

Chapter 1 Introduction to Physical Science ▪ Section 3 Summary

Measurement

Key Concepts

- Why do scientists use a standard measurement system?
- What are the SI units of measure for length, mass, volume, density, time, and temperature?

The metric system is a system of measurement based on the number 10. Modern scientists use a version of the metric system called the International System of Units, abbreviated as **SI**. **Using SI as the standard system of measurement allows scientists to compare data and communicate with each other about their results.** SI units are based on multiples of 10.

The basic unit of length in SI is the meter (m). To measure objects smaller than a meter, scientists use units called the centimeter (cm) or millimeter (mm). There are 1,000 meters in a kilometer.

Weight is a measure of the force of gravity acting on an object. **Mass** is a measure of the amount of matter an object contains. **The SI unit of mass is the kilogram (kg).** There are 1,000 grams in a kilogram and 1,000 milligrams in one gram.

Volume is the amount of space an object takes up. To measure the volume of a liquid, scientists use a unit known as the liter (L). There are 1,000 milliliters in a liter. To determine the volume of a solid object, scientists use a unit known as the cubic centimeter (cm^3). One cubic centimeter is exactly equal to one milliliter. **The SI unit of volume is the cubic meter (m^3).** To calculate the volume of a rectangular solid, use this formula: $\text{Volume} = \text{Length} \times \text{Width} \times \text{Height}$. To measure the volume of an irregular solid, immerse the object in water and measure how much the water level rises.

Density is mass per unit volume. To calculate the density of an object, divide its mass by its volume. **The SI unit of density is the kilogram per cubic meter (kg/m^3).** Two other common units of density are grams per cubic centimeter (g/cm^3) and grams per milliliter (g/mL).

The second (s) is the SI unit of time. Clocks and watches are used to measure time. Scientists commonly use the Celsius scale to measure temperature. In addition to the Celsius scale, scientists also use another temperature scale, called the Kelvin scale. **The kelvin (K) is the SI unit of temperature.** You can measure temperature using a thermometer.

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Measurement (pp. 16–26)

This section explains why scientists use a standard measurement system and identifies the standard units used for common measurements. It also explains how to convert from one unit to another.

Use Target Reading Skills

Before you read, look at the red headings in this section of the textbook. Then complete the graphic organizer by writing each red heading and a question about that topic. Answer your questions as you read.

Measurement		
Heading	Question	Answer
A Standard Measurement System		
Length		

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A Standard Measurement System (p. 17)

1. What is the metric system?

2. Modern scientists use a version of the metric system called the _____, abbreviated _____.
3. Circle the letter of each advantage of using SI as the standard system of measurements.
 - a. Using SI allows scientists to compare data.
 - b. Every country can have its own system.
 - c. All units are expressed in the French language.
 - d. Scientists can communicate with each other about their results.
4. SI units are based on multiples of _____.

Match the SI prefix with its meaning by writing the letter of the meaning in the correct blank.

- | | |
|------------------|---------------------------|
| _____ 5. hecto- | a. 1,000 |
| _____ 6. deci- | b. 100 |
| _____ 7. milli- | c. 10 |
| _____ 8. kilo- | d. 0.1 (one tenth) |
| _____ 9. deka- | e. 0.01 (one hundredth) |
| _____ 10. centi- | f. 0.001 (one thousandth) |

11. Is the following sentence true or false? Each SI unit is 10 times smaller than the next smallest unit. _____

Length (pp. 18–20)

12. What is length?

13. The basic unit of length in the SI system is the _____.

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Measurement *(continued)*

14. Which of the following sentences are true about meter measurements?
- a. Most 13-year-olds are between 1.5 and 2 centimeters tall.
 - b. The distance from the floor to a common doorknob is about 1 meter.
 - c. The ceiling in your classroom is about 1 meter above the floor.
 - d. Your arm is about 20 meters long.
15. One meter equals _____ centimeters.
16. Circle the letter of a common tool used to measure metric length.
- a. metric balance
 - b. metric ruler
 - c. graduated cylinder
 - d. kelvin

Weight and Mass (pp. 20–21)

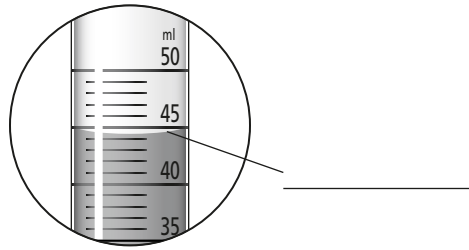
17. What is mass?
- _____
- _____
18. The basic unit of mass in the SI system is the _____.
19. 1 kilogram = 1,000 _____.
20. A device that works by comparing the mass of an object to a known mass is called a(n) _____.
21. Circle the letter of the best definition of weight.
- a. A measure of the amount of matter an object contains
 - b. A measure of the amount of space an object takes up
 - c. A measure of the force of gravity acting on an object
 - d. A measure of how much mass is contained in a given volume

Volume (pp. 22–23)

22. What is volume?
- _____
- _____
23. The tool that scientists commonly use to measure liquid volume is the _____.
24. 1 _____ = 1,000 milliliters

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25. What does the line point to? Write your answer in the space provided.



26. Circle the letter of each unit that can be used to measure the volume of a solid object.

- a. cubic meter (m^3)
- b. cubic gram (g^3)
- c. liter (L)
- d. cubic centimeter (cm^3)

27. What is the formula used to calculate the volume of a rectangular solid?

28. Is the following sentence true or false? One method used to measure the volume of an irregular solid involves immersing the object in water. _____

Density (pp. 24–25)

29. What is density?

30. What is the formula used to calculate the density of an object?

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Measurement *(continued)*

31. Circle the letter of each common unit of density.
- a. grams per milliliter (g/mL)
 - b. cubic gram (g³)
 - c. grams per cubic centimeter (g/cm³)
 - d. cubic centimeter (cm³)
32. What is the density of an object with a volume of 20 cm³ and a mass of 40 g?
- _____
- _____
33. Is the following sentence true or false? The density of a substance is the same for all samples of the substance. _____
34. An object will float if it is _____ dense than the surrounding liquid.

Time (p. 25)

35. What is the SI unit used to measure time?
- _____
36. 1 second = 1,000 _____.

Temperature (p. 26)

37. The temperature scale that scientists commonly use is the _____ temperature scale.
38. What is the official SI unit for temperature? _____
39. Circle each sentence that is true about the Kelvin scale.
- a. The Kelvin scale has no negative numbers.
 - b. Absolute zero is equal to -273° on the Kelvin scale.
 - c. Nothing can get colder than 0 K.
 - d. Water boils at 373 K.