

Make It Metric

Summary

Activities help students learn the sequence of metric prefixes and to make conversions within the metric system.

Group Size

Large Groups

Materials

Invitation to Learn

- Post-It® notes
- Poster Paper
- Markers

Instructional Procedures

- *Millions to Measure*
- [King Henry's Story](#)
- [Prefix Cards](#)
- [Digit Cards](#)
- Costume items
- [King Henry's Commands](#)
- [Royal Carpenter's Tools](#)
- [Metric Measurement](#)
- [Metric Measurement Steps](#)
- Scissors
- Gluesticks
- [Metric Conversion Record Sheet](#)
- Calculators
- [Make It Metric Dominoes](#)
- [Metric Tic Tac Toe](#)

Additional Resources

Books

Millions to Measure, by David M. Schwartz; ISBN 0-688-12916-1

Background for Teachers

Most countries use the metric system. With the increasingly global marketplace, citizens of the United States are exposed to more usage of this system. It is important for students in the educational system to have a knowledge of the metric system--its components, organization, and common benchmarks--to be able to use the system in the real world.

The metric system is based on powers of ten. This makes calculations and conversions simple. The prefixes are used across the measurement types to denote the magnitude, or power of ten of the measurement.

Prefix	kilo	hecto	deka	UNIT	deci	centi	milli
Unit: meter	kilomet er	hectom eter	dekam eter	meter	decime ter	centim eter	millimet er
Abbreviat ion	km/K	hm	dam	m	dm	cm	mm
Meaning	1000 m	100 m	10 m	1 m	0.1 m	0.01 m	0.001

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Power of Ten	10^3	10^2	10^1	10^0	10^{-1}	10^{-2}	10^{-3}

Prefix	kilo	hecto	deka	UNIT	deci	centi	milli
Unit: meter	kilogram	hectogram	dekagram	gram	decigram	centigram	milligram
Abbreviation	kg	hg	dag	g	dg	cg	mg
Meaning	1000 g	100 g	10 g	1 g	0.1 g	0.01 g	0.001 g
Power of Ten	10^3	10^2	10^1	10^0	10^{-1}	10^{-2}	10^{-3}

Prefix	kilo	hecto	deka	UNIT	deci	centi	milli
Unit: meter	kiloliter	hectoliter	dekaliter	Liter	deciliter	centiliter	milliliter
Abbreviation	kL	hL	daL	L	dL	cL	mL
Meaning	1000 L	100 L	10 L	1 L	0.1 L	0.01 L	0.001 L
Power of Ten	10^3	10^2	10^1	10^0	10^{-1}	10^{-2}	10^{-3}

Intended Learning Outcomes

1. Develop a positive learning attitude toward mathematics.
3. Reason logically, using inductive and deductive strategies and justify conclusions.
4. Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notation of mathematics.

Instructional Procedures

Invitation to Learn

There are so many things that we measure every day using the metric system. Pre-assess what your students know about this measurement system by having them brainstorm terms related to metric measurement. Have students work in cooperative groups of two to four students. Students should write each item on a separate Post-It® note. Allow three to five minutes for this activity.

Ask students to come up with a way to group or classify the items on their Post-It® notes. Sort the Post-It® notes into columns of like items and attach them to a sheet of poster paper for each group to display. Write a heading for each column created. Some possible headings students might use include length, capacity, volume, mass, weight, or temperature. Take time to have groups share their methods of classification. It is possible that there may be some items in columns that are not mathematically accurate. Be sure to clear up any misconceptions as needed. Leave the classification posters created by the groups hanging up in the room for future reference.

Instructional Procedures

(NOTE: The activities outlined in Instructional Procedures are intended to be taught sequentially. They will take several lessons/ days to complete with students.)

Read the book *Millions to Measure* to the class. Draw comparisons from the story to the classification posters students made in the Invitation to Learn.

Tell students *King Henry's Story*. This story will introduce the acronym being used to help students learn the sequence of metric prefixes and to make conversions within the metric

system. Although many acronyms are possible, these activities will be using King Henry Does Usually Drink Chocolate Milk.

Tape the *Prefix Cards* on the board in a "staircase" pattern to match the foldable students will be making later in this lesson. The cards should be placed in the following order: kilo, hector, deka, UNIT, deci, centi, and milli.

Select four students to play the roles of King Henry, the Royal Jester, the Royal Magician, and the Royal Carpenter. The other members of the class will be the Royal Subjects. King Henry will wear a crown and hold the canister with *King Henry's Commands*. The Royal Jester will wear a hat and hold the *Digit Cards*. The Royal Magician will wear a hat and hold the decimal point wand. The Royal Carpenter will wear a tool belt containing the *Royal Carpenter's Tools*.

King Henry will select a card from *King Henry's Commands* and read it to the class. An example might read: I command that a royal coach 15 meters in length be built to carry me to the ball.

The Royal Jester then places *Digit Cards* to represent 15 under the UNIT card on the board.

The Royal Magician steps in to hold the decimal point wand after the number 15. The Royal Carpenter then reaches into the tool belt without looking and pulls out a *Royal Carpenter's Tools*

card to see what measurement is available. If the Royal Carpenter pulls out "I, the Royal Carpenter, have centi_____ units available for measurement today," then the 15 meters must be converted to centimeters. The King may then call on a Royal Subject to help decide which direction and how many places the decimal point should move to convert the meters to centimeters. The Royal Magician must move the decimal point to the correct place indicated by the Royal Subject. The other members of the Royal Court may help decide if the answer is correct. Rotate the roles to other members of the class to get everyone involved.

Have students make the *Metric Measurement* foldable to use in converting within the metric system. This is a smaller version of the steps from the role playing that students can put in their journals. First, have them cut out the seven steps and fold each one in half on the double line. Students will attach them to the *Metric Measurement* paper using glue sticks as you explain each one as described in the procedural steps below:

a. Start with the center step labeled "USUALLY." Have students open the paper step and record inside that the word USUALLY stands for "Unit." Record that the basic units of measurement in the metric system are meter, liter, and gram and they have a value of 1 or 10^0 .

b. Have students open the step labeled "drink." This step is to be labeled "deci," and it has a value of 0.1 or 10^{-1} .

c. Have students open the step labeled "chocolate." This step is to be labeled "centi," and it has a value of 0.01 or 10^{-2} .

d. Have students open the step labeled "milk." This step is to be labeled "milli," and it has a value of 0.001 or 10^{-3} .

e. Have students open the step labeled "does." This step is to be labeled "deka," and it has a value of 10 or 10^1 .

f. Have students open the step labeled "Henry." This step is to be labeled "hector," and it has a value of 100 or 10^2 .

g. Have students open the step labeled "King." This step is to be labeled "kilo," and it has a value of 1000 or 10^3 .

Complete *Metric Conversion Record Sheet*. Use the *Metric Measurement* foldable to help make the conversions. Have a class discussion of patterns found. Have students write about the patterns in their journals.

Play the game Metric Dominoes. Students should be allowed to use their journal notes, their foldable, and/or a calculator to help make the conversions necessary on each domino to find matches in this game. Copy two sets of *Make It Metric Dominoes* on cardstock for each pair of students to play the game. Have students cut apart the dominoes. The rules of play are as

follows:

- a. Give each player five dominoes. Place the remaining dominoes in a draw pile.
- b. Player 1 places a domino on the table.
- c. Player 2 puts down a domino with a metric equivalent. For example, 40 cm and 400 mm are equivalent.
- d. Players continue to take turns putting down dominoes one at a time. If a player does not have a metric equivalent, that player must continue to draw from the pile until a match is possible.
- e. The first player to use all of his dominoes is the winner.

Extensions

Curriculum Extensions/Adaptations/ Integration

Have students write their own acronym for the metric prefixes.

Have students write their own story to fit their metric prefix acronym.

Have students use calculators to complete the *Metric Conversion Record*. Dividing by ten as they move to the left and multiplying by ten as they move to the right will help students to see the patterns on the calculator.

Have students make visual representations of some of the linear metric measurements. Lay out one meter of masking tape on the students' tables. Have students line up base ten rods the length of the meter to help them remember that ten decimeters are equivalent to one meter. Have students line up centimeter cubes the length of the base ten rods to discover that ten centimeter cubes are equivalent to one decimeter, and one hundred centimeters is equal to one meter.

Have students look at a teacher-made visual representation of one dekameter. Purchase one dekameter of rope. Tie knots in the rope to mark off each meter. Color each knot with a marker. Stretch out the rope to show students the length of a dekameter to help them remember that a dekameter is equivalent to ten meters.

Family Connections

Have students share the story of King Henry and their Metric Measurement foldable with their family.

Have students go on a metric scavenger hunt in their home. Record items and/or ways that the metric system is evident in their home. Come back and report their findings to the class.

Have students play Metric Dominoes with their family.

Assessment Plan

Correct the *Metric Conversion Record Sheet* for a grade.

Have students complete the *Metric Tic Tac Toe* handout.

Have students design their own Tic Tac Toe grid for a peer to solve.

Bibliography

Research Basis

Peterson, Shelley Stagg. Teaching content with the help of writing across the curriculum. *Middle School Journal*, November 2007, Vol. 39, Number 2, p26-33.

This study investigated the value of "discovery writing," a type of writing in which students have some control over the format, topic, purpose, and audience, to "staccato writing," a type of writing with little or no control such as filling in blanks, copying notes from the board, and short answers to questions, in the content areas. The author found that student control led to greater understanding of content area concepts. "Discovery writing" required greater concentrated attention to sorting through and making sense of ideas on the part of the learner.

Tomlinson, Carol Ann. Differentiating instruction. *Middle Ground*, August 2005, Vol. 9, Number 1, p12-14.

The author gives guidelines to help teachers use differentiation. Teachers must have "clear learning goals that are rich in meaning and provide various avenues and support systems to maximize the chance of each student succeeding." Through specific examples such as pre- assessment, meeting with small groups, using multiples presentation and teaching modes, creating differentiated homework, scaffolding reading, and allowing varied learning products, the author concretely helps teachers to provide for the diversity of learners in the classroom.

Authors

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