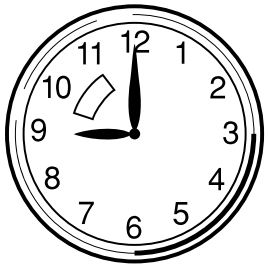
The learner will recognize and use standard units of metric and customary measurement.

2

2.01 Solve problems using measurement concepts and procedures involving:

Notes and textbook references

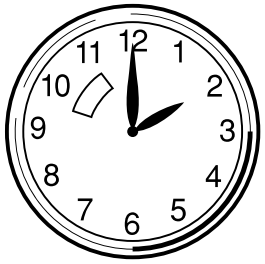


a.) Elapsed time.

A. Pose questions such as these to students:

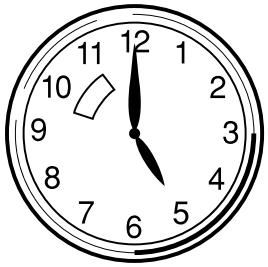
- If it is 2:00 p.m. now, how long is it until 8:00 p.m.? How long is it until 11:30 p.m.?
- If it is 7:00, what time was it 9 hours ago?
- If it is 6:00 now, what time will it be 5 1/2 hours from now?

Then let students or groups of students make up more problems and find the answers. Be certain that students know how quarter to ten, for example, looks on a digital watch (9:45).



B. Duplicate pages from TV Guide or television schedules from a newspaper. Have students draw times on clocks to show when favorite programs begin and end. Discuss how much time students spend watching television. Record the length of time of your favorite television shows. How many commercials were there during your show? How much time was spent in commercials? How much time was spent on the actual show?

Note: Consider turning these ideas into a study over a couple of weeks. Collect data and graph the amount of time spent watching television. Have students decide what other data could be interestingly displayed.



C. Choose a city in a different United States time zone. If it is 8:30 a.m. at your school what time would it be in that city?

Notes and textbook references

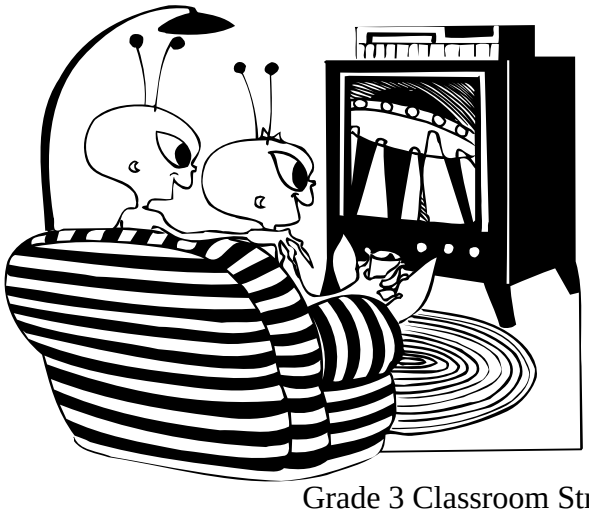
D. After giving students opportunities to explore numerical patterns on the calendar, try these mental math items:

- If Friday is the 15th, what date will next Monday be?
- What is the date one week before/after Christmas? Halloween? Valentine's Day?
- If today is Thursday, what day is it 500 days from today?
- Encourage students to create other similar questions.

E. Create an overhead transparency using a television schedule. Have students use manipulative clocks to discover the length of certain television shows. Create another schedule in which the lengths of some shows are given and the times for other shows are given. Have students use the given information to find the elapsed times.

TV Schedule for Tuesday, July 26th

5:30	WRAL News
7:00	Jeopardy
7:30	Wheel of Fortune
	Raven (30 minutes)
	Charlie and the Chocolate Factory (90 minutes)
	WRAL Special Report (45 minutes)



F. Have the students use poster or tag board to make larger clocks or watches. They can be traditional or digital and should show a specific time. Hang clocks in room. The students choose one of the clocks and answer questions similar to the following:

- What time was it an hour ago? Forty-five minutes ago?
- How much time will pass before lunch? P.E.? etc.
- What time was it 3 hours and 32 minutes before the time on your clock?

Notes and textbook references

Notes and textbook references

b.) Equivalent measures within the same measurement system.

A. Ask students to estimate and then measure the number of cups different containers will hold. How many cups will a quart/liter container hold? (*Explore, not memorize!*)

B. Ask students to determine whether a container is more or less than a cup. *Compare containers as a means of developing a sense of their capacities. Do not expect students to memorize ounces in a cup.* Give examples of things, which come in containers that are about a cup.

C. How many small juice cups can we fill with a quart/liter of lemonade? (Show student the quart.) Will we be able to fill more or fewer measuring cups than juice cups with a quart of liquid? Predict and then test your answer.

D. Collect containers of items sold by capacity (gallon jugs, half gallons, quarts, pints, half pints). Have students make mobiles with containers arranged in order according to this capacity. (Be aware that some items are sold by weight and comparison will involve decimal comparison).

E. **Building Meters.** Materials: Centimeter cubes, ten rods for decimeters, meter sticks or strings, die. Students, in turn, roll a die and choose the number of centimeter cubes displayed. Students trade 10 centimeters for a decimeter. Players must verbalize their trades. Trade ten decimeters for a meter. The player who builds a meter first is the winner.

F. Use water, rice, or sand to experiment and fill out charts such as this.

1 pint = _____cups
1 quart = _____pints
1 gallon = _____cups

Notes and textbook references

G. Make stations with a variety of everyday objects for the students to measure within the same measurement system. Allow students to rotatebetween and among the stations, then discuss how the units within the systems compare with each another.

Station examples:

Weight/Mass

Pounds and ounces: Station should include scales, weights, and objects to measure in both pounds and ounces.

Kilograms and grams: Station should include scales, weights, and objects to measure in both kilograms and grams.

Capacity

Standard: Station should include various containers and measurement tools for cups, pints, quarts, and gallons.

Metric: Station should include various containers and measurement tools for liters.

Linear

Standard: Stations should include string cut to varying lengths and measurement tools for yards, feet and inches.

Metric: Station should include string cut to varying lengths and measurement tools for meters and centimeters.

Discuss the comparisons. Students will later use this knowledge to solve measurement problems.

Notes and textbook references

H. Peanuts are a Coastal Plain specialty. Have students estimate the number of shelled (or unshelled) peanuts required to fill a quart-sized baggie™. Then, after determining the number of peanuts in a quart, have students determine how many pint-sized baggies can be filled from the quart of peanuts. Would the number be the same if you were to use quart-size and pint-size jars?

I. Have students estimate; then determine, which is greater when given "this or that" choices such as 10 dimes or 15 nickels, 78 pennies or 3 quarters, 4 hours or 120 minutes. Use a calculator to solve these when appropriate.

J. Play **Measurement Bingo** using Blackline Masters II - 1 through II - 3.

2.02 Estimate and measure using appropriate units.

Notes and textbook references

a.) Capacity (cups, pints, quarts, gallons, liters).

A. Give students a large container with macaroni (water, sand, rice or beans). Ask students to determine how many cups/liters there are in the container.

B. For homework, have children bring in a cup of something. Check everyone's cup by having children measure what everyone at their table brought. "How many of these would we have to put together to make a quart/liter?"

C. Estimate the amount of popcorn it takes to fill a cup. Use this information to estimate the amount of popcorn it takes to fill a quart and a gallon. Check your estimate.

D. Fill a container with dry beans. Have empty containers available in these sizes; cup, pint, quart, gallon, and liter. Be sure containers are labeled. Allow pairs of student to measure. Encourage the students to find answers to questions such as: How many cups in a gallon? How many pints in a quart? Which is larger, a liter or a quart?

E. Estimate the amount of water you think you can squeeze out of a wet sponge (only one squeeze allowed). Then, after soaking the sponge in water, squeeze it into an empty container. Record each student's estimate and the actual results of the experiment. Organize and display the data. Compare the results of the experiment with estimations.

F. Estimate the capacity of various containers filled with beans, rice, popcorn, etc. Pour into a calibrated jar to find the actual capacity.

Notes and textbook references

G. Have a capacity Scavenger Hunt:
Find something containing more than 1 liter.
Find something containing about 1 pint.

H. Have groups brainstorm lists of items that they know are measured with cups, pints, etc. Organize and display the information. What inferences can they make? What questions arise?

I. Have students estimate the order of several containers from greatest to least capacity. Check estimates by filling the containers with a like substance and measure the amounts. Have students record their results.

J. Have students work in groups. Take two 9 x 12 inch sheets of construction paper. Make a round tube by rolling one piece the long way. Tape the edges where they just meet. Roll the other piece the other way and tape. Will one tube hold more than the other or will both tubes hold the same? Record all guesses. Using corn (a Piedmont crop), let students record the amount each will hold.

K. Bring pots and pans of different sizes to class. Have students order them from least to greatest according to their estimated capacity. Use water or dry beans to check estimates and reorder as necessary.

L. Have students compare how many ounces of Hi-C come in a large can and how many ounces are in a 3-pack of boxed Hi-C. Compare the costs of both and discuss which type of packaging is the best buy. Repeat the activity with different products.

b.) Length (miles, kilometers).

Notes and textbook references

A. Use the scale on the official North Carolina map to find the distances between cities such as from Raleigh to Wilmington, in miles and/or kilometers.

B. Use a pedometer to determine the distance around the playground/ball field. Have students walk a mile one day. Discuss how many laps around the playground/ball field it took to reach a mile. On another day, review how many laps it took to walk the mile. Have students walk the same path, stopping when they reach a kilometer. This activity would be a great way to integrate P.E. with math.

C. Encourage parents to support student learning by having students have their parents to tell them when they have traveled a mile in a car. Have students keep a mileage/kilometer log of the distance that they travel in a car.

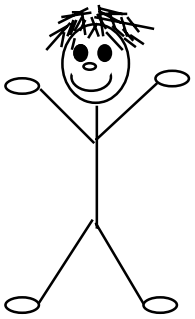
D. The base ten blocks can be used to play a trading game in which the goal is to be first to collect a meter. In this version, the base ten blocks are used as length segments; the centimeter cube, or unit, represents one centimeter, and the long or "ten stick" represents a decimeter. A meter is represented with ten decimeters. In a group of students, one needs to be the banker and hold all the blocks. The other students take turns rolling a regular die. The banker gives each player the number of units or centimeters shown on the die. As players accumulate "centimeters," they trade each group of ten for a decimeter until one has collected ten decimeters or one meter. In order to avoid having students who already have one meter sitting and waiting for the rest to reach this goal, the game should end as soon as one person reaches this goal. Each student can then record his/her score for that round. This score is the total number of centimeters collected to that point. After playing several rounds, students can total their centimeters for all games and see who has the highest total to determine "the winner."

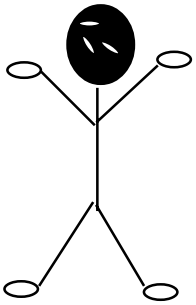
Notes and textbook references

E. After introducing the game in 2.02 b) D and the students have played for awhile, lead a discussion about what can be changed in order to create new games for practicing other measurement systems. This might include the following: trading seconds for minutes, minutes for hours, hours for days, days for weeks, weeks for years, cups for pints, pints for quarts, quarts for gallons, grams for kilograms, etc. Briefly discuss what kinds of concrete materials could be used to play these various games. Have small groups of students develop one of these ideas into a game with complete rules and materials. Then the class could field-test the games and give the developers feedback about how it works and how it could be improved (if this is necessary). At this point, the class has an extensive resource of games for practicing this skill.

F. **Are You a Square or a Rectangle?** How does your height compare with your arm span? Make a prediction - how many centimeters tall are you? How many centimeters wide is your arm span? Measure to find out:

Are you a square? height = arm span
Are you a tall rectangle? height > arm span
Are you a wide rectangle? height < arm span
Graph the results for the class. Allow students to draw themselves as squares, tall rectangles or wide rectangles.





G. Have students determine the appropriate kind of measurement for the following:

1. length of your hair
2. length of your state
3. distance of a walk
4. width of your classroom
5. distance of a ship voyage
6. height of a door
7. length of a soccer field
8. the length of a caterpillar

Be sure to use both the standard and metric systems.

Notes and textbook references

H. Have students search for other relationships between measures.

- Is their reach about the same as their height?
- Is their height about three times the distance around their head?
- Is the length of their foot about the same length as the length of their forearm?
- Is the distance from their navel to the floor about 1/2 their height?
- Is their over-the-head distance (from top of one ear, across top of head to top of other ear) about equal to their under-the-head distance (from top of one ear, under the chin to top of other ear)?

I. How many nickels could you stack up before they would fall? How tall a stack is this? How much is it worth? How much would a stack of dimes the same height be worth? If you could stack $100 worth of nickels, how tall would the stack be? Be sure to use both the standard and metric systems. Discuss the results.

J. Ask the students to bring in an assortment of "junk" to school (clean and safe throwaway objects: cardboard paper towel tube, empty jug, food box, old mitten, etc.). Gather measuring tools for finding length and weight and make the tools available to the students. Discuss various techniques for measuring standard items with unusual shapes. Have the students record the measurements in chart form. Be sure to use both the standard and metric systems.

K. Some human figure-drawing classes are taught by using the length of the head as a unit of measure. Ask students to consider this as a unit, measure this distance and then look for relationships which might help when drawing a whole person. All of these measures can be done in both standard and metric units. Students might want to use all of this information to draw a life-sized picture of themselves. Students might get very detailed with this process and measure the length of their smile, their hair, etc. These could be cut out and posted on a bulletin board, or placed in chairs for Open House.

Notes and textbook references

L. The ancients literally measured by "rule of thumb." They used various body parts as measuring tools and were aware of comparisons among these measures. The following is a list of some of these measures:

- **palm or hand** ... the distance across one's palm when the hand is held with fingers together
- **span** ... the distance from the little finger to the tip of the thumb when the hand is stretched with fingers wide open
- **cubit** ... the distance from the elbow to the tip of the fingers
- **reach** ... the distance from the tip of the fingers on the left to those on the right when arms are stretched out to the side
- **pace** ... the distance from heel to heel, or toe to toe, when taking a normal step
- **inch** ... the width of the thumb for some or the distance from the tip of the thumb to first knuckle
- **foot** ... the length of a person's foot
- **yard** ... the distance from the tip of the nose to the tip of the fingers when arm is outstretched
- **fathom** ... the length of outstretched arms

Some comparisons include:
1 reach = 2 yards or 1 fathom
1 span = 2 palms or hands
1 cubit = 2 spans
3 feet = 1 yard
1 foot = the distance around the fist

Report some of these ancient measures and comparisons to students. Brainstorm a list of body measures for every student to check . This might develop into a personal measurement record. Working with a partner, have students use their tape measures to check and record these various lengths themselves. Develop a class chart, or use the database on a computer, to record a few of these actual measures for each student. Discuss the results. Does everybody have the same span? What impact might this have on measuring things in our everyday lives? This would be a good time to reread How Big Is A Foot? by Rolf Myller.

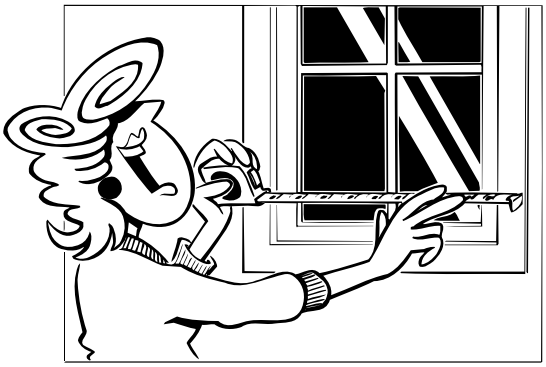
M. What is the best unit that could be used to measure your shoe, a key, the distance to the moon, the height of a basketball player? Is there more than one answer to any of these questions? Why?

Notes and textbook references

N. The new restaurant has a rectangular-shaped parking lot that is 50 feet on one side and 200 feet on the other side. The entrance is on the long side. Measure the space needed for the cars in the teachers' parking lot and design a parking lot for the restaurant, showing the dimensions on your drawing.

O. Identify the appropriate tool and unit of measurement to determine the distance around a person's waist. Measure the distance around your waist.

P. Have students estimate, then measure, spaces around the school. Examples might include the length of the front sidewalk, the distance around the playground (for a fence), or the distance from your classroom to the main office.



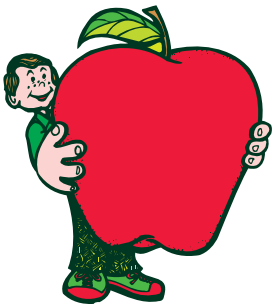
Q. Have a group or pairs scavenger hunt. (Using a ruler)

- Find something 1 meter long.
- Find something 1 foot long.
- Find something 6 inches wide.
- Find something 10 centimeters long.
- Find something greater than 2 meters in height.
- Find something about 50 centimeters tall.
- Find something between 9 and 12 inches long.
- Find something between 2 and 3 feet tall.
- Find something 1 yard long.
- Find something 1 inch long.

Have each group report their findings to the class as a whole group.

Notes and textbook references

c.) Mass (ounces, pounds, grams, kilograms).



A. Estimate the weight of your textbooks. Then weigh each and find the combined weight of the textbooks. What is the weight of all the textbooks in your class?

B. Pick up two objects. Put one in each hand and try to decide which is heavier. Check by weighing the objects. Try this again with many different objects. Find two objects you think weigh the same. Check by weighing.

C. Have each group of students estimate the weight of five objects and put the objects in order from least to greatest weight. Students then weigh each item and reorder, if necessary. Display results.

Variation: Compare objects with an arm balance rather than weighing on a scale. Using comparisons, order the objects from lightest to heaviest.

Journal entry: Describe how you decided the correct order of the objects.

D. Give each group of students five items of differing weights. Students weigh each object and create riddles for the five items related to their weight. Allow the students to exchange their objects and riddles with other groups. *Example:* This item does not weigh the most. This item weighs more than five grams.

E. Have students participate in or develop a scavenger hunt to discover more about ounces, pounds, grams, and kilograms. For example, find something with a mass of about 280 grams. Find something with a mass of about one kilogram. Find something weighing about one pound.

F. Use a balance scale and have children determine how many pattern blocks or other manipulatives weigh a kilogram (or a pound).

Notes and textbook references

G. Give groups of students an assortment of foods that have peels, shells or other removable coverings. Groups estimate the mass with the covering and without the covering, then weigh and record to find out the actual mass. Possible foods to use are bananas, oranges, peanuts, peaches (remove the pits).

H. Estimate the weight of a pumpkin. Then weigh the pumpkin and determine who had the closest estimate. Guess the circumference of the pumpkin before measuring it. Record who had the best estimate. Make your pumpkin into a jack-o-lantern, and compare the before and after weights.

I. Give each child a piece of bubblegum (not sugarless). Remove the wrapper and allow each student to weigh the gum in an individual cup. Ask each student to chew the gum for "x" amount of minutes. Predict whether the gum will weigh more or less after chewing. Place gum into cups and weigh again. (The weight lost is sugar).

J. Does one cup of everything weigh the same? You will need and equal arm balance, styrofoam cups and different materials to weigh. North Carolina materials such as shelled peanuts, unshelled peanuts, beans, cotton balls, sand, small rocks, etc. can be used.

K. Weigh an egg. Boil the egg and weigh again. Compare the weights. Peel the egg and weigh again. Is there a difference?

L. Have pairs of students make their own balance scale using a coat hanger, two paperclips, and two plastic or paper cups. Then give them sets of objects to estimate and compare weights.

M. Students estimate the weight of various objects in grams and then use a balance scale to check the accuracy of their measurements.

Notes and textbook references

N. Have students create and construct gingerbread houses out of graham crackers, cake icing, gumdrops, M & M's™, Lifesavers,™ etc. Instruct the children to weigh their finished products. By observation, have the children find a gingerbread house that they think weighs approximately the same as their own. Weigh the gingerbread house in question to find out whether their guess was correct.

O. Ask students whether they have ever wondered how much they are really paying for some foods after they have discarded the "unusable" parts. For example, how much does a peeled orange really weigh? Or, how much does the peeling cost? Brainstorm a list of foods that are purchased by weight and have included in this weight something that is discarded like peelings, pits, etc. Note, most packaged foods, like raisins, that are sold by weight do not include the weight of packaging. These are "net weights". Have students bring in these foods and their unit prices. Having a variety of each kind of food will provide more data since things like oranges come in a wide range of sizes and weights. Lead a discussion about how these foods will be used after weighing in order to avoid waste. Next, have students work in pairs to weigh foods before and after peelings, pits, etc. are discarded. They should also weigh the discarded items. Students should record this information and devise a way to organize and report their findings. Are there any patterns or generalizations that might help consumers purchase "better" buys?

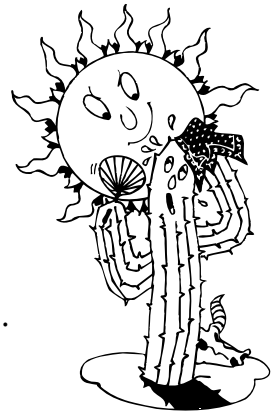
P. Use a balance and a one-kilogram weight (or a one pound weight). Ask children to determine whether objects are heavier or lighter than one kilogram (one pound). Record the findings on a chart.

Q. Bring items from the grocery store. Have student weigh the items. Compare the results with the printed weight on the packages. Why might the numbers not be exactly the same? (*This is a good time to talk about precision in measurement.*) Have student order four items according to their mass.

R. Give students four objects. Ask children to estimate which is heaviest and which is lightest. Have students weigh objects to check their estimates.

d.) Temperature (Fahrenheit, Celsius).

Notes and textbook references



A. Have students work in groups. Using the weather map in the newspaper, have each group record the temperature for several cities for a week. Graph the different temperatures. Choose a favorite city and decide what type of clothing you would take to the city based on your temperature chart..

B. Have the students record daily temperature in Fahrenheit for two weeks at beginning of year and then again in December. Compare temperatures and talk about how the temperature feels. Variation: Divide class into two groups. Have half of the students use Fahrenheit and half use Celsius thermometers to record temperatures.

C. Include temperature recording in the daily calendar activity or review. Students can take turns reading the thermometer, include both Celsius and Fahrenheit. Track the temperature indoors and outdoors. This can be done at different times of the day. After gathering data for a period of time, students should graph the data and write questions which could be answered using the data. Some sample questions are: What kind of clothing would be appropriate for these temperatures? What kind of outdoor activities might be appropriate? This activity might be repeated for two-week spans at different times of the year. Students might also track temperatures in other parts of the country by using the weather map from the newspaper.

D. Use a thermometer to measure temperature of a variety of liquids such as, hot water, cold water, a cup of sherbet, water from the water fountain. Record your results and discuss.

E. Make a chart. Divide the class into teams and have each team measure water temperature from water fountains throughout the building. Graph the results and discuss. Write a report of study.

Variation: Have some students use Fahrenheit and some use Celsius. Discuss the differences

Notes and textbook references

F. Draw pictures of what people wear at 0ºF, 0ºC ; 20ºF, 20ºC; and 30ºF, 30ºC. What clothing might you wear at 85ºF? 85ºC?

G. Lead a discussion about other things that might be checked for temperature. Students might check the temperature of the water in all the school's fountains and other running water sources. They might check soil temperatures. The food service staff might let students check temperature of food samples or refrigerator and freezer units. They might want to check temperature of a variety of rooms in the building; for example, the library, lunchroom, office, boiler room, computer lab, etc. After gathering these data, students could graph them and write a summary of their findings.