

Measurement

- the **assignment of numbers** to objects or events
- a type of **quantitative observation** made with a **measuring instrument**
- includes both a **number** and a **unit**
- **units** of measurement are essentially **arbitrary**: people make them up and then agree to use them

Measuring is an important part of everyday life!

What can we measure?

Why do we measure?

How can we measure?

How well can we measure?

WHAT can we measure?

- Length
- Distance on land
- Depth of water
 - Mass
 - Time
- Temperature
- Electric current
 - Light
 - Color

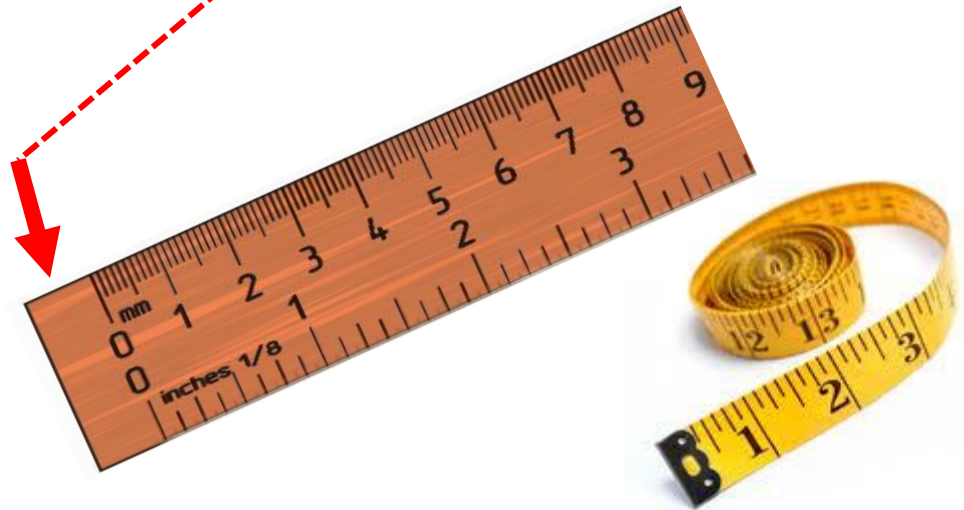
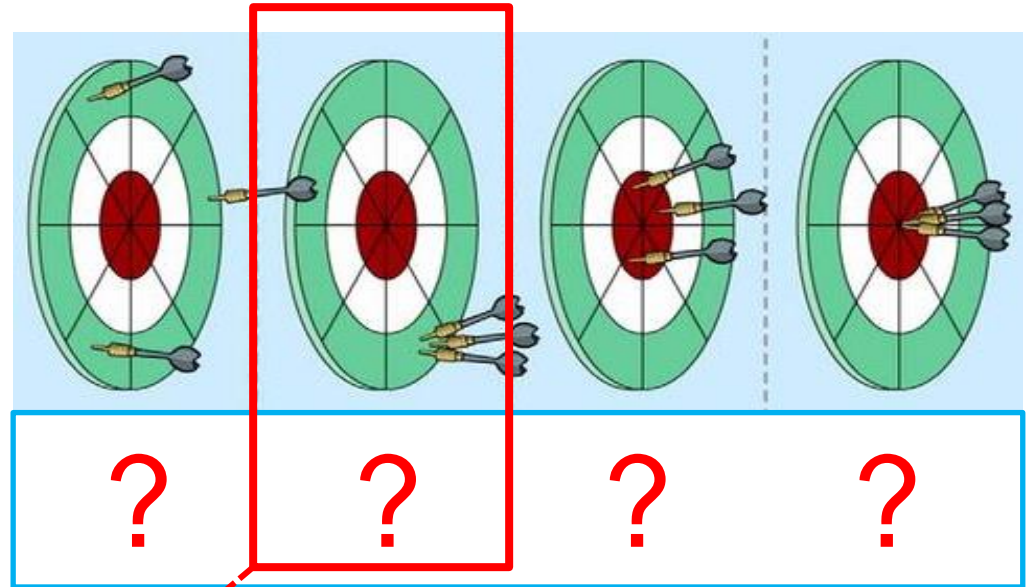
And HOW?

- ✓ Ruler
- ✓ Measuring Chain/Tape
- ✓ Sonar (echo sounder)
- ✓ Weighing scale
- ✓ Clock, timer
- ✓ Thermometer
- ✓ Ammeter
- ✓ Photometer
- ✓ Spectrometer

**AND
SO
ON...**

How good is the measurement?

- **Accuracy** is how close a measured value is to the *actual (true) value*.
- **Precision** is how close the measured values are to *each other* (repeatability and reproducibility).
- **Bias** is a built-in (systematic) error which makes *all measurements wrong by a certain amount*.



What is a System of Measurement?

A system of measurement is a collection of units of measurement and rules relating them to each other.

- Must have **base units** defined for all major quantities that need to be measured (example: a *foot*).
- Must specify **equivalency** relationship for all **additional units** used to measure the same quantity (example: length can also be measured in *inches* or *miles*, defined as 1 foot = 12 inches, 1 mile = 5280 feet).

Systems of measurement have historically been **important, regulated** and **defined** for the purposes of science and commerce.

The Metric System

is an **internationally agreed decimal** (based on power of 10) system of measurement originally introduced by France in 1799 as a **unified, natural, universal system**.



Modern "**Metric system**" term is a synonym for "**SI**" or the "**International System of Units**" (1960)—the official system of measurement used in science.