

By the Pound, Gram, Liter or Gallon

Utah Math Core Standards



Materials

- ◆ Variety of produce (apples, onions, potatoes, carrots, oranges, etc.)
- ◆ Grocery flyers (one per station)
- ◆ 5 scales to weigh produce
- ◆ empty 1-gallon milk jug
- ◆ 2 empty quart containers
- ◆ 2 empty liter containers (water bottles)
- ◆ Liquid measuring tools (4 measuring cups with both customary and metric measurements)
- ◆ 1 dry measuring cup
- ◆ Measuring spoons (customary and metric)
- ◆ Bag of un-popped “old-fashioned” popcorn (not microwave)
- ◆ Box of cereal
- ◆ 3 buckets of water
- ◆ Teaspoon of salt
- ◆ Tablespoon of cinnamon
- ◆ Glass of milk
- ◆ Copies of the two worksheets

Time: 2 hours

Grade Levels: 3-6

Objectives

1. Identify and describe measurable attributes of objects and units of measurement.
2. Use appropriate techniques and tools to determine measurements (grade 3).
3. Determine measurements using appropriate tools and formulas (grade 4).
4. Estimate length using metric and customary (English) units.

Background

Being able to measure in a variety of ways is a life skill and part of the National and State Standards for mathematics. How many times a day are we asked, or do we ask, “How much?” “How big?” “How far?” Fortunately, it’s easy to incorporate the math standards of measurement into daily curriculum. Many of our measurements are based on methods people used before they had measuring devices like yardsticks and rulers. Horses were measured according to how many hands high they were. A yard of fabric was the length of the merchant’s outstretched arm, from his or her nose to the tip of his or her thumb. A foot was the length of an average person’s foot.

This lesson provides students with an opportunity to practice measuring weight and volume in both the metric and customary (English) systems using a variety of tools and agricultural products. (For more resources on teaching measuring, visit the Utah Education Network Website, www.uen.org, and search “measuring.” You will find a variety of lesson plans and worksheets that will help you teach students how to accurately measure. There are even ready-made PowerPoint slides on the site to teach measuring.)

The materials list for this lesson is easily obtained, most can be found in your classroom, recycling, or at the local grocery store. Empty food containers such as cereal boxes, packaged rice or cracker boxes, are ready to use and the least expensive math manipulative you can find! Milk jugs, juice containers, and cans should be washed before use. (NOTE: Do not use packaging that contained raw meat; you might spread unwanted bacteria.) Most measuring tools contain measurement units for both the metric and customary systems.

Both third and fourth graders need to be able to “measure capacity using cups and quarts, and measure weight using pounds” and be able to “describe the relationship among customary units of capacity (i.e., cup, pint, quart, and gallons).” In addition they should be able



to measure capacity using milliliters, liters, cups, pints, quarts, and gallons and measure weight using grams, kilograms, and pounds. Estimation is an important skill, and students should be able to estimate both capacities of containers and weights using metric and customary units.

Whether you are a student buying an apple for lunch or a farmer selling wheat, you have to have a way to measure whatever it is you are buying or selling. The cashier at the grocery store probably will weigh your apple to determine how much to charge you. The amount of money the farmer gets for his or her wheat will depend on how many bushels he or she has produced. Some products are sold according to weight, some according to volume, and some by the piece.

The price of a beef steer depends on how much the steer weighs. When a steer is sold, it is weighed on a large livestock scale. The weight is then multiplied by the current market price. If the current market price is 90¢ per pound, and the steer weighs 770 pounds (carcass weight), the value of the steer would be \$693. Market prices are determined by how much of a product is available for sale, how much people are willing and able to pay for the product and other supply and demand factors. Utah products sold by the pound include apples, cherries, hay, onions, peaches, and mushrooms.

Wheat farmers sell their wheat by the bushel. Like beef, the price of wheat per bushel depends on the current market value. Oats, barley, feed corn, rye and soybeans are also sold by the bushel. However, the seed the farmer purchases for replanting is priced by the pound. Garden seeds and herbs are sold by the ounce because most gardeners do not need large quantities.

Most of the produce you buy in the grocery store—apples, peaches, onions, potatoes, tomatoes, squash—is sold by the pound. But if you go into the fields or buy the same produce from roadside stands or farmer’s markets, you probably will pay for it by the bushel or half-bushel. The grower measures the produce by filling a bushel or half-bushel basket. Smaller quantities are measured in quart or pint baskets. Most berries—raspberries, strawberries, and blueberries—are usually sold by the pint or by the quart.

Some produce is sold by the piece. Cucumbers, for example, may be priced at two for \$1 or 50¢ each, no matter how big they are. Corn on the cob usually is sold by the dozen. Pumpkins are sorted according to size—miniature, small, medium, large, jumbo. Each pumpkin in a category will cost the same.

Activity Procedures: Shopping (Day 1)

1. Set up four or five work stations, and supply each with a different kind of produce, a grocery flyer showing prices for each kind of produce and a small scale that registers ounces and pounds (diet scales or kitchen scales).
2. Divide the class into four or five groups, and assign each group to a work station. Hand out student worksheets. Review estimating, and discuss why it might be useful in a trip to the grocery store. Share background material.
3. Have students use the student worksheets to record their estimates of the weight and cost of the produce provided. Then have students weigh the produce and calculate the cost, based

Vocabulary:

Customary: A system of measurement used in the United States. The system includes units for measuring length, capacity, and weight.

Capacity: The maximum amount that can be contained by an object. Often refers to a measurement of liquid.

Customary Capacity units of measurement:

1 tablespoon (tbsp)	= 3 teaspoons (tsp)
1 fluid ounce (fl oz)	= 2 tablespoons
1 cup (c)	= 8 fluid ounces
1 pint (pt)	= 2 cups
1 quart	= 2 pints
1/2 gallon	= 2 quarts
1 gallon	= 4 quarts

Volume: The number of cubic units it takes to fill an object.

1 cubic foot (ft³) = 1,728 cubic inches
 $v = l \times w \times h$ (customary)

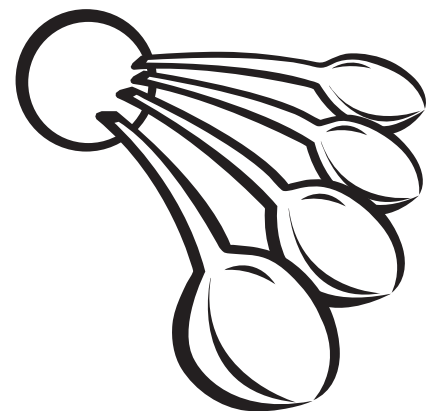
1 liter (L) = 1,000 milliliters (ml) (metric)

Weight: How light or heavy something is.

Pound (lb): The customary unit of measurement for weight, equal to 16 ounces

Ounces (oz): A customary unit equal to one-sixteenth of a pound

Gram (g): The metric unit for weight



on the prices listed in the grocery ads. If you have metric scales, record these weights or make the conversion with the students.

4. Ask the groups to move from station to station until each group has visited each station.
5. Students should complete the totals on the worksheet.
6. If all the totals are not the same, ask students to discuss possible reasons for the discrepancy (weights and costs may have been rounded up or down).

Activity Procedures: Weight and Capacity Shopping (Day 2)

1. Set up five work stations, and supply each with the following:
 - Station 1:** 1 gallon jug, 1 quart container, 1 liter container, measuring cup, and bucket of water
 - Station 2:** 1 quart container, 1 liter container, 1 pint container, measuring cup, and bucket of water
 - Station 3:** 1 box of cereal, popcorn, scale (discuss how to use the type of scale you are using) and measuring cup
 - Station 4:** 1 liquid and 1 dry measuring cups (with metric equivalent), measuring spoons, popcorn, and bucket of water
 - Estimation Station 5:** Measure and pour out onto a piece of paper a cup of popcorn, a cup of cereal, a teaspoon of salt, and a tablespoon of cinnamon. Add a glass of milk to this estimation station.
2. Divide the class into five groups, and assign each group to a work station. Hand out student worksheets.
3. Have students use the worksheets to record their findings.
4. Ask the groups to move from station to station until each group has visited each station.
5. Ask each group what they learned about capacity and weight. Did they see the relationships? How hard was it to measure accurately?

Additional Activities, What's Next?

1. Discuss the difference between weight and volume. Have students discuss whether it is more economical to buy produce by the pound, by the piece or according to volume. Why would it be more convenient to measure field crops like wheat by the bushel instead of by the pound? Why is produce usually sold by volume or by the piece in farmer's markets but by the pound in grocery stores?
2. Discuss different businesses that depend on scales. (Doctors weigh their patients to know how much medicine to prescribe. Greenhouses measure garden seeds. Pharmacists measure liquids and powders to fill prescriptions.)
3. Visit a grocery store and find five products sold by the pound, five sold by the piece and five sold according to volume.



Produce Shopping

Complete the following worksheet as you progress through the produce (fruit and vegetable) stations.

Station	Produce Name	Estimated Cost	Estimated Pounds	Actual Cost	Actual Pounds
1					
2					
3					
4					
5					
				Total Actual Cost of Produce: \$ _____	Total Actual Pounds _____ lbs.

What does an Americans eat each year? *On average...*

- 126 pounds of fresh fruit
- 196 pounds of fresh vegetables
- 20 pounds of rice
- 118 pounds of red meat
- 66 pounds of poultry (turkey or chicken)
- 196 pounds of flour & cereal products
- 30 pounds of cheese
- 22 gallons of milk (176 pounds)
- 251 eggs (31 pounds)
- 77 pounds of fats & oils



How is this possible? Do you think you ate 251 eggs last year? Probably not, but think about how many foods you ate containing eggs...cookies, pancakes, noodles, pudding, and cakes. Most of the foods we eat are combined with others. To compare the pounds of food we eat each year, compare these farm fresh products by creating a bar graph.



NAME _____

Weight and Capacity Shopping

Complete the following worksheet as you progress through the stations.

Station 1:

- Using the measuring cup, determine how many cups are in a gallon. _____ cups/gallon
- How many milliliters. _____ ml/gallon
- Using the measuring cup, determine how many cups are in a liter. _____ cups/liter
- How many milliliters are in a liter. _____ ml/liter
- Using the quart container, how many quarts are in a gallon. _____ quarts/gallon
- How does a quart and liter compare?



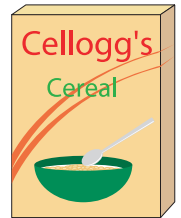
Station 2:

- Using the 1 pint container, determine how many pints are in a quart. _____ pints/quart
- Using the measuring cup, determine how many cups are in a pint. _____ cups/pint
- Using the measuring cup, determine how many cups are in a liter. _____ cups/liter
- Using the measuring cup, determine how many milliliters are in a liter. _____ ml/liter



Station 3:

- Weigh out 1 ounce of cereal. (Don't forget to add the weight of the container and add it to 1 ounce.)
Using the measuring cup, determine the number of cups in 1 ounce of cereal.
_____ cups to 1 oz of cereal
- Is the volume of 1 ounce of cereal the same as 1 ounce of water? _____
- How many grams is 1 ounce of cereal? _____g
- If you have 2 oz of cereal how many grams of cereal do you have? _____g
- How many ounces are in the box of cereal according to the label? _____oz.
- How many grams are in the box of cereal according to the label? _____g



Station 4:

- Measure 1 cup of popcorn in the "dry" measuring cup. Pour the measured popcorn into the liquid measuring cup. Are the amounts any different? _____. What is the metric measurement? _____ ml
- Why do you think we have "dry" and "wet" measuring tools?



Estimation Station 5:

Look at the five products in this station and estimate the volume of each:

Popcorn _____ cups _____ ml

Milk _____ cups _____ ml

Cereal _____ cups _____ ml

Salt _____ (teaspoons or tablespoons) _____ ml

Cinnamon _____ (teaspoons or tablespoons) _____ ml