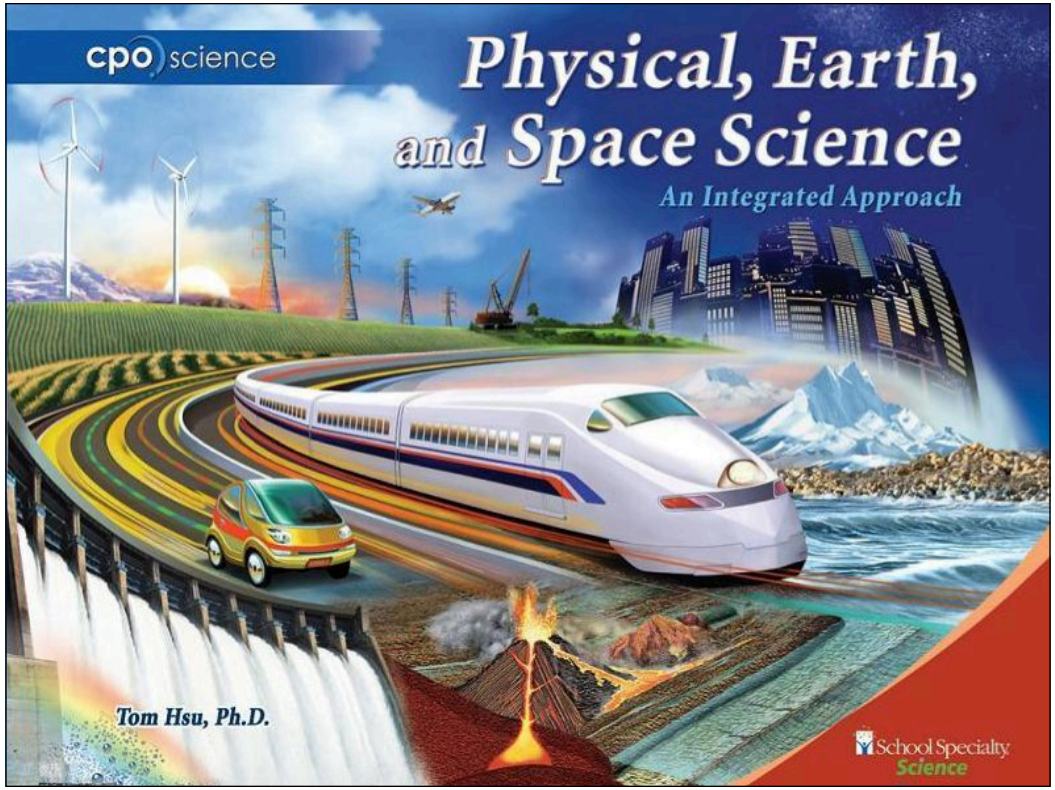
cpo science
Physical, Earth, and Space Science
An Integrated Approach
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School Specialty Science

Chapter One: Measurement

Section 1.1 Learning Goals

- Define measurement.
- Compare English and SI measurements.
- Become familiar with metric prefixes.
- Distinguish between accuracy, precision, and resolution.

Investigation 1A

Measurement

- **Key Question:**

  Are you able to use scientific tools to make accurate measurements?

1.1 Measurements

- A measurement is a determination of the amount of something.
- A measurement has two parts:
  - a number value and
  - a unit

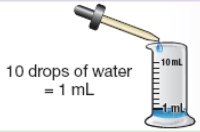
1.1 Two common systems

- The English System is used for everyday measurements in the United States.
- Miles, yards, feet, inches, pounds, pints, quarts, gallons, cups, and teaspoons are all English system units.
- In 1960, the Metric System was revised and simplified, and a new name was adopted—International System of Units.

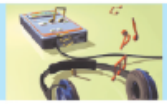
1.1 International System of Measurement (SI)

- The acronym SI comes from the French name Le Système International d'Unités.
- SI units form a base-10 or decimal system.
- In the metric system, there are:
  - 10 millimeters in a centimeter,
  - 100 centimeters in a meter, and
  - 1,000 meters in a kilometer.

Common SI Units

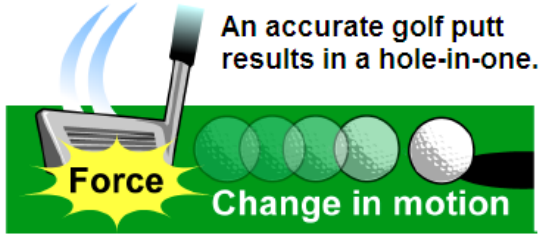
Measurement	Unit	Value
LENGTH		
	**meter (m)** kilometer (km) decimeter (dm) centimeter (cm) millimeter (mm) micrometer (µm) nanometer (nm)	 1 km = 1,000 m 1 dm = 0.1 m 1 cm = 0.01 m 1 mm = 0.001 m 1 µm = 0.000001 m 1 nm = 0.000000001 m
VOLUME		
	**cubic meter (m3)** cubic centimeter (cm3) liter (L) milliliter (mL)	 1 cm3 = 0.000001 m3 1 L = 0.001 m3 1 mL = 0.001 L
WEIGHT		
	**kilogram (kg)** gram (g) milligram (mg)	 1 g = 0.001 kg 1 mg = 0.000001 kg
TEMPERATURE		
	Kelvin (K) Celsius (°C)	0°C = 273 K 100°C = 373 K

Bytes and SI Prefixes

BYTE One unit of computer storage		*8 bits*		*1 character - anything you type on a keyboard*
KILOBYTE 1000 bytes		*1/2 page of text*		*One Apollo on-board computer (1969) = 74 KB of memory*
MEGABYTE One million bytes		*One minute of music*		*500 pages of text*
GIGABYTE One billion bytes		*18 hours of mp3 music*		*12 hours of flash video*
TERABYTE One trillion bytes		*Library of Congress has about 10 TB of print collections*		*Superstore data warehouse has about 9000 TB of data*
PETABYTE One quadrillion bytes		*Internet search engine processes 20 PB per day*		*All emails sent in the world in 2002 = 440 PB*

1.1 Accuracy, Precision and Resolution

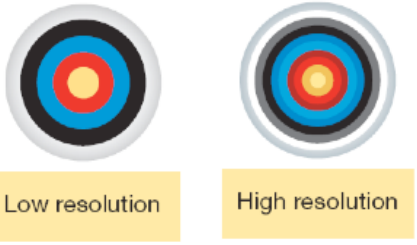
- **Accuracy is how close a measurement is to the accepted, true value.**
- **Precision describes how close together repeated measurements or events are to one another.**



An accurate golf putt results in a hole-in-one.

Why is precision important in golf?

1.1 Resolution



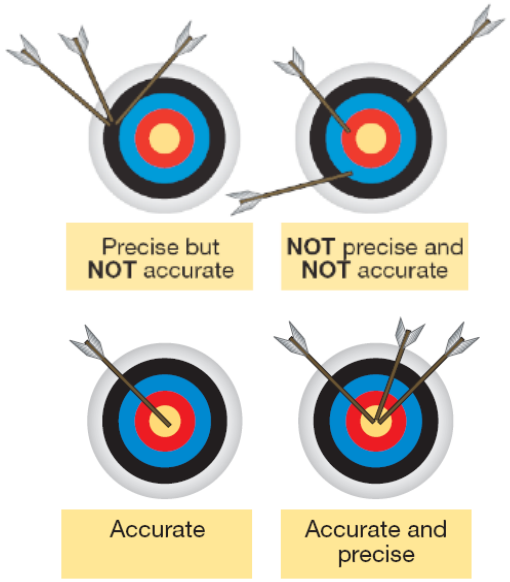
Low resolution

High resolution

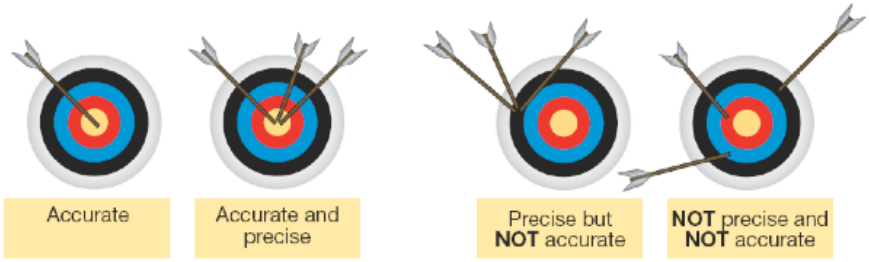
- Resolution refers to the smallest interval that can be measured.
- You can think of resolution as the "sharpness" of a measurement.

1.1 Measurement analogy

- Using the bow and arrow analogy explain how it is possible to be precise but inaccurate with a stopwatch, ruler or other tool.



Accuracy, Precision, and Resolution



Accurate

Accurate and precise

Precise but **NOT** accurate

NOT precise and **NOT** accurate

Low resolution

High resolution