You flip the light switch in your den, but nothing happens. What is wrong?

observation/experiment: Flip switch, but no light.

hypothesis: ~~Explanation: Light bulb is burned out.~~
Explanation: Circuit breaker has tripped.

prediction: ~~Changing the light bulb should restore the light.~~
Resetting the breaker might restore the light.

experiment: ~~Change the bulb. Result of changing the bulb, still no light.~~
Reset the breaker. Result is that the light comes on.

Measurements

Measurements are COMPARISONS of properties against accepted standards, called units.

A properly-reported measurement has TWO PARTS:
(1) a measured NUMBER
(2) a UNIT

English/US Units:

1 foot = 12 inches 1 yard = 3 feet 1 mile = 1760 yards

5280 ft = 1 mile

So what's the problem? English units are not very consistent. They don't relate to each other in meaningful ways.

So, the English system is hard to learn and hard to use. Relationships between different units for measuring the same kind of thing (like length) must all be memorized independently.

English units are nonstandard and difficult to use. Solution?

THE METRIC SYSTEM

All metric units are made up of COMBINATIONS of BASE UNITS!

Metric Base Units:

Length	meter	m
Mass	kilogram *	kg
Temperature	Kelvin	K
Time	second	s

* we usually treat the gram as if it's the base unit for mass!

Comparing to the English system:

- One meter is approximately 3.3 feet.
- One kilogram is approximately 2.2 pounds.

What about SIZE?

Metric units may be made larger or smaller by adding PREFIXES.

Metric Prefixes:

mega-	10^{6}	M
kilo-	10^{3}	k
centi-	10^{-2}	c
milli-	10^{-3}	m
micro-	10^{-6}	μ

Bigger units

smaller units

Memorize these prefixes!

Applying prefixes

1 _____ m = _____ m

1 Km = 10^{3} m (1000 m) $10 \times 10 \times 10 = 10^{3}$

1 cm = 10^{-2} m ($\frac{1}{100}$ m) $\frac{1}{10} \times \frac{1}{10} = 10^{-2}$

Scaling units with metric prefixes ... examples

The distance between here and Columbia, SC is about 107,000 meters. What metric unit would be best suited for a distance like this?

$k = 10^3$ $km = 10^3 m$ (1000 m)

107 km

By "best suited", we mean a metric unit that would represent the number without many beginning or end zeros. These kinds of numbers are easier for us to remember!

A piece of chalk is 0.080 meters long. What metric unit would be best suited for this length?

$c = 10^{-2}$ $cm = 10^{-2} m$ ($1/100$ m)

8.0 cm