

# Magnetic Metric Staircase

**Contents:** Magnetic Metric Staircase, 2 foam magnets

## Introduce the Metric Staircase

The Magnetic Metric Staircase is a great way to teach students to visualize the metric system when converting between metric units. Using the cat and shoe magnets to mark which units are being converted, students can imagine the cat chasing the shoe up and down the staircase!

Put the Magnetic Metric Staircase on your whiteboard and review the metric prefixes that are shown on each step. For example, kilo means 1000 so a kilometer = 1000 meters. These are the definitions for the commonly used prefixes in the metric system:

**kilo-** = one thousand (1000)

**deci-** = one tenth ( $\frac{1}{10}$ )

**hecto-** = one hundred (100)

**centi-** = one hundredth ( $\frac{1}{100}$ )

**deca-** = ten (10)

**milli-** = one thousandth ( $\frac{1}{1000}$ )

The center step, called the base unit, can be used to represent meters (to measure length), liters (to measure volume), or grams (to measure mass). For consistency, we will use meters as the base unit in this instruction guide. Therefore, the top step will represent kilometers (abbreviated *km*), the second step will represent hectometers (abbreviated *hm*), etc. Make sure students know the abbreviations before proceeding; it may help to write the abbreviations on the board.

Explain to students that each step on the stairs represents a multiple of 10. For example, put the cat on the *milli-* step at the bottom. Move the cat up one step to *centi-* and ask the class, "How much bigger is a centimeter than a millimeter?" Answer: 10 times bigger.

### Arrow Confusion

Students may be confused by the fact that a millimeter is one tenth of a centimeter, yet the arrow on the staircase says to multiply as you go down the staircase. This is because the arrows are for *converting* metric units to make them *equivalent*. For example, if you have 1 cm and you are trying to find its equivalent in millimeters, you must multiply by 10 to find the number of (smaller) millimeters which equals the single (larger) centimeter.

Put the cat back on the *milli-* step. Now, move it up two steps to the *deci-* step and ask your class, "How much bigger is a decimeter than a millimeter?" Answer: 100 times (10 x 10) bigger.

Finally, put the cat back on the *milli-* step. Now, move it up three steps to the base unit step and ask your class, "How much bigger is a meter than a millimeter?" Answer: 1000 times (10 x 10 x 10) bigger.

If necessary, keep repeating this activity, continuing up the Magnetic Metric Staircase until students understand that **every step upward** on the staircase represents a **unit that is 10 times larger than the one below**.

# Using the Metric Staircase to Convert Between Units in the Metric System

Show students how the Metric Staircase makes it easy to visualize converting between units in the metric system.

## Example 1—Moving Down the Staircase

Write the following problem on the board:

$$1 \text{ cm} = \underline{\hspace{2cm}} \text{ mm}$$

Put the cat on the *centi-* step and the shoe on the *milli-* step.

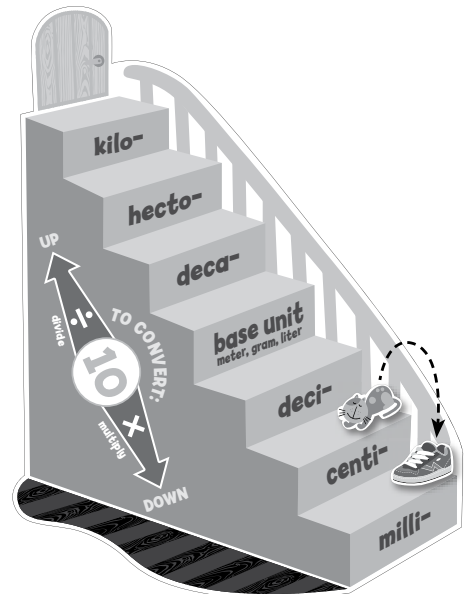
Ask students,

“How many steps must the cat walk to get to the shoe?” (Answer: 1)

“Does the cat need to walk up or down the stairs to get to the shoe?” (Answer: down)

“What operation must you perform when you move down the staircase?” (Answer: multiplication)

Point out that the arrow on the stairs says to multiply by 10 every time you go down a step. Since the cat is going down 1 step, you multiply by 10 ONE time.



$$\begin{array}{r} 1 \text{ cm} \\ \times 10 \text{ mm/cm} \\ \hline 10 \text{ mm} \end{array}$$

$$1 \text{ cm} = \underline{10} \text{ mm}$$

### Decimal Shortcut

If your students are familiar with decimals, show them that they can move the decimal point one place to the right.

$$1 \times 10 = 1.\underset{\uparrow}{0} = 10$$

## Example 2—Moving Up the Staircase

$$1 \text{ m} = \underline{\hspace{2cm}} \text{ km}$$

Put the cat on the base unit step and the shoe on the *kilo-* step.

Ask students,

“How many steps must the cat walk to get to the shoe?” (Answer: 3)

“Does the cat need to walk up or down the stairs to get to the shoe?” (Answer: up)

“What operation must you perform when you move up the staircase?” (Answer: division)

“How many times must you divide by 10?” (Answer: 3)

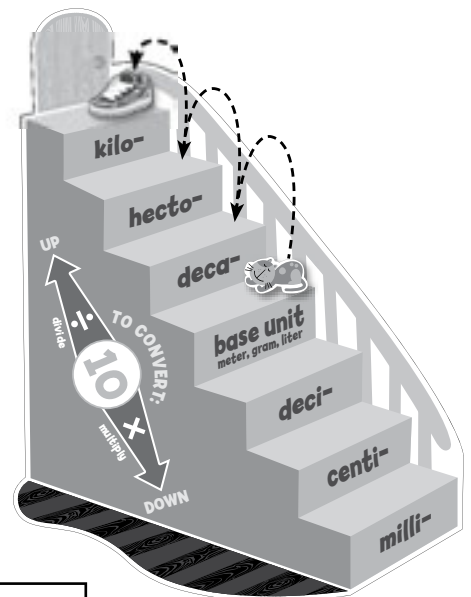
$10 \times 10 \times 10 = 1000$ , so divide by 1000.

$$1 \text{ m} \div 1000 = \underline{0.001} \text{ km}$$

### Decimal Shortcut

Show students that they can move the decimal point three places to the left.

$$1 \text{ m} \div 1000 = 0.\underset{\uparrow}{\underset{\uparrow}{\underset{\uparrow}{0}}}.001 = 0.001 \text{ km}$$



### Example 3—Multistep problem (advanced)

1. Write the following problem on the board:

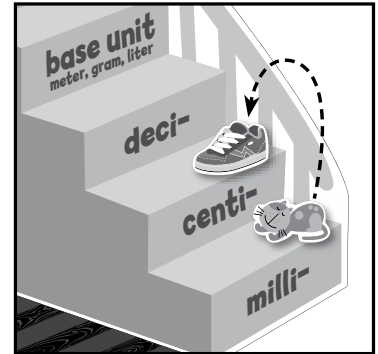
$$5329 \text{ mm} = \underline{\hspace{2cm}} \text{ cm} = \underline{\hspace{2cm}} \text{ m} = \underline{\hspace{2cm}} \text{ km}$$

Start with the cat on the *milli-* step and the shoe on the *centi-* step.

Show students that the cat must walk up 1 step, so:

$$5329 \text{ mm} \div 10 = \underline{532.9} \text{ cm}$$

$$5329 \div 10 = 5329. = 532.9$$



millimeters to centimeters

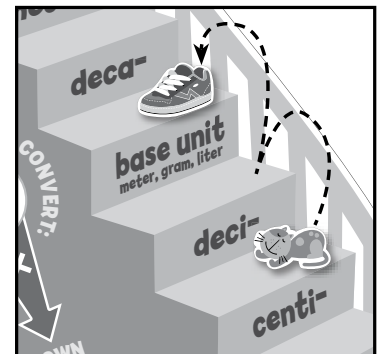
2. Now, leave the cat on the *centi-* step and move the shoe to the base unit (m).

$$532.9 \text{ cm} = \underline{\hspace{2cm}} \text{ m}$$

The cat must walk up 2 steps.

$$532.9 \text{ cm} \div 100 = \underline{5.329} \text{ m}$$

$$5329 \div 100 = 5329. = 5.329$$



centimeters to meters

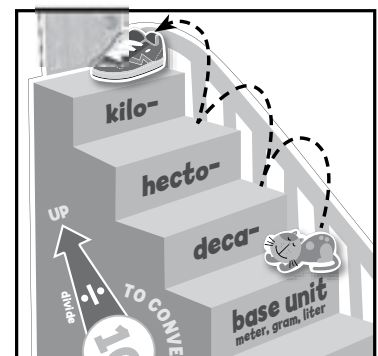
3. Finally, leave the cat on the base unit step and move the shoe to the *kilo-* step.

$$5.329 \text{ m} = \underline{\hspace{2cm}} \text{ km}$$

The cat must walk up 3 steps.

$$5.329 \div 1000 = 0.005329 = 0.005329$$

$$5.329 \text{ m} \div 1000 = \underline{0.005329} \text{ km}$$



meters to kilometers

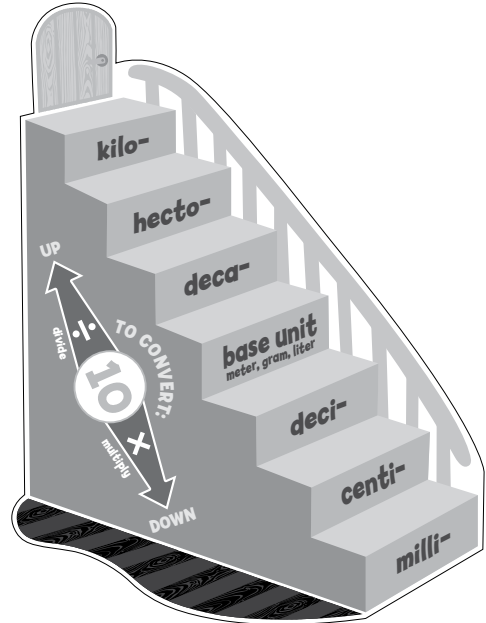
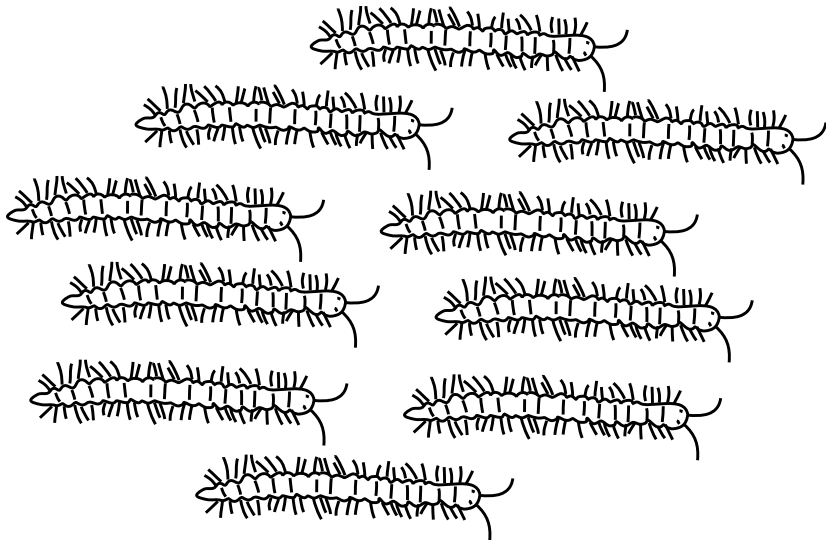
## Using the Reproducible

Copy the reproducible on the back of this page and ask students to complete it.

The answer to the riddle: a *centipede*!

**Directions:** Solve each problem. Use the Metric Staircase to help you convert between units. Find the answer at the bottom of the page. Write the letter after each problem above its answer at the bottom of the page.

**What do you call a group of 10 millipedes?**



1. When you move up or down one step on the Metric Staircase, you must multiply or divide by the number \_\_\_\_\_. **(D)**
2. When you move down the metric stairs to convert units, do you multiply or divide? \_\_\_\_\_ **(P)**
3. 2 cm = \_\_\_\_\_ mm **(E)**
4. 15 cm = \_\_\_\_\_ mm **(A)**
5. When you move up the metric stairs to convert units, do you multiply or divide? \_\_\_\_\_ **(I)**
6. 10 mm = \_\_\_\_\_ cm **(E)**
7. 320 mm = \_\_\_\_\_ cm **(T)**
8. 1 meter = \_\_\_\_\_ cm **(N)**
9. 7400 cm = \_\_\_\_\_ m **(E)**
10. 2 km = \_\_\_\_\_ mm **(C)**

\_\_\_\_\_ !  
 150      2,000,000      20      100      32      divide      multiply      1      10      74