Name_____Date_____ Team _____

INQUIRY SKILL FOCUS: Measurement

Measure

Can you imagine trying to build a set of wooden bookshelves without using measurements? Measurements are necessary to be sure that the pieces of wood you cut will fit together. Measurements are also necessary to be certain that the finished bookshelf will fit through the door. Measurements are important for any construction project. In science, measurements are also necessary. Standard measurements allow scientists to repeat the work of others.

Measuring is comparing an object or process to a standard. In science, a common set of standards, called the International System of Units, is used for measuring. This system, a version of the metric system, is sometimes called SI (for its French name, *Système International d'Unités*). Common SI units include the meter, the liter, the gram, and degrees Celsius.

Property	Basic Unit	Symbol
Length	meter	m
Liquid volume	liter	L
Mass	gram	g
Temperature	degrees Celcius	°C

Sometimes units smaller or larger than the standard units are used. A set of prefixes is used to name smaller and larger units and show their size relative to the standard unit. For example, a kilometer is equal to 1,000 meters. The kilometer is useful when measuring long distances. A milligram is 1/1,000 gram, and is used when measuring objects with very small masses. To convert between units, you must multiply or divide. For example, to change a measurement in kilometers to a measurement in meters, you would multiply by 1,000.

Prefix	Symbol	Meaning	Example
mega	**M**	**1 000 000**	**Megameter (Mm)**
kilo-	k	1,000	kilometer (km)
hecto-	h	100	hectometer (hm)
deka-	da	10	dekameter (dam)
deci-	d	$0.1\left(\frac{1}{10}\right)$	decimeter (dm)
centi-	c	$0.01\left(\frac{1}{100}\right)$	centimeter (cm)
milli-	m	$0.001\left(\frac{1}{1,000}\right)$	millimeter (mm)
micro	µ	0.000 001 1/1000 000	micrometer (µm)
nano	n	0.000 000 001 1/100 000 000	Nanometer (nm)

Measure (*continued*)

In science, tools are used to make measurements. Selecting the correct tool and using the tool properly are both important steps in making correct measurements. Length can be measured using a centimeter ruler or a meter stick. Liquid volume is often measured using a graduated cylinder. Balances are used to measure mass. Thermometers are used to measure temperature.

TIPS FOR MAKING MEASUREMENTS

- Select the appropriate unit and tool for the measurement you are making.
- Make sure you know how to correctly use the measuring tool. If you have questions, ask your teacher.
- Always label your measurements with the appropriate units.
- If you perform mathematical calculations using your measurements, be sure to label the results with the correct units.

What is 420 kilometers expressed as meters? Show the calculations you used to find your answer.

Name_____Date_____ Team _____

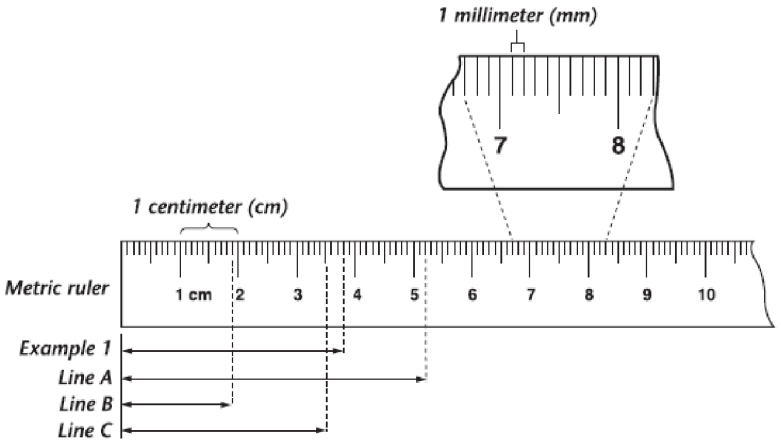
INQUIRY SKILL FOCUS Practice

Measure: Length

Write your answers to the questions below in the spaces provided.

Length is the distance between two points. The SI unit for length is the meter (m). Meters can be divided into smaller units, such as the centimeter (cm) and millimeter (mm), to measure small objects. Meters are combined into larger units, such as the kilometer (km), to measure long distances.

Common tools used to measure length are meter sticks and centimeter rulers. A centimeter ruler is shown below. The labeled units are centimeters (cm). Each centimeter is divided into 10 millimeters. When measuring length, choose the unit and measuring tool that is most appropriate for the object being studied. If you are comparing the lengths of several objects, choose a unit that can be used to measure all of the objects.



Look at Example 1 above. If you measure this line in centimeters, it is 2.9 cm long. In millimeters, this line is 29 mm long.

1. How many millimeters long is Line A?_____

2. How many centimeters long is Line A?_____

3. How many millimeters long is Line B?_____

4. How many centimeters long is Line B?_____

5. How many millimeters long is Line C?_____

6. How many centimeters long is Line C?_____

7. What is the difference between lines A and B?_____ cm

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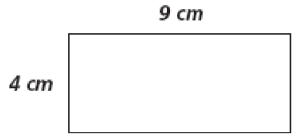
Measure: Length (*continued*)

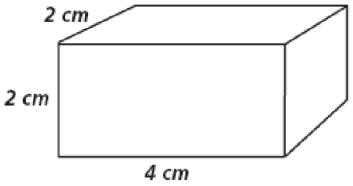
Using Length Measurements to Find Area and Volume

You can use metric measurements to find the area of a rectangular figure by multiplying length and width. Area is measured in units squared.

You can use metric measurements to find the volume of a solid rectangular figure by multiplying the length, width, and height. Volume is measured in units cubed.



Area = 9 cm × 4 cm = 36 cm^2



Volume = 4 cm × 2 cm × 2 cm = 16 cm^3

8. What are the length and width of the figure at the right?

Length _____

Width _____

ht?

use

9. What is the area of the figure at the right? Be sure to use the correct units. _____

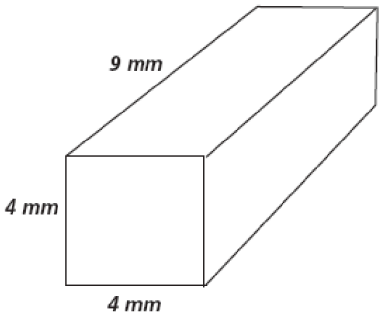
_____

10. What are the length, width, and height of the figure shown on the right?

Length _____

Width _____

Height _____



11. What is the volume of the figure on the right? Be sure to use the correct units.

_____

12. Think It Over Find the area of a rectangle with a length of 5 cm and a width of 32 mm. Explain the steps you used to find your answer.

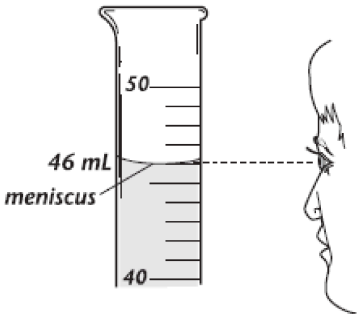
_____

Name_____Date_____ Team _____

INQUIRY SKILL FOCUS Practice

Measure: Liquid Volume

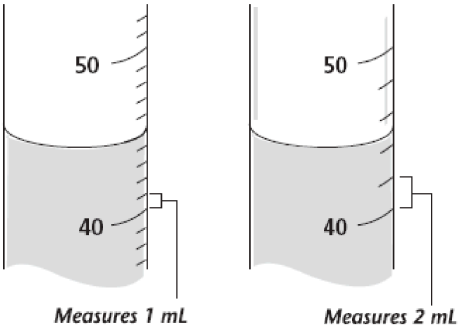
Write your answers to the questions below in the spaces provided. If you need more space, use a separate sheet of paper.



A

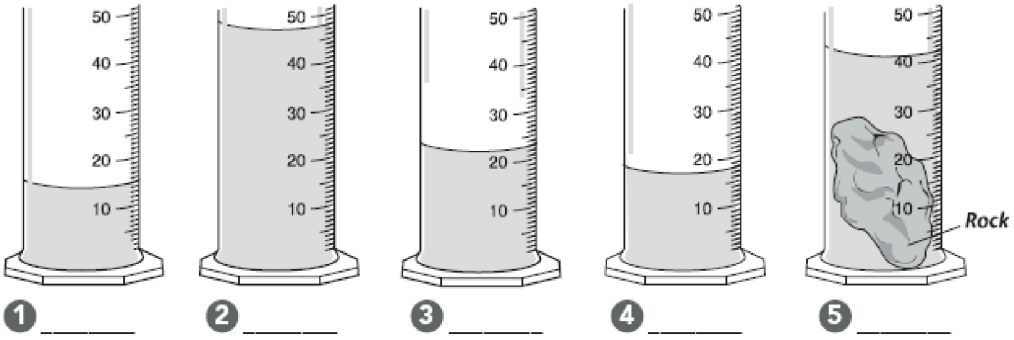
Volume is the amount of space an object takes up. common SI unit for liquid volume is the liter (L). Liters are divided into smaller units, such as the milliliter (mL).

The graduated cylinder is a tool frequently used to measure liquid volume. ("Graduated" means that the cylinder is marked with measurement units.) Water in a graduated cylinder has a curved surface, as shown top right. The curved surface is called a meniscus. The volume should be read at the lowest point of the meniscus. Be sure to read the volume at eye level.



(*Hints:* Always check the unnumbered marks on a graduated cylinder to see what each mark indicates. Sometimes, the bottom of the meniscus falls between two markings. In that case, you need to estimate the measurement between the two marks.) Both of the graduated cylinders on the right contain the same volume of liquid. Although the cylinders have different markings, both cylinders contain 45 mL of liquid.

What is the volume of liquid shown in graduated cylinders 1-4 below? What is the total volume in graduated cylinder 5?



6. If the diagram for Questions 4 and 5 show the same graduated cylinder before and after the rock was added, what is the volume of the rock?

7. **Think It Over** Explain the steps that you would use to determine the value of the unnumbered marks on a graduated cylinder.

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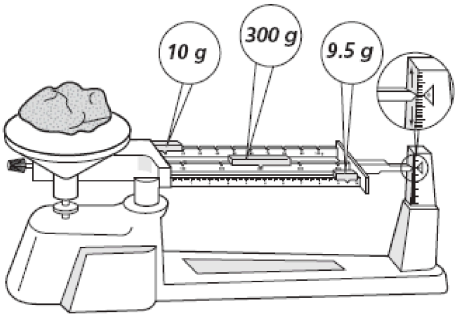
INQUIRY SKILL FOCUS Practice

Measure: Mass

Write your answers to the questions below in the spaces provided.

Mass is the amount of matter in an object. Mass is measured using a balance. There are several different kinds of balances. Some balances give a single reading. Others give two or more readings that must be added to find the object's total mass.

The balance on the right is a triple-beam balance. The middle beam measures the largest amounts. To find the mass of an object, record the masses on each of the beams. Then add the readings.



300 g + 10 g + 9.5 g = 319.5 g

(*Hint:* If you need to find the mass of an object in a container, first find the mass of the empty container. Subtract that mass from the combined mass.)

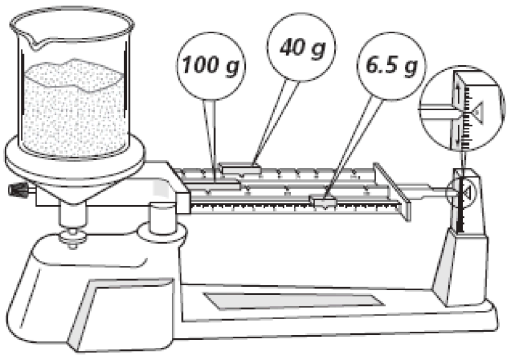
Mass of substance and container	246 g
Mass of container	−15 g
Mass of substance	231 g

1. The mass of the container holding this table salt is 3 g. What is the mass of the table salt?

_____

_____

_____



2. What is the mass of the table salt if the combined mass of the table salt and the container is 124 g and the mass of the container is 9 g?_____

_____

3. **Think It Over** A gram is equal to 1,000 milligrams. If a sample has a mass of 52 grams, what is its mass in milligrams?

_____

_____

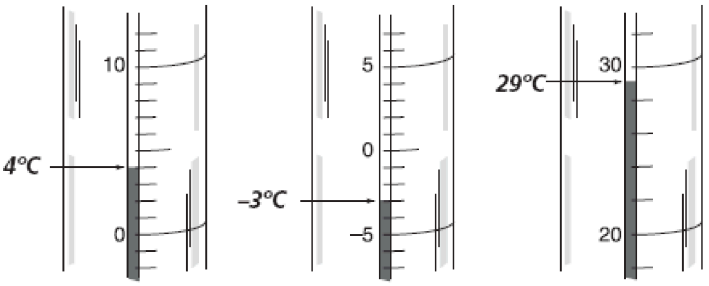
Name_____Date_____ Team _____

INQUIRY SKILL FOCUS Practice

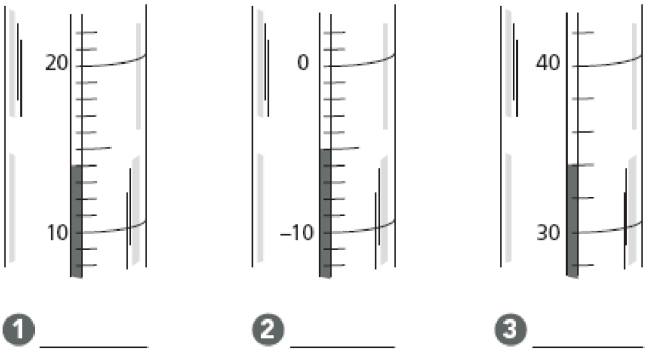
Measure: Temperature

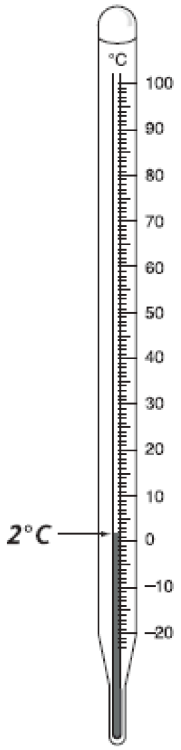
Write your answers to the questions below in the space provided.

Temperature is a measure of how hot or cold something is. A Celsius thermometer, like the one shown here, is used to measure temperatures in science. The SI unit for temperature is °C, read as degrees Celsius. As you measure temperature using a thermometer, notice which thermometer marks are labeled and unlabeled. Check whether you are reading temperatures above or below zero. Temperatures below zero should be shown with a minus sign.



What temperature is shown in each of the diagrams below?





4. The temperature of a water sample was 15°C. During an experiment, the temperature of the water increased by 16°C. What was the final temperature of the water?_____

5. If a thermometer is numbered every 5 degrees and the temperature reading is exactly in the middle of the 25-degree and 30-degree markings, what is the temperature of the sample?_____

6. **Think It Over** If the outside temperature dropped from 7°C to −1°C, what was the total temperature change? Explain how you found your answer.

Name_____Date_____ Team _____

_____

_____

_____

_____

_____

_____

_____