

MEASUREMENT

K- 1ST

BACKGROUND

Measurement is an important skill all students need to acquire – be it for science, cooking in the kitchen, or building a house. Helping students develop this skill is important and challenging. The need for measurements has been a part of our human history. Weights and measures have taken a great variety of forms over the course of history, from simple informal expectations in barter transactions to elaborate state and super-national systems that integrate measures of many different kinds. Weights and measures from the oldest societies can often be inferred at least in part from archeological specimens and are often preserved in museums. It is possible to group official measurement systems for large societies into historical systems that are relatively stable over time, including: the Babylonian system, the Egyptian system, the Olympic system of Greece, the Roman system, the British system, and the metric system.

BASIC LESSON

Objective(s)

Students will be able to...

Explore types of measurements using different equipment.

State Science Content Standard(s)

1.2: Select and use appropriate tools including technology to make measurements (including metric units) and represent results of basic scientific investigations.

- ❖ Identify measurement tools.
- ❖ Choose the appropriate tool to measure time, temperature, mass, length, and liquid volume.

Materials		Safety
From the Kit	Provided by Teacher	
<ul style="list-style-type: none"> • Balance • Thermometer • Clear Measuring cup • Craft sticks • Clock • Mini Balances (foam board) • Small metal pans to place on balance • Water Bottle Activity • Red measuring cups • Large plastic bowl 	<ul style="list-style-type: none"> • Ruler • Digital Clock possibly • Labeled objects to put on the balance for massing • Sand or rice/beans • Trays • Gallon milk jugs or pitchers to hold water 	<ul style="list-style-type: none"> • [List any safety precautions here]

Key Vocabulary	Mastery Questions
<ul style="list-style-type: none"> • Clock • Thermometer • Ruler • Scale • Beaker/Measuring cup • Words describing measurement such as taller, shorter, small, large, lighter, heavier, hotter, colder, warm and variations of the terms such as large, larger, largest, morning. Also afternoon, evening, today, yesterday, tomorrow, week, year. 	<ul style="list-style-type: none"> • What tool is used to measure time, temperature, mass, length, and liquid volume?

Detailed Plan

Introduction of Measurement tools

Objective: Introduce the students to tools used to measure time, temperature, mass, length, and liquid volume.

Have a variety of measurement tools displayed at the front of the room – Thermometer, balance, measuring cup, ruler or meter stick, and a clock from kit (could also be the wall clock or a large digital clock). Tell the students each tool/piece of equipment is important to measuring different objects.

A. Time

Point to the clock. Ask: *What does this measure?* (time) *What is it called?* (clock) *Give an example of how a clock is used.* (tell time, time a race, know when a TV program is on...)

Young children think of time as morning and night, longer days and shorter days, school days and weekends, story time and snack time. Some things take longer to do, other things take a shorter amount of time to complete. Students need to understand this concept before they tackle hours, minutes and seconds. The purpose of this lesson is NOT to teach how to tell time but just the concept of time and the importance of its use.

Ask students: *“what takes longer walking to school or driving to school, day or a week, making cookies or opening a bag of cookies from the store?”*

Students can learn that clocks and calendars are tools to help them keep track of time and are useful when planning events and activities. You will need to talk about the difference between a digital clock and a circular clock.

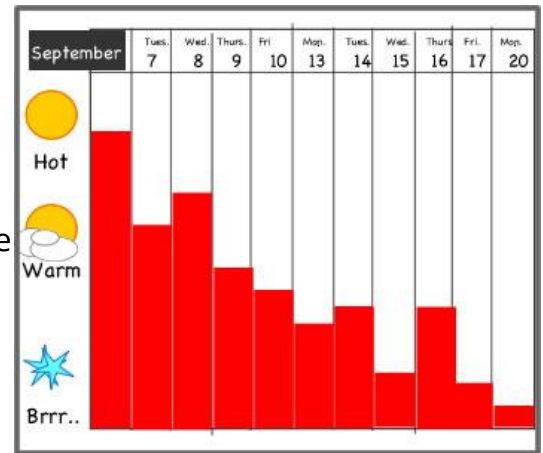


1. A fun activity is to wipe the chalkboard with a damp cloth on a hot day. Students count and observe how long it takes for the water to disappear (usually a minute or two).
2. Another way to practice time is to hold your breath and let the students count until you release your breath.

B. Temperature

Hold a thermometer. (A larger thermometer drawn on the white board or poster paper may be helpful.) Ask: *What does this measure?* (temperature) *What is it called?* (a thermometer) *What does it tell us?* (hotness or coldness) *Give an example of how a thermometer is used?* (indicate the weather, heating an oven for baking, detecting a fever...)

Have precut thin red strips all the same size. Have a chart or picture on the whiteboard which looks much like the one on the left but have the 12 months of the year labeled at the top instead of days of the week. The strips need to fit under the columns. The strips represent the red in a thermometer.



The students can then predict the length of the strips based on what they know about the weather of that month. You may need to help them with the prediction based on the time frame of the month.

C. Mass

Hold up or point out the plastic balance. Ask: *What does this measure?* (mass or weight) *What is it called?* (balance or scale) *What does it tells us?* (how much material an object has) *Give an example of how a balance or scale is used* (indicates how much a person weighs, how much fruit you are buying at the store...) Place different sized objects in each pan and talk about the concept of heavier vs. lighter.

Water Bottle Activity

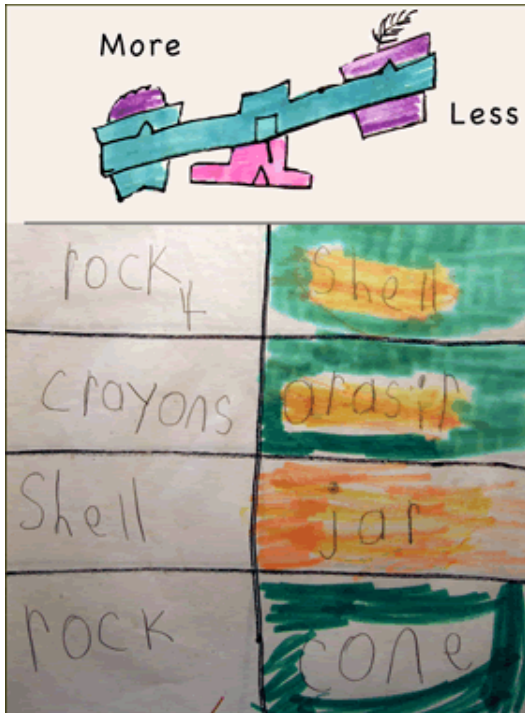
Ask the students: *How much do I weigh? What do you need to know to answer the question?* (measuring tool – balance or scale) *If you don't have a tool to measure what can you use instead?* (Comparison – I weigh less than a house or more than a penny.) Next ask: *What*

object weighs more than a water bottle? (Have as many water bottles available as needed for the students to hold them.) *What objects in the room weigh more? What objects weigh less than the water bottle?* Give the students enough time to explore and pick up objects for comparison. Have the students record their findings on the Water Bottle Activity handout found on our website. After the students are done you can have them share their findings by putting the names of what they found on a similar chart created on a whiteboard or poster paper. The activity can become interesting when the students find an object whose weight is close to the same as the water bottle.

It is beneficial for students to record their measurement experiences.

Balance Activity – More or Less

- In this activity, the students chose two different items and put them on different ends of a balance or scale. This activity will give the students practice with the concepts of more or less (heavier or lighter.) The plastic balance found in the TRC kit can be used for demonstration and the mini foam board balances are for the students divided into groups of two or three.
- Have the students set the balance on the tabletop with the pushpins underneath. Tell them to notice how neither end of the balance is touching the tabletop. Before using the foam balances, check to make sure the ends of the balances do not touch the tabletop. If they do, make small angle adjustments on the pushpins.
- Have the students practice balancing by placing same size metal pans (tops or bottoms) on each end of the foam balance, adjusting the position until neither end is touching the tabletop. These pans can be used to hold the objects being weighed and prevent them from rolling.
- Prepare a few objects (rocks, crayons, shell and other items with word labels for each balance or display a picture with the word written by it. Six to eight objects should be enough. Groups can share objects. The words will help the students spell them correctly on the recording sheets.
- Have the students place an object on each end and determine which one is heavier. How do they know?
- On a piece of paper, have the students create the drawing as pictured below and then which object weighs less, and which weighs more by writing the words in the appropriate column.



Conversations with students can be about how one object is heavier or lighter than another object.

To make more foam board balances, directions can be found in the Extension section. An alternative balance using a shoe box cover and tin can is shown in the Extension section.

D. Length

Hold up a ruler. Ask: *What does this measure?* (length, distance) *What is it called?* (a ruler) *What does it tell us?*(the length or size of an object)*Give an example of how a ruler is used?*(measure the size of your foot, measure the length of a room, measure how much fabric you want to buy)

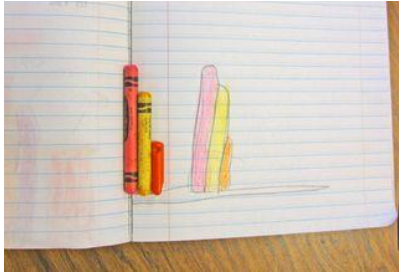
Longer or Shorter Activity

This activity can be used as a formative assessment to see what the students already know. Give them a craft stick and let them go forth into the room quietly to find objects that are shorter or longer than the stick. As they are working, circulate and ask them to show you objects that are longer/shorter than the sticks. Ask them *How do you know?* And *What does that mean—shorter or longer?* Try to get a general idea of where the class stands as a whole in their understanding.

During a share time, have the students show or point out examples of longer/shorter objects they found. Have some students demonstrate how they compared the objects to the sticks. Have some children show how they lined the objects up at one end. Discuss why that's important and what happens if you don't. Talk about the words longer, shorter, taller, bigger, and smaller. *How are they the same? How are they different? When would you use them?* (For example: A giraffe is ____ than I am. This pencil is ____ than the scissors). Talk about what length is. (distance from one end to another end) *What are we measuring when we measure length?*

Putting Objects in Order – Tall to Short

This is a quick activity to see if students can place objects in order according to their length. Have the students pick out three crayons of different length? Have them put the crayons in order of tall to short and then draw a picture of what they did.



Ask a student: *I noticed you lined the crayons up on one end as you put them in order. Why did you do that? What would happen if you didn't do that?*

Class Activity – Short to Tall

Have the students sit in a big circle and give them each one object that you have gathered from around the classroom. (Choose objects that can easily be ordered by length). Tell them that we are going to put all of these objects in order from shortest to longest. Start by putting one object down. Review why it's important to line objects up on one end and come up with a strategy to do that for all of the objects. (In the picture the strip between the carpet and tile is used).



Call on a student to place his/her object down. Do not show them where to place it. They have to estimate where it will go in the whole scheme of things. For example, it wouldn't be the best idea to put the paperclip right next to the yard stick. Mostly, allow the students to put things where they think they will go without interfering. Moving objects around to make room for new objects is part of the whole problem-solving process. Do, however, guide them through questioning: *I noticed you left a lot of room between your marker and the apple pointer. Can you tell me why you did that?*

The more objects that are on the floor, the harder it becomes to place the next object. Some objects are very close in size and the students will really have to focus to see which is longer. It is an excellent opportunity to revisit good strategies for comparing lengths (i.e. lining objects up on one end).



After a student places an object, ask the class: *Do you agree or disagree?* If someone disagrees, have them explain why. If the object needs to be moved, have that person work with the student who placed it to move it to the correct spot.

E. Volume

Hold up a measuring cup. Ask: *What does this measure?* (volume of a liquid or a solid) *What is it called?* (a measuring cup) *What does it tell us?* (how much volume an object has) *Give an example of how a measuring cup is used?* (Measuring flour to make cookies, measuring the amount of water you need to make Kool-Aid or lemonade.)

Hold up a large container and ask *How many scoops of sand will it take to fill this bucket?* *How can we find out? Plus, how will we know when it is full?*

Measuring Volume Activity

Materials

- Cups – Use the same size cup in each group for consistency.
- Bowls or large containers
- Sand or water
- Tray to put the bowl or large container on – easier clean up
- Use gallon milk jugs or other small mouth containers to provide water

If a sensory table (sand/water) is available, use a large container, such as a dishpan or bucket, to hold the sand/water, if not, use a tray to hold the materials.

Place the students in groups of four so they may explore together. Facilitate a discussion while children are busy exploring with the containers provided. Ask children the following questions:

- *Which is larger, the bowl or the cup?*

- Which would hold more sand? Why?
- How far do we need to fill the cup before pouring it? Show me.
- How many cups of sand does it take to fill the bowl? (Call an estimation)
- When do we need to stop pouring sand in the bowl? How do we know when the cup or bowl is full?

1. Have the students predict the number of cups of sand/water needed to fill the bowl. Ask each child to take turns with the cup. Have the students take turns pouring a full cup of sand/water into the bowl. Remind them to fill the cup to the top. As the students take turns filling and pouring, have the remaining students count the number of cups used to fill the bowl. Compare the estimates to the actual count.
2. (Possibly us this as an extension) During the next few days, provide different size cups and different size bowls/containers for the students to use when experimenting. Use different substances for filling, such as water, rice or beans. Scaffold the student's understanding of volume measurement and build vocabulary through probing questions and conversations during their explorations. Reinforce the concepts and use of terms such as full, empty, how many.

Encourage students who understand the concepts to compare the number of cups needed to fill two same size large containers with different substances, such as rice compared to beans.

Assessment

- Monitor classroom discussions
- Check worksheets for understanding.
- After exploring each tool for measurement, hold up each tool and have the students tell you the name of the instrument and what it is used for or do the opposite, ask them *What tool do you use to measure time, mass, volume, temperature, and length?*
- Have the students fold a piece of a paper into fours or give them a piece already folded. Have them write each measurement in a different square: 1. Time, 2. Length, 3. Volume, 4. Temperature, and 5. Mass. Number 5 can be placed on a back square. Instruct the students to draw a picture and/or write the name of the instrument used for measuring.

Resources

- www.kindergartenkindergarten.com/ This a great website with MANY activities for further exploring concepts of measurement.
- [8 Activities to Help Your Kindergartener Master Measurement](http://www.education.com/slideshow/master-measurement-kindergarten/ruler/)
<http://www.education.com/slideshow/master-measurement-kindergarten/ruler/>

- State of Ohio – Kindergarten lesson in Measurement
http://ims.ode.state.oh.us/ODE/IMS/Lessons/Content/CMA_LP_S02_BD_LPK_I06_01.pdf

ADVANCED LESSON

Objective(s)

Students will be able to...

- ❖ Use the appropriate tool to measure , mass, volume, length, and temperature

State Science Content Standard(s)

1.2: Select and use appropriate tools including technology to make measurements (including metric units) and represent results of basic scientific investigations.

- ❖ Use tools to measure time, mass, volume, length, and temperature

Materials

Safety

From the Kit

Provided by Teacher

- [List any safety precautions here]

- Balance
- Thermometer
- Measuring cup
- Craft sticks
- Clock
- Gallon Man
- Mini Balances (foam board)
- Small metal pans to place on balance
- Water Bottle Activity
- Red measuring cups
- Large plastic bowl

- Ruler
- Clock (digital and toy or paper)
- Labeled objects to put on the balance
- Shoe box tops
- Small tin cans
- Sand or rice
- Thermometer to be able to change temperature (drawn on white board)

Key Vocabulary

Mastery Questions

- Clock
- Thermometer
- Ruler
- Scale
- Beaker/Measuring cup
- Words describing measurement such as taller, shorter, small, large, lighter, heavier, hotter, colder, warm and variations of the terms such as large, larger, largest, morning. Also afternoon, evening, today, yesterday, tomorrow, week, year.
- Metric
- Hours
- Minutes

- What tool is used to measure time, temperature, mass, length, and liquid volume?
- How do you measure time, temperature, length, mass, and liquid?
- What is a unit used to measure time, temperature, length, mass, and liquid

Detailed Plan

See Basic Lesson for ideas. These lessons can be adapted to teach the students how to measure using different units of measure.

Additional Measuring Lessons

A. Time

Objective: Students will tell time in hours and half-hours and use their bodies to demonstrate time in hours and half hours.

Duration: Two class periods, each 30-45 minutes each

Materials:

- digital clock
- analog clock (toy or paper one that can be manipulated)

Key Vocabulary: clock, hour, half hour, sixty, thirty, analog, digital, vertical, horizontal

Step-by Step Procedure:

1. If you know your students are shaky on time concepts, it's best to start this lesson with a discussion of morning, afternoon, and night. When do you get up? When do you brush your teeth? When do you get on the bus for school? When do we do our reading lessons? Have students put these into the appropriate categories of morning, afternoon, and night.
2. Tell students that we are going to get a little more specific. There are special times of day that we do things, and the clock shows us when. Show them the analog clock (the toy or the classroom clock) and the digital clock.
3. Set the time on the analog clock for 3:00. First draw their attention to the digital clock. The number(s) before the : describe the hours, and the numbers after the : describe the minutes. So, for 3:00, we are exactly at 3 o'clock and no extra minutes.
4. Then draw their attention to the analog clock. Tell them that this clock can also show the time. The short hand shows the same thing as the number(s) before the : on the digital clock – the hours.
5. Show them how the long hand on the analog clock moves faster than the short hand – it is moving by minutes. When it is at 0 minutes, it will be right up at the top, by the 12. (This is hard for kids to understand.) Have students come up and make the long hand move quickly around the circle to reach the 12 and zero minutes several times.
6. Have students stand up. Have them use one arm to show where the long clock hand will be when it is at zero minutes. Their hands should be straight up above their heads. Just like they did in Step 5, have them move this hand rapidly around an imaginary circle to represent what the minute hand does.

7. Then have them imitate the 3:00 short hand. Using their unused arm, have them put this out to the side so that they are imitating the hands of the clock. Repeat with 6:00 (do the analog clock first) then 9:00, then 12:00. Both arms should be straight above their heads for 12:00.
8. Change the digital clock to be 3:30. Show what this looks like on the analog clock. Have students use their bodies to imitate 3:30, then 6:30, then 9:30.
9. For the remainder of the class period, or at the introduction of the next class period, ask for volunteers to come up to the front of the class and make a time with their bodies for other students to guess.

Homework/Assessment: Have students go home and discuss with their parents the times (to the nearest hour and half hour) that they do at least three important things during the day. They should write these down on paper in the correct digital format. Parents should sign the paper indicating that they have had these discussions with their child.

Assessment: Take anecdotal notes on students as they complete Step 9 of the lesson. Those students who are still struggling with the representation of hours and half hours can receive some extra practice with another student or with you. Periodically during the day, practice telling time, asking the students what time it is. Use repeating times that occur during the day such as the start of school, lunch, recess, the end of school.

B. Temperature

Objective: A three-part lesson objective might include teaching students how to use thermometers to measure temperature, instructing them on how to record temperature measurements and associating temperature measurements with specific seasons.

Materials:

- Thermometers from kit
- Prepare a demonstration thermometer using cardboard and markers, with a sliding temperature indicator so you can adjust temperature levels.

Procedure:

1. Your lesson plan should emphasize the concept of degrees. Use an actual thermometer or one you've made yourself to teach different degree readings.
2. Explain the difference between Fahrenheit and Celsius and that they will be using Fahrenheit to usually measure and Celsius is a metric unit.
3. Ask students to determine whether a given reading is relatively cold, cool, moderate, warm or hot and apply these readings to the various seasons of the year by asking the season in which a given reading would be most likely to occur.

4. Have the students measure the temperature of the air using the thermometers from the kit. Have them measure the temperature of hot and cold water.

Assessment:

- Evaluation should focus on how accurately students are able to read temperatures, understand the concept of degrees and link specific temperature readings with the various seasons of the year. If you choose to have the students work in groups, you can also observe the group dynamics to determine how well each student works with the other students in the group.
- Copy the “Reading a Thermometer” worksheet found in the binder and assess your students understanding.

C. Mass

Use the same balances described in the basic lesson. On one side place an object but on the other side try to balance the object with paperclips, marbles, wooden blocks, sugar cubes, pennies anything that has consistently the same mass. Have the students keep track of how many cubes it takes to make the scale balance. Talk about pounds and ounces. Ask the students how much they weigh? Talk about how pounds and ounces are used to measure food amounts. Mention metric units for mass – grams and kilograms. In the kit are small pans that can be balanced on each end of the scale to keep the objects from rolling. Have the students be sure to have the pans balanced on both sides.

Students can record their results on a piece of paper and then compare results with other groups. Ask them why two groups measuring the same object may have gotten different results. (different scales, different way to count) Where they close to the same?

D. Length

When teaching your first graders about length, give them lots of time to practice comparing lengths and using non-standard units of measurement, before introducing standard ones like inches and feet. These fun measurement lesson plans for first grade will help your students get started with measuring length.

How Many Steps?

Challenge your students to measure how far it is from their desks to different places in the classroom such as the sink, the door or the teacher’s desk. Have them measure using their own feet and taking steps heel to toe to ensure that their steps stay uniform. Before sending them off to measure give each student a paper with the different locations you want them to measure

and a pencil. Then practice what it means to step heel to toe. When they are finished measuring, gather them together to discuss their results. Some questions to discuss are:

- Do they all have the same answers? Why or why not?
- Does it matter what size feet different people have?
- Will smaller feet need to take more steps or fewer steps?
- How about bigger feet?

Measuring with Smaller Units

To practice measuring smaller units, give each pair of students a few smaller items to measure. Some things to measure are erasers, pencil boxes, markers and glue bottles. Then provide them with two or three different items to measure the lengths with, such as paperclips, snap cubes and pennies. Have them measure each item with all three units and record them on a chart. Then compare and discuss their findings.

How Long is a Foot?

Give each student a length of yarn or string that is longer than a foot. Have them mark how long they think a foot it is on the string and then measure with a ruler to see if they guessed longer or shorter. Help the students cut their yarn to be one foot long and then give them time to measure items in the classroom and compare whether they are shorter than, longer than, or the same as a foot. They can record their findings in a math journal or on a chart.

The craft sticks can also be used to measure different items in the classroom.

E. Volume

Use Gallon Man found in the TRC kit to teach volume. Found in the back of the binder is an instruction manual that has several suggestions as how Gallon Man can be used to teach volume.

This website gives directions for students creating their own Gallon Man.

<http://www.squidoo.com/liquid-measurement>

Assessment

See lessons

Resources

Lesson for telling time: <http://mathlessons.about.com/od/firstgradelessons/a/Lesson-Plan-Telling-Time.htm>

Lesson for length: <http://www.brighthubeducation.com/lesson-plans-grades-1-2/50168-math-measurement-lesson-plan/>

EXPLORE MORE

Balance Scale:

Get a sheet of foam board. You can find it at any store that carries poster boards. It is about a 1/4 of an inch thick and super light. I always keep some on hand because you can use it for anything! (A teacher must-have!)

Using an exact-o knife (or kitchen knife or scissors) cut a piece about 3"x12" or whatever size you would prefer. I also cut 8 pieces 1/4"x3" (or, however wide your first piece was). I used a little bit of glue to make a small box on each end of the first piece so that it formed sort of a tray to help hold on the items you are weighing.

Finally, flip the piece over (so the trays are facing down) and use a ruler to find the middle. The more exact your middle the more accurate your scale will be. Place two thumb tacks in the middle (like this -- > [:] The ":" represents the two thumb tacks.) I put just a dab of glue on each thumb tack so that it would stay in and I didn't have to worry about the kids pulling them out. If your thumb tacks pop out on the top place another 1/4"x3" strip of the foam board to cover the points.

Mine ended up being very accurate. The thumb tacks raise the trays so you can see it tip to one side and also are wide enough feet that it can hold both sides up if they are equal. Make one for every few students if you have the time. Like I said, it takes about 15 minutes. I added some paint to give them some color. Source: Yahoo Answers

