

# BACK TO THE BASICS: MEASUREMENT

**Grade Level or Special Area:** 4<sup>th</sup> Grade

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**Length of Unit:** Six lessons (approximately six days, one day = 60 minutes)

## I. ABSTRACT

This unit was written with the intent to give assistance to those students struggling with the basic concepts of measurement. The unit provides enjoyable activities and experiments that can be supplemental to your current curriculum. Most of the materials you will need can be found in your school. Some activities may require materials that you can buy in a supermarket.

## II. OVERVIEW

### A. Concept Objectives

1. Students will understand and apply basic concepts of measurement and relate these to other mathematical concepts.
2. Students recognize how to use a variety of tools and techniques to measure, apply the results in problem-solving situations, and communicate the reasoning used in solving these problems. (Colorado Mathematics Standard Five)

### B. Content from the *Core Knowledge Sequence*

1. 4<sup>th</sup> Grade Mathematics: Measurement (page 102-103)
  - a. Linear measure: estimate and make linear measurements in yards, feet, and inches (to 1/8 in.); and in meters, centimeters, and millimeters.
  - b. Weight (mass): estimate and measure weight in pounds and ounces; grams and kilograms.
  - c. Capacity (volume): estimate and measure liquid capacity in teaspoons, tablespoons, cups, pints, quarts, gallons; and in milliliters and liters.
  - d. Know the following equivalencies among U.S. customary units of measurement, and solve problems involving changing units of measurement:
    - i. Linear Measure  
1 ft. = 12 in.  
1 yd. = 3 ft. = 36 in.  
1 mi. = 5,280 ft.  
1 mi. = 1,760 yd.
  - e. Know the following equivalencies among metric units of measurement, and solve problems involving changing units of measurement:
    - i. Linear Measure  
1 cm = 10 mm (millimeters)  
1 m = 1,000 mm  
1 m = 100 cm  
1 km = 1,000 m

### C. Skill Objectives

1. The students will evaluate their measurement knowledge with a pre-assessment test.
2. The students will find out how the old system of measurement worked.
3. The students will identify customary and metric units of length measurement.
4. The students will measure the length of objects using customary and metric units of measurement.
5. The students will make linear measurements using feet and inches.
6. The students will convert inches to feet and inches.

7. The students will estimate and measure weight using pounds and ounces.
8. The students will measure and use equivalent capacities to make glob.
9. The students will evaluate their end of unit knowledge with a post-assessment test.

### III. BACKGROUND KNOWLEDGE

- A. For Teachers
  1. *What Your 4<sup>th</sup> Grader Needs to Know* by E.D. Hirsch
  2. *Measurement Mania* by Lynette Long
  3. *Math For Every Kid: Easy Activities that Make Learning Math Fun* by Janice Van Cleave
- B. For Students
  1. Students should have prior knowledge of common terminology dealing with measurement from first, second, and third grade.
  2. Students should have previous knowledge about linear measurement from studying it in third grade.

### IV. RESOURCES

- A. *Measurement Mania: Games and Activities that Make Math Fun and Easy* by Lynette Long (Lessons Two and Three)
- B. *Math for Every Kid; Easy Activities that Make Learning Math Fun* by Janice VanCleave (Lesson Five)

### V. LESSONS

#### Lesson One: Pre-Assessment and Introduction (approximately 60 minutes)

- A. *Daily Objectives*
  1. Concept Objective(s)
    - a. Students will understand and apply basic concepts of measurement and relate these to other mathematical concepts.
  2. Lesson Content
    - a. Know the following equivalencies among U.S. customary units of measurement, and solve problems involving changing units of measurement:
      - i. Linear Measure  
 1 ft. = 12 in.  
 1 yd. = 3 ft. = 36 in.  
 1 mi. = 5,280 ft.  
 1 mi. = 1,760 yd.
    - b. Know the following equivalencies among metric units of measurement, and solve problems involving changing units of measurement:
      - i. Linear Measure  
 1 cm = 10 mm (millimeters)  
 1 m = 1,000 mm  
 1 m = 100 cm  
 1 km = 1,000 m
  3. Skill Objective(s)
    - a. The students will evaluate their measurement knowledge with a pre-assessment test.
    - b. The students will find out how the old system of measurement worked.
    - c. The students will identify customary and metric units of length measurement.

- B. *Materials*
1. Appendix A (one copy per student)
  2. Appendix B (one copy per teacher)
  3. Metric ruler (one per student)
  4. Measuring tape (one per student)
- C. *Key Vocabulary*
1. The *cubit* is an old measurement unit of length; measuring from the fingers to the elbow.
  2. The *palm* is an old measurement unit of length; measuring from one side of your palm to the other.
  3. The *span* is an old measurement unit of length; measuring an open hand from the thumb to the pinky finger.
  4. The line that goes through the center of a circle is called the *diameter*.
- D. *Procedures/Activities*
1. Begin with a pre-assessment test for all of your students.
  2. Note- remember this unit was written only for those students struggling with the basic measurement concepts.
  3. This same test will be used at the end of the unit to show the growth of the students. Note- the test may also determine particular areas of weakness for students.
  4. Tell the students that they will be taking a test today to see what they already know.
  5. Tell them you may not assist any of them during this test; instead they must work independently the entire time.
  6. **Special Education Accommodation:** Be sure to make the proper accommodations for your students on Individual Education Plan's or learning contracts.
  7. Distribute a copy of Appendix A to every student. Note- refer to the materials section of this lesson for the proper tools.
  8. Allocate at least 50 minutes for the completion of this test. Note- be sure to have quiet sponge activities available to those students who finish early.
  9. Once the students are all complete, ask them to find a seat on the floor for a short discussion.
  10. Begin the discussion talking about areas of difficulty the students may have encountered on the test.
  11. After having the students reflect on their performance, tell them that you are going to briefly discuss how the old system of measurement worked hundreds of years ago.
  12. To begin, ask the students how many cubits tall the ceiling is. Of course, your students will look shocked because they have most likely never heard of a unit of measurement called the cubit.
  13. Tell the students that people did not always measure length the way we measure it today. Let them know that long ago, some people measured length with units such as the cubit, palm, and span.
  14. Share the following definitions with the students:
  15. The *cubit* is an old measurement unit of length; measuring from the fingers to the elbow.
  16. The *palm* is an old measurement unit of length; measuring from one side of your palm to the other.
  17. The *span* is an old measurement unit of length; measuring an open hand from the thumb to the pinky finger.

18. Tell the students that the trouble with using units like these is that everyone is not the same size. And that's why these units are no longer used.
19. Explain to them that what you might measure as 20 cubits long, someone else might measure as 25 cubits.
20. Let them know that to avoid such confusion and arguments the first standard units of length measurement were created to be the same for everyone.
21. Tell them this first system of length measurement called the customary or English system was based on lengths of the human body just like before. But this time there was no confusion because the units would be the same for everyone all over the world.
22. Tell the students the most common units of length measurement in the customary system are: the inch (abbreviated in.), the foot (abbreviated ft and equal to 12 inches), the yard (abbreviated yd and equal to 3 feet), and the mile (abbreviated mi and equal to 5,280 feet).
23. Share the following hints to help students comprehend the length of these customary units.
24. Tell them to think of the diameter of a quarter to be about 1 inch, the length of a binder as about 1 foot, the width of a doorway as about 1 yard, and four times around a football field as about 1 mile. This should give your students great visuals for the different lengths.
25. Tell the students that another system of measurement was created called the metric system.
26. Tell them the most common units of length in the metric system are: the meter (abbreviated m), the millimeter (abbreviated mm and equal to 1/1000 of a meter), the centimeter (abbreviated cm and equal to 1/100 of a meter), the decimeter (abbreviated dm and equal to 1/10 of a meter), and the kilometer (abbreviated km and equal to 1000 meters).
27. Let the students know that the decimeter is used less often than the other units.
28. Show them that each unit has the same root word; meter. Tell them the prefix shows how big a unit is compared to a meter.
29. Make them understand that this system uses numbers that are multiples of ten.
30. Share the following hints to help students comprehend the length of these metric units.
31. Tell them to think of the thickness of a dime to be about 1 millimeter, the diameter of a crayon to be about 1 centimeter, the length of a new crayon to be about 1 decimeter, the height from the floor to the doorknob as about 1 meter, and three times around a football field to be about 1 kilometer. This will give your students great visuals to help them understand the size of each unit.
32. Now that you have described the two systems of measurement and the most common units of length you will conclude.
33. Ask that the students pull out a piece of notebook paper and write down a short summary explaining why the old system of measurement is no longer used.
34. Give the students a couple minutes to write their responses.
35. Collect their responses and tell the students that the next time you meet they will be actively participating in an activity measuring objects and converting units. Note- you will want to read your students responses, but no official grade will be given for this assignment.

E. *Assessment/Evaluation*

1. Students will be assessed based upon their completion of Appendix A (use Appendix B to grade).

**Lesson Two: Measuring Length (approximately 60 minutes)**

A. *Daily Objectives*

1. Concept Objective(s)
  - a. Students will understand and apply basic and/or advanced concepts of measurement and relate these to other mathematical concepts.
  - b. Students recognize how to use a variety of tools and techniques to measure, apply the results in problem-solving situations, and communicate the reasoning used in solving these problems.
2. Lesson Content
  - a. Linear measure: estimate and make linear measurements in yards, feet, and inches (to 1/8 in.); and in meters, centimeters, and millimeters.
3. Skill Objective(s)
  - a. The students will measure the length of objects using customary and metric units of measurement.

B. *Materials*

1. Nine index cards
2. Metric ruler (one per student)
3. Measuring tape (one per student)
4. Pencil (one per student)
5. Calculator (one per student)
6. Paper clip (one per student)
7. Band-aid (one per student)
8. Scissors (one per student)
9. Post-It Note (one per student)
10. Zip-Loc Bag (one per student)
11. Appendix C (one transparency copy)
12. Appendix D (one copy per three students)

C. *Key Vocabulary*

None

D. *Procedures/Activities*

1. Start today's lesson with an activity used to practice learning the relative values of metric and customary length measurements.
2. Note- do the following preparation before starting today's lesson.
3. Write one of the following distances on each of nine index cards.

1 meter (m)	1 yard (yd)	1 decimeter (dm)
1 centimeter (cm)	1 foot (ft)	
1 kilometer (km)	1 inch (in)	
1 millimeter (mm)	1 mile (m)	
4. Tell the students that this game will require their involvement. Let them know this activity will review what was taught yesterday.
5. Start by shuffling the cards. Tell the students you have nine cards, each with a measurement written on it from either the customary or metric system.
6. Distribute the nine cards to nine students. Ask that they keep them face down on their desks until you tell them otherwise.
7. Tell the students that the object of this game is to put the cards in order from smallest to largest, reading from left to right.
8. Remind the students of the visuals you gave them yesterday to help remember the size of each unit. Note- you may wish to have the visuals drawn on the board for the students to refer to.

9. Tell them that on the count of three they must flip their cards over and attempt to order themselves from smallest to largest in the front of the room. Remind them to shout “Done!” when they believe they have put them in the correct order.
10. Now count to three and have the students try to put the cards in the proper order from smallest to largest.
11. When the students have said “Done!” then it is your responsibility to review their work.
12. The order should go as follows: 1 millimeter; 1 centimeter; 1 inch; 1 decimeter; 1 foot; 1 yard; 1 meter; 1 kilometer; 1 mile
13. Now that you have activated the student’s prior knowledge, it is time to practice measuring.
14. Tell the students that they will be working independently to complete three simple measuring activities.
15. Appendix C has the directions and materials needed for the three activities. Put this transparency up to review with the students before you distribute their materials or record sheets. Note- you will need to gather the student materials and put them into Zip-Lock bags before this lesson.
16. After reviewing the directions, distribute the bag of materials and a copy of Appendix D to every student.
17. Note- Appendix D is made for three students. This page will be used for the students to record their results.
18. Give the student’s time to use their metric rulers and measuring tapes to measure the objects and record their results onto their record sheets.
19. Pull the students together on the floor, in the classroom, to discuss their results. Note- you will have to measure the objects and have an answer key already made. There is no answer key because the measurements will vary.
20. Take time to discuss the student’s results and any problems they may have encountered with this activity.
21. Let the students know that tomorrow they will be using the measuring tapes again to measure in inches and feet.
22. Note- depending on the student’s progress you may wish to continue practice for another day or so.

E. *Assessment/Evaluation*

1. Students will be assessed on their measurements recorded on Appendix D. The answers will vary per objects used, so there is no answer key provided.

**Lesson Three: Jump Start; Conversions (approximately 60 minutes)**

A. *Daily Objectives*

1. Concept Objective(s)
  - a. Students will understand and apply basic and/or advanced concepts of measurement and relate these to other mathematical concepts.
  - b. Students recognize how to use a variety of tools and techniques to measure, apply the results in problem-solving situations, and communicate the reasoning used in solving these problems.
2. Lesson Content
  - a. Linear measure: estimate and make linear measurements in yards, feet, and inches (to 1/8 in.); and in meters, centimeters, and millimeters.
  - b. Know the following equivalencies among U.S. customary units of measurement, and solve problems involving changing units of measurement:

i. Linear Measure  
1 ft. = 12 in.

3. Skill Objective(s)  
a. The students will make linear measurements using feet and inches.  
b. The students will convert inches to feet and inches.

B. *Materials*

1. Paper and pencil (one per student)
2. Pieces of chalk (two per group)
3. Measuring tape (one per group)
4. Clipboard (one per student)
5. Appendix E (one copy per group of three)
6. Appendix F (one copy per two students)
7. Appendix G (optional)

C. *Key Vocabulary*

1. To *convert* one unit to another means to change it.

D. *Procedures/Activities*

1. The objective of today's lesson is to get the students measuring on their own and converting from inches to feet and inches.
2. The students will be measuring how far they can jump in feet and inches.
3. Note- this lesson will have to be done outside or in the gym, so plan accordingly. Be sure to allow plenty of room for each of the six events.
4. To begin ask the students to pull out their clipboards and distribute a copy of Appendix E to every three students. Note- this page can be cut to share amongst three students.
5. Get the students to write their names onto their sheet of paper and clip it onto their boards.
6. Tell the students that today they will be working in cooperative groups to measure distances in inches.
7. Start this lesson by describing the events written on the chart of Appendix E.
8. Note- you may wish to make a poster with the event information readily available to the students at each event station.
9. **Event 1: High Jump:** Stand facing a wall. The wall will have a tall chalk mark already drawn. Now jump up, keeping the hand holding the chalk fully extended. At the top of your jump, make a chalk mark on the wall. Measure the distance between the two chalk marks. This is how high you can jump.
10. Note-don't forget it is your responsibility to set stations for these events. At station one you will need to make the chalk line on the wall for the students.
11. **Event 2: Standing Broad Jump:** Draw a chalk line on a sidewalk. Stand with the toes of both feet touching the line. Then jump as far as you can. Stay in place where you landed and make a chalk mark behind the heel that is closest to the chalk line. Measure the distance from the chalk line to the chalk mark. This is how far you can jump when standing.
12. **Event 3: Running Broad Jump:** Run down the sidewalk toward the chalk line and jump just before you get to the line. Stay where you landed and make a chalk mark behind the heel that is closest to the chalk line. Measure the distance from the chalk line to the chalk mark. This is how far you can jump when running.
13. **Event 4: Longest Step:** Stand with the chalk line behind the heel of one foot. Take the longest step you can with your other foot and make a chalk mark behind the heel of the second foot. Measure the distance from the chalk line to the chalk mark to get the length of your longest step.

14. **Event 5: Hopping:** Stand on one foot behind the chalk line and hop forward. Make a chalk mark behind the heel of your hopping foot. Measure the distance between the chalk line and the chalk mark to get your hopping distance.
15. **Event 6: Backward Jump:** Stand with the chalk line behind the heels of both feet and jump backward as far as you can. Make a chalk mark at the tip of your toes and measure the distance between the chalk line and the chalk mark. This is how far you can jump backward.
16. After reviewing the six events with the students put them into six groups (one group at each event).
17. These groups will rotate through the events one at a time. The students will know to rotate because you will blow a whistle to indicate that it is time to move to the next station.
18. Before you send the groups to their assigned stations tell them that they must try each of the events three times. Hence, the three blanks on their record sheets.
19. Remind them to record all three distances on their chart that was already distributed to them.
20. Note- do not get the help of parent volunteers for today's events. After all, the objective is to get the students measuring distances.
21. Now that the students have all recorded their jump distances (in inches) you will want to distribute Appendix F. Note- this page can be cut to share amongst two students.
22. Appendix F will ask the students to make a personal best chart. To do so they must choose which of the three attempts was their personal best for each event.
23. Ask that they use Appendix F to record their best distances in each event in inches and in feet and inches.
24. To do this the students may need some tips.
25. Tell them that to convert a measurement from inches to feet and inches, they must divide the number of inches by 12.
26. Why 12? They may ask. Tell them to divide by 12 because that is the number of inches in a foot.
27. Remind them to write the answer in feet and leave the "remainder" in inches.
28. Share the following example with them: To convert 52 inches to feet and inches:
29. Start by dividing 52 by 12. Once the students do the division, they will determine the answer to be 4 with a remainder of 4. Show the students that this means 52 inches = 4 feet 4 inches.
30. Once you have shown the students this example, it is now time for them to work independently at entering their best distances into the chart on Appendix F.
31. Ask the students if writing a measurement one way rather than another way makes it seem longer. They should realize that no matter which way it is written the distance is still the same.
32. Note- you may want to make awards for those students with the top distance in each event.
33. Be sure to end today's lesson with a discussion of the activity. Permit the students time to talk about what they liked, disliked, and/or areas of difficulty.
34. Note: - you may want to use the game on Appendix G for additional practice converting between different customary and metric units of length.

E. *Assessment/Evaluation*

1. Students will be assessed on their completion of Appendix F. The answers will vary you must check these individually.

## **Lesson Four: Measuring Weight (approximately 60 minutes)**

### A. *Daily Objectives*

1. Concept Objective(s)
  - a. Students will understand and apply basic concepts of measurement and relate these to other mathematical concepts.
  - b. Students recognize how to use a variety of tools and techniques to measure, apply the results in problem-solving situations, and communicate the reasoning used in solving these problems.
2. Lesson Content
  - a. Weight (mass): estimate and measure weight in pounds and ounces; grams and kilograms.
3. Skill Objective(s)
  - a. The students will estimate and measure weight in pounds and ounces.

### B. *Materials*

1. Ten objects (should vary in size but not exceed 5 pounds)
2. One kitchen scale
3. Ten index cards
4. Appendix H (one copy per student)
5. Appendix I (once copy per teacher)

### C. *Key Vocabulary*

1. Fruit and vegetables are sometimes called *produce*.

### D. *Procedures/Activities*

1. Begin today's lesson by telling the students that it is time to learn about weight measurement.
2. Let them know this is something they will use in their everyday lives.
3. For instance, a trip to the grocery store for produce requires a person to know how to weigh items.
4. Make them understand that weight and mass are not the same, but they are similar.
5. Let them know that weight measures how heavy an object is. Mass measures the amount of matter in an object.
6. Give this example: Suppose you took a trip to the moon. If you got on a scale, you'd be quite surprised. The moon has less gravity than Earth, and the amount of gravity affects the weight. The moon pulls down on your body less than Earth does, so your weight would be less on the moon. Remind them that there is still the same amount of you no matter where you are. Your mass on the moon would be the same as on Earth.
7. Share with the students the objective for today's lesson. Tell them that they will be estimating and measuring weight with your help.
8. As a class, the students will work together to order items from least to greatest based upon their weight.
9. To begin, ask the students which is heavier: an ounce of feathers or an ounce of nails. Hopefully they realize they are both the same! The feathers take up more space, but they weigh the same.
10. Remind them that if something is larger, it doesn't mean that it is always heavier than something small.
11. Tell the students to remember that important fact for this next activity called the Human Scale.
12. For this activity, you will need to have already chosen ten things from around the classroom. Note- the items should vary in size but not exceed 5 pounds.
13. Write the names of each of these items on the board in no particular order.

14. Tell the students they will be acting as a human scale to put these ten items in order from lightest to heaviest.
15. Now it is time to begin. Ask a student to choose two items from the table. Tell that same student to hold the items, one in each hand. Now ask that same student which they think is the heaviest item of the two being held and to place it on the right-hand side of the demonstration table.
16. Now ask another student to participate in the activity. Ask this next student to pick up another item from the table that has not been held. They must try to determine where that item falls in order with the other items already placed on the table.
17. This will continue until all ten items have been placed and the students are comfortable with their decisions. Remember they must be in order from lightest to heaviest.
18. Now find out how good the students are as human scales.
19. Start with a quick lecture about the units of weight (both customary and metric). Tell them weight can be measured in ounces, pounds, or tons. Tell them these are the customary units of weight.
20. Give the following equivalencies to help the students visualize each unit.
21. Tell them a slice of cheese weighs about 1 ounce.
22. A loaf of bread weighs about 1 pound.
23. A Clydesdale horse weighs about 1 ton.
24. Also, mention the metric units of mass. These include the gram, kilogram, and metric ton.
25. Give additional equivalencies to help them visualize these units.
26. A dollar bill has a mass of about 1 gram.
27. A nickel has a mass of about 5 grams.
28. A textbook has a mass of about 1 kilogram.
29. A really small car has a mass of about 1 metric ton.
30. These visuals should help the student understand the units better.
31. Now let the students know that you are going to need their help to weigh each item to be sure they have placed the items in the proper order from least to greatest.
32. Note- use a kitchen scale so that you can weigh the item in ounces.
33. Tell the students a kitchen scale weighs objects in units of weight called ounces and pounds. Let them know that today we will focus on ounces only.
34. Start with what they think is the lightest object and weigh it on a scale. How many ounces does it weigh? Get the students to help with the weighing of these items.
35. As you weigh each item, write the weight on an index card and put it next to the object.
36. Weigh all ten items. Do not move any of the items even if they are misplaced. Allow the students to realize their mistakes, if any.
37. Ask the kids how good they were at getting everything in order.
38. Wrap up today's unit with a quick checking of their understanding. Distribute a copy of Appendix H to every student.

E. *Assessment/Evaluation*

1. Students will be assessed on the completion of Appendix H (use Appendix I to score).

**Lesson Five: Measuring Capacity (approximately 60 minutes)**

A. *Daily Objectives*

1. Concept Objective(s)
  - a. Students will understand and apply basic concepts of measurement and relate these to other mathematical concepts.
  - b. Students recognize how to use a variety of tools and techniques to measure, apply the results in problem-solving situations, and communicate the reasoning used in solving these problems.
2. Lesson Content
  - a. Capacity (volume): estimate and measure liquid capacity in teaspoons, tablespoons, cups, pints, quarts, gallons; and in milliliters and liters.
3. Skill Objective(s)
  - a. The students will measure and use equivalent capacities to make glob.

B. *Materials*

1. One bottle borax (sodium borate), found in supermarket with washing detergents (per two students)
2. 4 fluid oz. bottle of liquid glue, white all-purpose (per two students)
3. One tablespoon (per two students)
4. One measuring cup (per two students)
5. Two Zip Lock plastic bags (per two students)
6. One bottle of distilled water (per two students)
7. One 2-liter bowl (per two students)
8. One marking pen (per two students)
9. Two clean, empty quart jars, with one tight-fitting lid (per two students)
10. One graduated cylinder (per two students)

C. *Key Vocabulary*

1. The amount of liquid a container holds is called its *capacity*.

D. *Procedures/Activities*

1. Note- the activity in this lesson requires access to water.
2. Begin today's lesson by reviewing the student's responses to Appendix H from yesterday. Take the time to answer any questions your students may have.
3. Note- if the students had great difficulty with the last lesson do not move on; instead review and reteach.
4. When the students are ready to move forward, begin with the following discussion on capacity.
5. Ask the students what size milk container their families buy. Or ask how much water does your family use each day.
6. Tell the students these questions can all be answered by measuring capacity.
7. Let them know the amount of liquid a container holds is called its capacity.
8. Share with them some customary units of capacity. Note- the students should recognize these.
9. Teaspoon (tsp), tablespoon (tbsp), fluid ounces (fl oz), cup (c), pint (pt), quart, (qt), half gallon (1/2 gal), and the gallon (gal) are the most common.
10. The metric system also has units of capacity. These should be just as easily recognized by the students: liter (L) and milliliter (mL). Remind the students that 5 milliliters are equal to a teaspoon (the smallest of customary capacity units).
11. Tell the students that today they will be working with a partner measuring and using equivalent capacity units to make glob.
12. Note- be sure to get volunteers into the classroom for this activity.
13. Note- already have the materials set up for groups of two throughout the classroom.

14. Note- this activity is taken from Janice VanCleave's *Math for Every Kid*.
15. Get the children partnered up and ready to go. You will model the procedure for the students to copy at their designated areas.
16. To start, make a borax solution by filling one of the quart (liter) jars with water from the faucet. Note- you may want a parent volunteer to have this step done already.
17. Label this jar Borax with the marking pen. Use a graduated cylinder to add 15 ml of borax to the water. Put the lid on the jar and shake vigorously.
18. Now make the glue solution by emptying a 4 fluid ounce bottle of glue into the second quart (liter) jar, labeled Glue.
19. Fill the empty glue bottle with distilled water and pour the water into the jar.
20. With a clean measuring spoon, stir until the glue is thoroughly mixed.
21. Pour one measuring cup of the borax solution into the empty bowl.
22. Slowly pour the glue solution into the bowl containing the borax. Stir as you pour.
23. Use the stirring spoon to dip the glob out of the bowl.
24. Place the glob on top of a plastic bag for two minutes.
25. Pick up the glob with your fingers and squeeze.
26. Transfer the glob from one hand to the other, and squeeze until it and your hands are dry.
27. Squeeze it! Pull it! Stretch it! Have fun with it!
28. Place the glob inside the plastic bag and seal to store.
29. Make sure the students wash their hands when you are finished.
30. You have just made a white, pliable glob that stretches and breaks easily when pulled apart sharply, but flows if placed where gravity is the acting force.
31. Note- you can make different colored globs by adding a drop of food coloring to the glue-water mixture.
32. Remind the students that this activity was done to permit them practice at measuring with units of capacity.
33. Tell the students that tomorrow they will finish up this unit with a post-assessment on everything they have learned.

E. *Assessment/Evaluation*

1. Students will be assessed by the outcome of their glob mixture. A mess up in measuring will not produce the desired results.

**Lesson Six: Final Assessment (approximately 60 minutes)**

A. *Daily Objectives*

1. Concept Objective(s)
  - a. Students will understand and apply basic concepts of measurement and relate these to other mathematical concepts.
  - b. Students recognize how to use a variety of tools and techniques to measure, apply the results in problem-solving situations, and communicate the reasoning used in solving these problems.
2. Lesson Content
  - a. Linear measure: estimate and make linear measurements in yards, feet, and inches (to 1/8 in.); and in meters, centimeters, and millimeters.
  - b. Weight (mass): estimate and measure weight in pounds and ounces; grams and kilograms.
  - c. Capacity (volume): estimate and measure liquid capacity in teaspoons, tablespoons, cups, pints, quarts, gallons; and in milliliters and liters.

- d. Know the following equivalencies among U.S. customary units of measurement, and solve problems involving changing units of measurement:
  - i. Linear Measure
    - ft. = 12 in.
    - 1 yd. = 3 ft. = 36 in.
    - 1 mi. = 5,280 ft.
    - 1 mi. = 1,760 yd.
- e. Know the following equivalencies among metric units of measurement, and solve problems involving changing units of measurement:
  - i. Linear Measure
    - 1 cm = 10 mm (millimeters)
    - 1 m = 1,000 mm
    - 1 m = 100 cm
    - 1 km = 1,000 m
- 3. Skill Objective(s)
  - a. The students will evaluate their end of unit knowledge with a post-assessment test.
- B. *Materials*
  - 1. Appendix A (one per student)
  - 2. Appendix B (one per teacher)
- C. *Key Vocabulary*
  - None
- D. *Procedures/Activities*
  - 1. Pass out the test to the students (Appendix A). This is the same test as given at the beginning of the unit.
  - 2. Review the directions and answer any questions.
  - 3. **Special Education Accommodation:** Be sure to make the proper accommodations for your students on Individual Education Plan's or learning contracts.
  - 4. Collect the tests at the end of the class period.
  - 5. Note- be sure to have quiet sponge activities for students to do when they have finished the test.
- E. *Assessment/Evaluation*
  - 1. Students will be assessed based upon their completion of Appendix A (use Appendix B to grade).

## VI. CULMINATING ACTIVITY

- A. The students will create a fantasy bedroom and review all they learned about measurement. Distribute a copy of Appendix J to every student. This page has the guidelines for the activity. Have a day when the students can share their fantasy bedrooms with other children in the classroom.

## VII. HANDOUTS/WORKSHEETS

- A. Appendix A: Measurement Assessment
- B. Appendix B: Measurement Assessment Answer Key
- C. Appendix C: Measurement Activity Directions
- D. Appendix D: Activity Record Sheet
- E. Appendix E: Jump Start Organizer
- F. Appendix F: Best Distances Chart
- G. Appendix G: Converting Activity

- H. Appendix H: Measuring Weight
- I. Appendix I: Measuring Weight Answer Key
- J. Appendix J: Fantasy Bedroom Guidelines

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Appendix A, page 1  
**Measurement Assessment**

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. Describe the very old way of measuring and explain why we don't use it today.

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2. Put the following units of length measurement in order from smallest to largest: yard, millimeter, meter, foot, kilometer, inch, mile, centimeter, and decimeter

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3. Tell if each of these is closest to 1 inch or 1 foot.

- The length of your smile \_\_\_\_\_
- The length of your forearm \_\_\_\_\_
- The width of your wrist \_\_\_\_\_

4. Complete.

- 17 in. = \_\_\_\_\_ ft \_\_\_\_\_ in.
- 6 ft = \_\_\_\_\_ in.
- 26 in. = \_\_\_\_\_ ft \_\_\_\_\_ in.

5. Hannah and Joshua weighed their mother. Circle the most reasonable weight.

- 50 pounds
- 150 pounds
- 500 pounds

6. For each item, circle the most reasonable estimate of its weight.

- |             |              |            |              |
|-------------|--------------|------------|--------------|
| • Mouse     | 4 ounces     | 40 ounces  | 400 ounces   |
| • Pasta Box | 1,600 ounces | 160 ounces | 16 ounces    |
| • Squirrel  | 180 ounces   | 18 ounces  | 1,800 ounces |

7. Riley estimated the height of his classroom ceiling. Circle the most reasonable estimate.

21 feet                      9 feet                      60 feet

**Appendix A, page 2**

8. Without measuring, estimate the length of your foot, from heel to toe. Then measure the length of your foot.

Estimate: about \_\_\_\_\_ inches

Measurement: about \_\_\_\_\_ inches

9. For each animal, circle the most reasonable estimate of its weight.

Squirrel:      less than 500 pounds              greater than 500 pounds              about 500 pounds

Giraffe:      less than 500 pounds              greater than 500 pounds              about 500 pounds

Blue Whale:      less than 500 pounds              greater than 500 pounds              about 500 pounds

10. A hamster weighs about 100 grams. Circle.              True              False

11. A pencil weighs about 230 ounces. Circle.              True              False

12. A banana weighs about 1,400 grams. Circle.              True              False

Appendix B, page 1  
**Measurement Assessment Answer Key**

Name: ANSWER KEY

Date: \_\_\_\_\_

1. Describe the very old way of measuring and explain why we don't use it today.

**The very old way of measuring was based on human body parts. This system is not used today because there were no standard measurements. In other words, the trouble with using this system is that everyone is not the same size.**

2. Put the following units of length measurement in order from smallest to largest: yard, millimeter, meter, foot, kilometer, inch, mile, centimeter, and decimeter

**millimeter, centimeter, inch, decimeter, foot, meter, yard, kilometer, and mile**

3. Tell if each of these is closest to 1 inch or 1 foot.

- The length of your smile: **1 inch**
- The length of your forearm: **1 foot**
- The width of your wrist: **1 inch**

4. Complete.

- 17 in. = **1 ft 5 in.**
- 6 ft = **72 in.**
- 26 in. = **2 ft 2 in.**

5. Hannah and Joshua weighed their mother. Circle the most reasonable weight.

- 50 pounds
- **150 pounds**
- 500 pounds

6. For each item, circle the most reasonable estimate of its weight.

- |             |                 |                  |                  |
|-------------|-----------------|------------------|------------------|
| • Mouse     | <b>4 ounces</b> | 40 ounces        | 400 ounces       |
| • Pasta Box | 1,600 ounces    | 160 ounces       | <b>16 ounces</b> |
| • Squirrel  | 180 ounces      | <b>18 ounces</b> | 1,800 ounces     |

7. Riley estimated the height of his classroom ceiling. Circle the most reasonable estimate.

21 feet                      **9 feet**                      60 feet

**Appendix B, page 2**

8. Without measuring, estimate the length of your foot, from heel to toe. Then measure the length of your foot.

Estimate: about \_\_\_\_\_ **answers will vary** \_\_\_\_\_ inches

Measurement: about \_\_\_\_\_ **answers will vary** \_\_\_\_\_ inches

9. For each animal, circle the most reasonable estimate of its weight.

Squirrel:      **less than 500 pounds**              greater than 500 pounds              about 500 pounds

Giraffe:      less than 500 pounds              greater than 500 pounds              **about 500 pounds**

Blue Whale:      less than 500 pounds              **greater than 500 pounds**              about 500 pounds

10. A hamster weighs about 100 grams. Circle.              **True**              False

11. A pencil weighs about 230 ounces. Circle.              True              **False**

12. A banana weighs about 1,400 grams. Circle.              True              **False**

Appendix C  
**Measurement Activity Directions**

**Materials Needed for All Activities (per Student)**

1 metric ruler	1 Post-It note
1 pencil	1 pair of scissors
1 paper clip	1 calculator
1 band-aid	1 measuring tape

*Note: Put one of everything into a Zip-Lock bag for each student to use.*

**1. Activity One: Centimeters**

Purpose: To use a metric ruler to measure lengths in centimeter units.

Facts: On a metric ruler, the printed numbers indicate centimeter measurements.

Directions: Use the metric ruler to determine the length of the objects provided. Express the answer to the nearest centimeter.

**2. Activity Two: Millimeters**

Purpose: To use a metric ruler to measure lengths in millimeter units.

Facts: On a metric ruler, the printed numbers indicate centimeter measurements. Each small division between the numbers is equal to 1 millimeter. One centimeter equals 10 millimeters. Multiply each numbered centimeter measurement by 10 to get the number of millimeters.

Directions: Use the metric ruler to determine the length of the objects provided. Express the answer to the nearest millimeter.

**3. Activity Three: Inches**

Purpose: To use a measuring tape to measure lengths in inch units.

Facts: On a measuring tape, the printed numbers indicate inch measurements.

Directions: Use the measuring tape to determine the length of the objects provided. Express the answer to the nearest inch.

**Appendix D**  
**Activity Record Sheet**

Name: \_\_\_\_\_

Date: \_\_\_\_\_

<b>Object</b>	<b>Centimeters (cm)</b>	<b>Millimeters (mm)</b>	<b>Inches (in)</b>
Pencil			
Paper Clip			
Band-Aid			
Post-It Note			
Scissors			
Calculator			

Name: \_\_\_\_\_

Date: \_\_\_\_\_

<b>Object</b>	<b>Centimeters (cm)</b>	<b>Millimeters (mm)</b>	<b>Inches (in)</b>
Pencil			
Paper Clip			
Band-Aid			
Post-It Note			
Scissors			
Calculator			

Name: \_\_\_\_\_

Date: \_\_\_\_\_

<b>Object</b>	<b>Centimeters (cm)</b>	<b>Millimeters (mm)</b>	<b>Inches (in)</b>
Pencil			
Paper Clip			
Band-Aid			
Post-It Note			
Scissors			

Calculator			
------------	--	--	--

Appendix E  
**Jump Start Organizer**

Name: \_\_\_\_\_

<b>Event</b>	<b>Trial 1 (in)</b>	<b>Trial 2 (in)</b>	<b>Trial 3 (in)</b>
High Jump			
Standing Broad Jump			
Running Broad Jump			
Longest Step			
Hopping			
Backward Jump			

Name: \_\_\_\_\_

<b>Event</b>	<b>Trial 1 (in)</b>	<b>Trial 2 (in)</b>	<b>Trial 3 (in)</b>
High Jump			
Standing Broad Jump			
Running Broad Jump			
Longest Step			
Hopping			
Backward Jump			

Name: \_\_\_\_\_

<b>Event</b>	<b>Trial 1 (in)</b>	<b>Trial 2 (in)</b>	<b>Trial 3 (in)</b>
High Jump			
Standing Broad Jump			
Running Broad Jump			
Longest Step			
Hopping			

Backward Jump			
------------------	--	--	--

## Appendix F

# Best Distances Chart

Name: \_\_\_\_\_

Look at your three jumps for each event and choose the best one to record on the chart. Be sure to complete both columns entering the distance in inches and in feet and inches. Remember the example your teacher shared with you in class to help with the conversions.

<i>Event</i>	<i>Best Distance in Inches</i>	<i>Best Distance in Feet and Inches</i>
High Jump		
Standing Broad Jump		
Running Broad Jump		
Longest Step		
Hopping		
Backward Jump		

Name: \_\_\_\_\_

Look at your three jumps for each event and choose the best one to record on the chart. Be sure to complete both columns entering the distance in inches and in feet and inches. Remember the example your teacher shared with you in class to help with the conversions.

<i>Event</i>	<i>Best Distance in Inches</i>	<i>Best Distance in Feet and Inches</i>
High Jump		
Standing Broad Jump		
Running Broad Jump		
Longest Step		
Hopping		
Backward Jump		

## Appendix G

# CONVERSION CARDS

(adapted From *Measurement Mania* by Lynette long)

### Materials

- 2 pencils
- 32 index cards
- 2 calculators
- several pieces of notebook paper
- 2 players

### Game Preparation

1. Write “inches” on each of four index cards. Do the same for “feet,” “yards,” and “miles,” so that there are 16 cards altogether. On the back of each card, write “UM,” which stands for unit of measurement.
2. Write one of the following expressions on each of 16 other index cards:

6 inches	2 feet	1 yard	½ mile
24 inches	10 feet	3 yards	1 mile
72 inches	30 feet	10 yards	2 mile
108 inches	42 feet	100 yards	10 miles
3. Write “Expression” on the back of each of these cards.

### Game Rules

- Shuffle all 32 cards and spread them on the table so that the “UM and “Expression” sides are face up.
- Each player gets a calculator and a pencil and paper.
- Both players simultaneously draw two cards, one UM card and one Expression card.
- Both players change the expression on their Expression card to the units on their UM card. Players can use their calculators, the Tips and Tricks box, and a pencil and paper.
- The first player to finish shouts, “Done!”
- The other player stops working and checks the answer of the player who is finished. If the player’s answer is correct, he or she wins all four cards. If the answer is incorrect, the other player wins the cards.
- When all the cards have been played, the player with the most cards wins the game.

### Tips and Tricks

To convert inches

- to feet divide by 12
- to yards divide by 36
- to miles divide by 63,360

To convert yards

- to inches multiply by 36
- to feet multiply by 3
- to miles divide by 1,760

To convert feet

- to inches multiply by 12
- to yards divide by 3
- to miles divide by 5,280

To convert miles

- to inches multiply by 63,360
- to feet multiply by 5,280
- to yards multiply by 1,760

## Appendix H Measuring Weight

Name: \_\_\_\_\_

Date: \_\_\_\_\_

### Customary Units of Weight

**ounce (oz) = about a slice of cheese**

**pound (lb) = 16 ounces = about a loaf of bread**

**ton (T) = 2000 pounds = about a Clydesdale Horse**

### Metric Units of Weight

**gram (g) = about a dollar bill**

**kilogram (kg) = 1000 grams = about a nickel**

**metric ton = 1000 kilograms = about a really small car**

Directions: Use the chart above to answer the following questions.

1. Blake estimated the weight of his Saint Bernard dog. Circle the most reasonable estimate.

1 ton                  180 pounds                  180 grams

2. Hannah and Joshua weighed their mother. Circle the most reasonable weight.

50 pounds          150 pounds                  500 pounds

3. For each animal, circle the most reasonable estimate of its weight.

Squirrel:          less than 500 pounds                  greater than 500 pounds                  about 500 pounds

Giraffe:          less than 500 pounds                  greater than 500 pounds                  about 500 pounds

Blue Whale:          less than 500 pounds                  greater than 500 pounds                  about 500 pounds

4. A pencil might weigh about

2.5 kg          25 kg                  250 kg

5. A newborn baby might weigh about

3 kg                  30 kg                  300 kg

6. A mouse weighs about 100 grams. Circle.                  True                  False

7. A candy bar weighs about 230 ounces. Circle.                  True                  False

8. A banana weighs about 1,400 grams. Circle.                  True                  False

Appendix I  
**Measuring Weight Answer Key**

Name: ANSWER KEY

Date: \_\_\_\_\_

**Customary Units of Weight**

**ounce (oz) = about a slice of cheese**

**pound (lb) = 16 ounces = about a loaf of bread**

**ton (T) = 2000 pounds = about a Clydesdale Horse**

**Metric Units of Weight**

**gram (g) = about a dollar bill**

**kilogram (kg) = 1000 grams = about a nickel**

**metric ton = 1000 kilograms = about a really small car**

Directions: Use the chart above to answer the following questions.

1. Blake estimated the weight of his Saint Bernard dog. Circle the most reasonable estimate.

1 ton                      **180 pounds**                      180 grams

2. Hannah and Joshua weighed their mother. Circle the most reasonable weight.

50 pounds              **150 pounds**                      500 pounds

3. For each animal, circle the most reasonable estimate of its weight.

Squirrel:              **less than 500 pounds**                      greater than 500 pounds                      about 500 pounds

Giraffe:              less than 500 pounds                      greater than 500 pounds                      **about 500 pounds**

Blue Whale:      less than 500 pounds                      **greater than 500 pounds**                      about 500 pounds

4. A pencil might weigh about

**2.5 kg**              25 kg                      250 kg

5. A newborn baby might weigh about

3 kg                      **30 kg**                      300 kg

6. A mouse weighs about 100 grams. Circle.                      **True**                      False

7. A candy bar weighs about 230 ounces. Circle.                      True                      **False**

8. A banana weighs about 1,400 grams. Circle. True **False**

**Appendix J**  
**Fantasy Bedroom Guidelines**

**ROOM REDECORATING**

(Adapted From *Measurement Mania* by Lynette Long)

Materials: tape measure, pencil paper, one piece of white construction paper, several pieces of construction paper in different colors, ruler, and scissors.

Procedure:

1. Measure the length and width of your room with a tape measure. Record the measurements on a piece of paper.
  
2. On a white piece of construction paper, draw a bird's eye view of your room to scale. For the scale, let 1 inch of your drawing represent 1 foot of your room. If your room is 12 feet long and 10 feet wide, use a ruler to draw a rectangle that is 12 by 10 inches. Use pencil lines to indicate on your drawing where the doors and windows are.
  
3. Measure your furniture and cut out models from different colored pieces of construction paper in the same scale as your model room. If your bed is 3 feet wide and 6 feet long, cut out a 3-by-6- inch piece of colored construction paper. Cut out pieces of construction paper to represent the other large objects in your room. Arrange the paper furniture in your model room in different ways to see all the possibilities.
  
4. Pick the layout you like the best and create a new bird's eye view of your bedroom.

Bring in the final product by \_\_\_\_\_ to be shared with the other members of the class.