unsaturated Fat* to the mass of the cup.

Mass of cup _____g + Mass of Unsaturated Fat _____g =

Total Mass of Unsaturated Fat _____g

   c. Place the riders on the balance to equal the Total Mass. Add the olive oil (representing *Unsaturated Fat*) to the plastic cup until the scale balances.

   d. Measure the gram amount of 3 servings of Unsaturated Fat using measuring spoons (teaspoon). Record your findings in Table B.

NOTE: Olive oil is being used to represent unsaturated fat in this investigation, however olive oil is only one type of unsaturated fat in the diet. Some other sources include canola and soybean oils, flaxseeds and walnuts.

4. Draw a triangle around *Sodium* on each Nutrition Facts label.

   a. Measure the Recommended Daily Allowance (RDA) (2,300 mg) for *Sodium*. Use the balance and salt (representing *Sodium)* to measure the appropriate number of grams. You will first need to convert milligrams to grams. Record your finding in Table B.

b. Use the balance to measure the mass of an empty plastic cup. Add the calculated mass of sodium to the mass of the cup.

Mass of cup _____g + Mass of Sodium _____g =

Total Mass of Sodium _____g

c. Place the riders on the balance to equal the Total Mass. Add the salt (representing sodium) to the plastic cup until the scale balances.

d. Measure the gram amount of *Sodium* using measuring spoons (teaspoon). Record your finding in Table B.

NOTE: Salt is being used to represent sodium in this investigation, however salt is only 40% sodium and 60% chloride.

5. Draw a circle around *Sugars* on each Nutrition Facts label.

a. How much *Sugar* is in 3 servings of each snack? Record this number of grams in Table B.

b. Use the balance and measure the mass of an empty plastic cup. Add the calculated mass of sugar to the mass of the cup.

Mass of cup _____g + Mass of Sugar _____g = Total Mass of Sugar _____g

c. Place the riders on the balance to equal the Total Mass. Add the sugar to the plastic cup until the scale balances.

d. Measure the gram amount of 3 servings of *Sugar* using measuring spoons (teaspoon). Record your finding in Table B.

NOTE: Table sugar is being used to represent all sugar in this investigation; however table sugar is only one type of sugar in the diet. Some other sources include candy, corn syrup, honey, jam or jelly, soda, fruit juices, and ketchup. On the Nutrition Facts label, Sugars can also include natural sources from fruits, olives, grains and dairy foods. To find added sugar, look at the ingredients list. Ingredients like corn syrup, high-fructose corn syrup, fruit juice concentrate, maltose, dextrose, sucrose, honey, maple syrup, and cane sugar are considered added sugars.

6. Draw a star next to the Nutrition Facts label with the most *fiber*.

TEACHER EDITION

Table A: Total Calories, Carbohydrates, and Fat

	Snack #1: Classic Potato Chips	Snack #2: Baked Potato Chips
Calories	450 calories	360 calories
Carbohydrate	45 grams	63 grams
Fat	30 grams	9 grams

Table B: Saturated Fat, Unsaturated Fat, Sugar, and Sodium

	Snack #1: Classic Potato Chips	Snack #2: Baked Potato Chips
Saturated Fat	3 grams 0.6 tsp	1.5 grams 0.3 tsp
Unsaturated Fat	27 grams 5.5 tsp	7.5 grams 1.5 tsp
Sugar	0 grams 0 tsp	6 grams 2 tsp

HINT: To obtain total grams Unsaturated fat, you will need to add Polyunsaturated fat (grams) and monounsaturated fat (grams).

TEACHER'S NOTE: Numbers in the tables above are estimates only. The values your students obtain may vary.

Conclusion:

1. Calculate the calories from total carbohydrates for 3 servings for each label. Use the grams of *Total Carbohydrate* found on the food labels. (*HINT:* There are 4 calories for each gram of carbohydrate.)

Label 1. 45 x 4 = 180

Label 2. 63 x 4 = 252

2. Calculate the calories from total fat in 3 servings for each label. Use the grams of *Total Fat* found on the food labels. (HINT: There are 9 calories for each gram of fat.)

Label 1. 30 x 9 = 270

Label 2. 9 x 9 = 81

3. Calculate the calories for *Saturated Fat* in 3 servings for each label. Use the grams of saturated fat found on the food labels. (*HINT:* There are 9 calories for each gram of fat.)

Label 1. 3 x 9 = 27

Label 2. 1.5 x 9 = 13.5

Which product has more calories from fat?

Label 1 – Classic Potato Chips

4. Calculate the calories from sugar in 3 servings for each label. Use the grams of sugar found on the food labels. (*HINT:* There are 4 calories for each gram of carbohydrate.) *Show your work.*

Label 1. 0 x 4 = 0

Label 2. 6 x 4 = 24

Which product has more calories per serving from sugar?

Label 2 - Baked Potato Chips

5. Calculate how many teaspoons of saturated fat are in 3 servings for each snack. Use the density of butter to estimate saturated fat. There are approximately 4.5 grams of butter in a teaspoon. *Show your work.*

Label 1:

3 servings x 1g = 3g

$\frac{3g}{4.5g} = \frac{2}{3}$ tsp

Label 2:

3 servings x 0.5g = 1.5g

$\frac{1.5g}{4.5g} = \frac{1}{3}$ tsp

6. Calculate how many teaspoons of unsaturated fat are in 3 servings for each snack. There are approximately 4.5 grams of olive oil in a teaspoon. *Show your work.*

   Label 1:

   3 servings x 9g = 27g

   $\frac{27g}{4.5g}$ = 6 tsp

   Label 2:

   3 servings x 2.5g = 7.5g

   $\frac{7.5g}{4.5g}$ = 1 $\frac{2}{3}$ tsp

7. Calculate how many teaspoons of sugar are in 3 servings for each snack. There are approximately 4 grams of sugar in 1 teaspoon. *Show your work.*

   Label 1:

   3 servings x 0g = 0g

   $\frac{0g}{4g}$ = 0 tsp

   Label 2:

   3 servings x 2g = 6g

   $\frac{6g}{4g}$ = 1 $\frac{1}{2}$ tsp

8. Do your calculations match your measurements in Table B? **YES** **NO**

Why? Explain any differences.

Answers may differ due to human error and the use of using "representative" food materials versus measuring exact amounts of fat, sugar, and sodium present in food.

9. Use the Nutrition Facts labels to complete the chart below. Draw an "X" next to the best answer.

Which snack option is the best option if you wanted to…

	Classic Potato Chips	Baked Potato Chips
…Reduce Total Fat Intake		X
…Reduce Saturated Fat Intake		X
…Reduce Sodium Intake		X
…Reduce Sugar Intake	X	
…Increase Fiber Intake		X

10. Referring to the chart above, which snack has the best nutrition profile? Explain.

Baked chips have the best nutrition profile because they have less total fat, saturated fat, and sodium compared to regular chips and more fiber than regular chips.

Investigating Your Health:

Everyday Weighing and Measuring

Name: _____

Objective: Investigate the Nutrition Facts label of your favorite snack and compare it to an alternative snack.

You use weights and measures for many different things, like when you are determining what size clothes to buy or when cooking. When cooking in the kitchen you use dry and liquid measuring cups to measure the ingredients. You can also use a scale to weigh the ingredients.

Did you know the Nutrition Facts label is actually a measurement of what's in your food? The grams and milligrams on the label are the weight of what is in that food. When reading labels, the first thing you should look at is the amount of calories in one serving. The calories come from the fat, carbohydrates, and protein in the food. Each gram of carbohydrate and protein accounts for 4 calories. Each gram of fat accounts for 9 calories.

Although trans fat does not have a % Daily Value (DV), you should eat as little of this as possible. Sugar also does not have a % DV, and if the sugar is added, you should try to limit this food. Choose foods low in trans fat and sugar, with >20% DV of Vitamin A, C, iron, calcium, potassium, and fiber, and choose foods with <5% DV of saturated fat, cholesterol, and sodium. If a food is high in trans fat, saturated fat, cholesterol, sodium, and added sugars, and low in vitamins, minerals, and fiber, you should limit how much you eat of that food. For more measuring fun, see the *Try This at Home* recipe!

1. Go to the grocery store and look at the Nutrition Facts label on one of your favorite snack foods. If you are unable to go to the grocery store, use the handout provided by your teacher, or access the nutrient database on the USDA website noted below. Complete the Nutrition Facts Labels and the % DV chart below. Record how many servings you normally eat per week of your favorite snack. You will use this information to help you answer questions 6 through 11.

USDA Nutrient Database: http://ndb.nal.usda.gov/ndb/foods/search/list

Your Favorite Snack: Canned Pineapple Packed in 100% Juice

Number of Servings: _____

Use the information in the Nutrition Facts label and % Daily Value chart you completed for your favorite snack to help you answer questions 2 through 6 and questions 10 and 11.

2. Draw a square around *Serving Size* on each nutrition facts label.

3. Draw a circle around *Sodium* on each nutrition facts label.

4. Draw a triangle around *Sugars* on each nutrition facts label.

Nutrient	%DV
Saturated Fat	0%
Cholesterol	0%
Sodium	0%
Potassium	4%
Fiber	5%

Nutrition Facts

Serving Size	½ cup
Calories	70
Total Fat	0g
Sodium	0mg
Total Carbohydrates	16g
Dietary Fiber	1g
Sugars	15g
Protein	<1g

Vitamin A	0 %	Vitamin C	25 %
Vitamin E	0 %	Calcium	0 %
Iron	2 %	Thiamin	0 %
Niacin	0 %	Folate	0 %
Vitamin B_{12}	0 %	Zinc	0 %
Magnesium	0 %		

6. Calculate how many calories you are eating from your favorite snack. Multiply the number of servings you normally eat by the number of calories of each snack. *Show your work.*

   Student's answer will vary based on their favorite snack.

   2 servings x 140cal = 280cal

7. Calculate the calories from *Total Fat* for the amount of servings you normally eat. Use the grams of *Total Fat* found on the food label. There are 9 calories for each gram of fat. *Show your work.*

   Student's answer will vary based on their favorite snack.

   2 servings x 7g fat = 14g fat

   $$\frac{14g \times 9cal}{14g} = 126cal$$

8. Calculate the calories from Total Carbohydrate for the amount of servings you normally eat. Use the grams of Total Carbohydrate found on the food label. There are 4 calories for each gram of carbohydrate. *Show your work.*

   Student's answer will vary based on their favorite snack.

   2 servings x 21g fat = 42g fat

   42g x 4cal = 168cal

9. Calculate the calories from sugar from the amount of servings your normally eat. Use the grams of sugar found on the food label. There are 4 calories for each gram of carbohydrate. *Show your work.*

   Student's answer will vary based on student's favorite snack.

   2 servings x 13g sugar = 26g sugar

   26g x 4cal = 104cal

10. If you were to replace your favorite snack with ½ cup of pineapple chunks packed in 100% fruit juice, calculate the number of calories, calories from Total Fat, and calories from Total Carbohydrate. Do the same calculations as in questions 6-9, but use the canned pineapple Nutrition Facts instead.

    Calories: Student's answer will vary based on their favorite snack.

    70

    Calories from total fat: Student's answer will vary based on their favorite snack.

    0

    Total carbohydrate: Student's answer will vary based on their favorite snack.

    64

11. Based on your answers to the previous questions, which snack is the better option and why?

    Student's answer will vary based on student's favorite snack. When comparing the Oreos in this example, the canned pineapple is the better option because it has fewer calories, fat and more potassium, fiber, and vitamins and minerals than the Oreos. Oreos are also more processed when compared to the canned pineapple. Processing removes beneficial nutrients from the raw ingredients in Oreos while they are made.

TRY THIS AT HOME:

Oatmeal-Flax Chocolate Chip Cookies

Makes 32 cookies

You will need:

1 ½ cups all-purpose flour
¼ cup pre-ground flaxseed
½ teaspoon salt
12 tablespoons unsalted butter
¾ cup packed dark brown sugar
1 cup semisweet chocolate chips
1 cup quick-cooking oats
1 teaspoon baking soda
½ teaspoon cinnamon
1 cup granulated sugar
2 large eggs
1 teaspoon vanilla extract

INSTRUCTIONS:

1. Preheat oven to 350˚F
2. Whisk the flour, oats, flaxseed, baking soda, salt, and cinnamon in a bowl
3. Beat the butter, granulated sugar, and brown sugar in a large bowl until fluffy.
4. Beat in the eggs one at a time.
5. Beat in vanilla.
6. Add the flour mixture and beat until just combined.
7. Stir in the chocolate chips.
8. Drop heaping tablespoonfuls of cookie dough on baking sheets. Place cookie dough about 2 inches apart.
9. Bake 10-12 minutes, or until golden brown.
10. Let the cookies cool for 3 minutes and enjoy!