

A LITER BIT OF THIS AND AN OUNCE OF THAT

Grade Level: Fourth

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Length of Unit: Seven lessons

I. ABSTRACT

The purpose of “A Liter Bit of This and An Ounce of That” is to combine the Core Knowledge content on measurement with hands on learning activities. This is an introductory unit on weight and capacity with a variety of activities designed to meet the different learning styles of students. Assessment will be based on work completed by the students and reflecting on activities.

II. OVERVIEW

- A. Concept Objectives
 - 1. The student will understand and apply the appropriate units and procedures to measure weight and capacity.
- B. Core Knowledge Content
 - 1. Weight (Mass)
 - 2. Capacity (Volume)
- C. Skills to be Taught
 - 1. The student will estimate and measure weight using standard units including ounces and pounds.
 - 2. The student will estimate and measure weight using standard units including grams and kilograms.
 - 3. The student will estimate and measure capacity using standard units including cups, pints, quarts, and gallons.
 - 4. The student will estimate and measure capacity using standard units including milliliters and liters.

III. BACKGROUND KNOWLEDGE

- A. For Teachers:
 - 1. Hirsch Jr., E.D. *What Your Fourth Grader Needs to Know.* New York: Doubleday, 1992. ISBN 0-385-31260-1.
 - 2. Any textbook or materials that contain the concepts addressed in this unit.
- B. Students’ Prior Knowledge
 - 1. Linear Measurement

IV. RESOURCES

- A. Britannica Online www.britannica.com/bcom/eb/article/9/0,5716,11589+1+11455,00.html
- B. PBS Mathline <http://www.pbs.org/mathline>
- C. Full Option Science System, “Measurement”, Lawrence Hall of Science, University of California, Berkeley, California 94720
- D. *Math Advantage*, Harcourt Brace ISBN 0-15-310708-1
- E. 1-Measurement (2 of 4), 4MATION LessonBank, 1993 Collection. Excel, Inc., LessonBank Collection, 200 West Station Street, Barrington, Illinois 60010

V. LESSONS

Lesson One: Introduction to Weight

- A. *Daily Objectives*
 - 1. Concept Objective
 - a. The student will understand and apply the appropriate units and procedures to measure weight.

2. Lesson Content
 - a. Weight (Mass)
 3. Skill Objectives
 - a. Students will estimate and measure weight using pounds and ounces
 - b. Predicting
- B. *Materials:*
1. Individual baby pictures and birth weight of students
 2. Post It notes
 3. Four or five objects (for each group), one of which weighs a pound with others being close to that weight
 4. Paper
 5. Markers
- C. *Key Vocabulary*
1. Weight - how heavy something is
 2. Ounce - a standard unit of weight equal to 1/16 of a pound
 3. Pound - a standard unit of weight equal to 16 ounces
- D. *Procedures and Activities*
1. Prior to the lesson, each student will be asked to bring in their baby pictures and their birth weights.
 2. Students will write their birth weight on a Post It note and display along with baby picture on a bulletin board.
 3. Discuss with students their understanding of pound and ounce.
 4. Divide students into four groups. Distribute objects to each group. Have students predict by looking and handling the objects to see which weighs closest to a pound.
 5. Students from each group will order objects from the least to closest to a pound. Post and share each group's findings on the board.
 6. Discuss and compare their birth weights to the object that weighs exactly one pound. How many _____ do you weigh?
 7. Lecture on early measurement systems using information taken from Britannica Online. (www.britannica.com/bcom/eb/article/9/0,5716,11589+1+11455,00.html)
- E. *Assessment*
- Observation of students and the completion of their predictions along with discussions of their birth weight to objects.

Lesson Two: Bean Babies

- A. *Daily Objective*
1. Concept Objective
 - a. Students will understand and apply the appropriate units and procedures to measure weight
 2. Lesson Content
 - a. Weight
 3. Skill Objectives
 - a. Students will measure weight to the nearest pound.
 - b. Students will construct and interpret a bar graph.
- B. *Materials*
1. Four baby scales to measure pounds and ounces
 2. Sentence Strip
 3. Scoops
 4. 5-10 index cards
 5. Pinto beans
 6. Paper Clips

7. Bulletin board paper
8. Masking tape
9. Multicultural crayons

Each student needs

1. One gallon plastic bag
2. Markers
3. White construction paper
4. Scissors
5. Tape or glue

C. *Vocabulary*

1. Weight - how heavy something is
2. Ounce - a standard unit of weight equal to 1/16 of a pound
3. Pound - a standard unit of weight equal to 16 ounces

D. *Procedures and Activities*

1. Prior to the lesson the teacher uses sentence strips to draw scales depicting pounds and ounces. Label each ounce. Use index cards to denote pounds. See Appendix A. Make enough scales to represent the birth weights of the students in the class. Choose one student to come to the front of the classroom. Have the student place a one-gallon plastic bag on one of the baby scales. Help the student to fill the bag with beans until it equals the student's birth weight. Seal the plastic bag.
2. Divide students into 4 groups. Students measure and place enough beans into a plastic bag to equal their birth weight. With construction paper, crayons and markers, they draw a head, arms, and legs and turn the bags of beans into Bean Babies.
3. As students are making the bean babies, call one student at a time up to the board. Using the post-it-notes from Lesson 1, student places his/her note on correct birth weight.
4. After all of the students have placed the post-it-notes on the graphs, ask the students to determine the number of pounds that most of the children in the class weighed at birth. Have them further analyze the data by determining the least and greatest birth weights in the class.
5. Students display their completed Bean Babies in the classroom.

E. *Assessment*

Students will be assessed on their participation in measuring to the nearest pound in creating a Bean Baby and in their construction and interpretation of a bar graph.

Lesson Three: Introduction to Grams

A. *Daily Objectives*

1. Concept Objective
 - a. Students will understand and apply the appropriate units and procedures to measure weight.
2. Lesson Content
 - a. Weight
3. Skill Objective
 - a. Students will estimate and measure weight using grams.

B. *Materials*

1. Appendix A

For each group of four:

1. Balance scale
2. 2 plastic cups

3. 1 set of weights consisting of 25 1-gram pieces, 5 5-gram pieces, 2 10-gram pieces, and 1 20-gram piece
4. 1 washer
5. 1 wood square
6. 1 poker chip
7. 1 container $\frac{1}{2}$ liter (for water)

For the teacher to distribute later

1. 2 cups, each containing 50 regular paper clips
2. 2 cups, each containing 25 jumbo paper clips

C. *Key Vocabulary*

1. Gram- the standard unit of weight (mass) in the metric system: the weight of 1 cubic centimeter of water
2. Standard- a unit of measure agreed upon and used by everyone

D. *Procedures and Activities*

1. Prior to lesson assemble the balance. Prepare the paper clips. Prepare the weight sets. The paper clips and weight sets should be kept out of sight until they are needed.
2. Hold up a washer, a wood square, and a poker chip. Challenge the students to put the objects in order from heaviest to lightest. Divide the students into 4 groups. Ask the Materials Manager to get a washer, a wood square, and a poker chip from the materials station. Let the students place the objects in order.
3. Introduce the Balance.
4. Introduce the units. Tell the students that we want to weigh the three objects using paper clips.
5. Explain weighing in paper clips using the following explanation: Put the object to be weighed in one cup on the balance. Put the paper clips in the other cup until the beam is even or balanced. Count the number of clips that were needed to balance the object.
6. Weigh the objects in paper clips: Teacher will pass out a cup of paper clips to each group, being sure to give half of the groups regular clips and the other half jumbo paper clips. Allow plenty of time for the students to complete their weighing.
7. Discuss the discrepant event. Ask the reporter from each group to report how much their washer weighed in paper clips. Record results on the board and discuss why there is a discrepancy. Ask the materials manager from each group to hold up a sample of paper clips that they used to weigh. The students should realize that because the paper clips are not all the same size, the objects will not weigh the same from group to group. At this point explain the need for an agreed upon standard unit of measure.
8. Introduce the gram. Explain that the standard metric unit for measuring weight is called the gram. Show the students the different gram pieces and identify each one.
9. The Materials Manager from each group goes to the material center and gets a set of gram weights. Students then estimate and weigh the original objects in grams and record the estimation and the actual weight in grams.

E. *Assessment*

1. Students answer the following questions:
 - a. Name the parts of the balance system.
 - b. What makes a gram a good standard unit for weighing things?
 - c. What could be used for a standard unit of weight if we didn't have the gram?
 - d. What other uses can you think of for the balance?
 - e. What experiment could you design that used a balance?

Lesson Four: Introduction to Kilograms

A. *Daily Objectives*

1. Concept Objectives
 - a. Students will understand and apply the appropriate units and procedures to measure weight.
2. Lesson Content
 - a. Weight
3. Skill Objective
 - a. Students will estimate and measure weight using kilograms and grams.

B. *Materials*

For each group

1. Balance scale
2. 2 cups
3. 1 weight set
4. Light objects found in the classroom that could be measured in grams such as markers, erasers, pencils, etc.
5. Apple
6. 1 bag of gravel at least 1000 g.
7. 1 cup
8. 1 small bag
9. Label
10. Tape
11. Paper
12. Pencil

C. *Key Vocabulary*

1. Kilogram- 1000 grams or the weight of one liter of water

D. *Procedures and Activities*

1. Review the metric units for measuring weight (grams) and the parts of a balance scale.
2. Divide students into 4 groups. The Materials Manager in each group selects classroom objects such as erasers, pencils, and markers. Students estimate the weight of each object in grams. Record estimations on sheet used in Lesson 3. Weigh the objects and record the weights on the sheet.
3. Students share their findings with whole class.
4. Teacher holds up an apple and proposes to weigh it. Place the apple on one side of the balance and one complete set of metric weights on the other side. The scale will not balance. Ask the students to think of ideas of how to weigh an object that weighs more than the set of weights.
5. Challenge the students to use the gravel and bags to make a 100 gram weight to add to their sets. Allow the Materials Manager from each group to get gravel, bags, a cup, and a label from the materials station. Students weigh 50 grams of gravel twice to make the 100 gram weight. (They should work out this solution). After the bag contains 100 grams of gravel, the Recorder in each group should tape the bag shut and label as 100 grams.
6. Ask one student from each group to bring their 100 gram weight to the materials station. At the station combine all the weights in a large zip bag. Ask each group to make an additional 100 gram weight. Select 2 of the groups to make an additional 100 gram weight. Add the additional weights to the large zip bag so that now we have 1000 grams. Pass the 1 kilogram weight around so everyone will get the sense of how a kilogram feels.

7. Students search for objects in the classroom that weigh about a kilogram. Share their findings with the whole class.
- E. *Assessment*
1. Students will be assessed on participation and ability to identify objects that weigh close to a kilogram.
 2. Answer the following questions:
 - a. How could you find out how many grams are in a kilogram?

Lesson Five : Introduction to Capacity

- A. *Daily Objectives*
1. Concept Objective:
 - a. The student will understand and apply the appropriate units and procedures to measure capacity.
 2. Lesson Content:
 - a. Capacity
 3. Skill Objective:
 - a. The student will estimate and measure capacity using cups, pints, quarts, and gallons.
- B. *Materials*
- Each group of students will need:
1. Five different sized jars (olive jar, baby food jar, pill bottle, etc.)
 2. Water
 3. Paper
 4. Pencil
 5. 2 Plastic cup measure
- C. *Key Vocabulary:*
1. Capacity- volume of fluid (such as water) a container can hold when full.
- D. *Procedures/Activities*
1. Prior to lesson, fill each group's jars with varying amount of liquid.
 2. Students will observe jars and predict how the five jars can be ordered from the least to the greatest amount of liquid.
 3. Allow time for each group to share their predictions with the class.
 4. Students will devise a way to figure out which has the most, the least, and so on using the 2 Cup measures in their investigations.
 5. Allow time for each group to share their plan with the class.
 6. Students imagine themselves as a container. " Write about yourself and draw a picture of what you look like. What are you made of? What would you hold? Where are you found?"
 7. Share your description with a partner.
- E. *Assessment*
1. Observation of the students and the completion of their predictions.
 2. Completion of writing assignment.

Lesson Six: Cups, Pints, Quarts, and Gallons

- A. *Daily Objectives*
1. Concept Objective:
 - a. The students will understand and apply the appropriate units and procedures to measure capacity.
 2. Lesson Content:
 - a. Capacity

3. Skill Objective:
 - a. The students will estimate and measure capacity using cups, pints, quarts, and gallons.
- B. *Materials*
Each group of students needs:
 1. Cup, pint, quart, and gallon containers
 2. Plastic tub
 3. Paper towels
 4. Recording sheet
 5. Pencil
- C. *Key Vocabulary:*
 1. Cup- a standard unit of liquid measure (8 fluid ounces)
 2. Pint- a standard unit of liquid measure (16 fluid ounces)
 3. Quart- a standard unit of liquid measure (32 fluid ounces)
 4. Gallon- a standard unit of liquid measure (128 fluid ounces)
- D. *Procedures/Activities*
 1. Discuss liquid measurement. Show different containers used to measure cups, pint, quart, and gallon.
 2. Students work in groups using the container marked “Cup” to determine the capacity of the other containers. For example, how many cups of water does it take to fill the pint container? How many cups of water does it take to fill the quart container? How many cups of water does it take to fill the gallon container? Record those measures on the recording sheet.
 3. Select another container and use it to determine the capacity of the other containers. Record.
 4. Continue selecting other containers until you have found as many ways as you can to fill each of the other containers. Record all solutions. (See Appendix B)
- E. *Assessment*
 1. Student completion of the activity and the recording sheet.

Lesson Seven: Milliliters and Liters

- A. *Daily Objectives*
 1. Concept Objective:
 - a. The student will understand and apply the appropriate units and procedures to measure capacity.
 2. Lesson Content:
 - a. Capacity
 3. Skill Objective:
 - a. The student will estimate and measure capacity using milliliter and liter.
- B. *Materials*
 1. 2 vials (may use pill bottles) 1 small and 1 large
 2. water
 3. 2 plastic cups
 4. 2 one liter containers of water
 5. 2 basins
 6. paper towels
 7. 1 liter beaker
 8. 1 milliliter spoon
 9. 4 – 100 ml beakers
 10. 4 plastic cups with water

- C. *Key Vocabulary:*
1. Liter- the metric standard for measuring volumes of fluids (1 liter is equal to 1000 milliliters)
 2. Milliliter- 1/1000 of a liter (1 milliliter equals 1 cubic centimeter)
- D. *Procedures/Activities*
1. Have 2 students come to the front of the classroom where you have already set up 2 stations. Each station will have a vial, a plastic cup, 1 liter of water, and a basin.
 2. Each student puts his cup and his water container in the basin to control water spills. Each student fills his vial with water and then pours into the cup.
 3. After the cup is full the students compare their findings. Discuss the discrepancy of their findings.
 4. Introduce the standard of milliliters and liters used to measure liquids. Do this by holding up the 1 liter beaker. Tell students that the liter is divided into 1000 parts called milliliters.
 5. Introduce the 100 milliliter beakers. Divide the students into their same groups. Ask the Materials Manager to get a 100 ml. beaker from the materials station.
 6. Ask the Reader from each group to pour water into the beaker until it holds exactly 100 milliliters.
 7. Ask a member from each group to bring the beaker of water up to the front of the room and pour it carefully into the 1-liter beaker.
 8. Ask the class to confirm how many milliliters of water are in the beaker. Each group will measure additional 100 ml and add to the 1-liter beaker until 1 liter is obtained. Ask the students how many milliliters are in 1 liter.
- E. *Assessment*
- Students reflect on the activity by answering the following questions:
1. How many milliliters are in one liter?
 2. How can you find out how many milliliters are in a liter?
 3. What units would you use to measure the capacity of a bathtub?
 4. If the liter were not in use as the standard unit for measuring capacity in the metric system, what would you use for the standard?

VI. CULMINATING ACTIVITY

Students will choose one of the following activities:

- A. Bean Babies
 1. Choose an important person from the American Revolution and create a Bean Baby in their image.
- B. Gallon Man/Woman
 1. Use construction paper, glue and markers to create a large visual of a Gallon Man or Woman to help understand the relationship between cups, pints, quarts, and gallons. (See Appendix C)
- C. Design a container out of modeling clay which would hold 1 cup of liquid.

VII. HANDOUTS/WORKSHEETS

- A. Birth weight scale
- B. Example of recording chart for cups, pints, quarts, and gallons
- C. Gallon Man/Woman

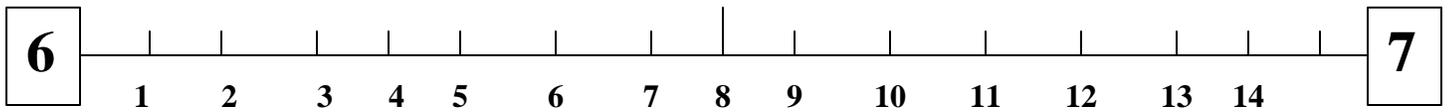
VIII. BIBLIOGRAPHY

- A. Britannica Online:
www.britannica.com/bcom/eb/article/9/0,5716,11589+1+11455,00.html

- B. Full Option Science System, "Measurement", Lawrence Hall of Science, University of California, Berkeley, California 94720
- C. *Math Advantage*, Harcourt Brace ISBN 0-15-310708-1
- D. 1-Measurement (2 of 4), 4MATION LessonBank, 1993 Collection. Excel, Inc., LessonBank Collection, 200 West Station Street, Barrington, Illinois 60010
- E. PBS Mathline <http://www.pbs.org/mathline>

Appendix A

Birth Weight Scale



Adapted from PBS Mathline The Elementary School Math Project "Sand Babies" Math Grows Up (Measurement) <http://www.pbs.org/mathline>

Appendix B

Recording Sheet

Name _____

Date _____

It takes _____ cups to fill a pint.

It takes _____ cups to fill a quart.

It takes _____ cups to fill a gallon.

It takes _____ pints to fill a quart.

It takes _____ pints to fill a gallon.

It takes _____ quarts to fill one half-gallon.

It takes _____ quarts to fill a gallon.

Adapted from Full Option Science System, "Measurement", Lawrence Hall of Science,
University of California, Berkley, California 94720

Appendix C

Gallon Man

Students can create their own Gallon Man or Gallon Woman to help them see the relationship between cups, pints, quarts, and the gallon.

Materials needed:

Construction paper – different colors for the face, cups, pints, quarts, and gallon

Scissors

Glue

Markers or crayons

Steps:

1. Cut out shapes for each part of Gallon Man.
2. Label each CUP, PINT, QUART, and GALLON.
3. Assemble Gallon Man and decorate.

