Convert 14500 mg to kg

$mg = 10^{-3} g$ $\qquad$ $Kg = 10^{3} g$

$$14500\, mg \times \frac{10^{-3}\, g}{mg} \times \frac{Kg}{10^{3}\, g} = 0.0145\, Kg$$

Convert 0.147 cm^2 to m^2

$cm = 10^{-2} m$

Tip: When making factors out of prefixes, you can only apply them to a base that doesn't already have an exponent!

$$0.147\, cm^2 \times \frac{10^{-2}\, m}{cm} \times \frac{10^{-2}\, m}{cm} = 1.47 \times 10^{-5}\, m^2$$

$(0.0000147\, m^2)$

When converting SQUARED or CUBED units, remember to use each conversion factor two (for squared) or three (for cubed) times. It makes sense if you remember:

$cm^2 = cm \cdot cm \qquad cm^3 = cm \cdot cm \cdot cm$

8.45 kg to μg $Kg = 10^3 g$ $\mu g = 10^{-6} g$

$$8.45\ Kg \times \frac{10^3\ g}{Kg} \times \frac{\mu g}{10^{-6}\ g} = 8450000000\ \mu g$$

$(8.45 \times 10^9\ \mu g)$

88100 kHz to MHz $KHz = 10^3 Hz$

$MHz = 10^6 Hz$

$Hz = s^{-1}$ (frequency)

$$88100\ KHz \times \frac{10^3\ Hz}{KHz} \times \frac{MHz}{10^6\ Hz} = 88.1\ MHz$$

Convert 38.47 in to m, assuming 2.54 cm = 1 in

$2.54\ cm = in \qquad cm = 10^{-2}\ m$

$$38.47\ in \times \frac{2.54\ cm}{in} \times \frac{10^{-2}\ m}{cm} = \boxed{0.9771\ m}$$

Convert 12.48 km to in

$2.54\ cm = in \qquad cm = 10^{-2}\ m \qquad Km = 10^{3}\ m$

$$12.48\ Km \times \frac{10^{3}\ m}{Km} \times \frac{cm}{10^{-2}\ m} \times \frac{in}{2.54\ cm} = \boxed{491300\ in}$$

Accuracy and Precision

- two related concepts that you must understand when working with measured numbers!

Accuracy

- how close a measured number is to the CORRECT (or "true") value of what you are measuring

- "Is it right?"

- checked by comparing measurements against a STANDARD (a substance or object with known properties)

Precision

- how close a SET of measured numbers are to EACH OTHER

- "Can I reproduce this?"

- checked by repeated measurements

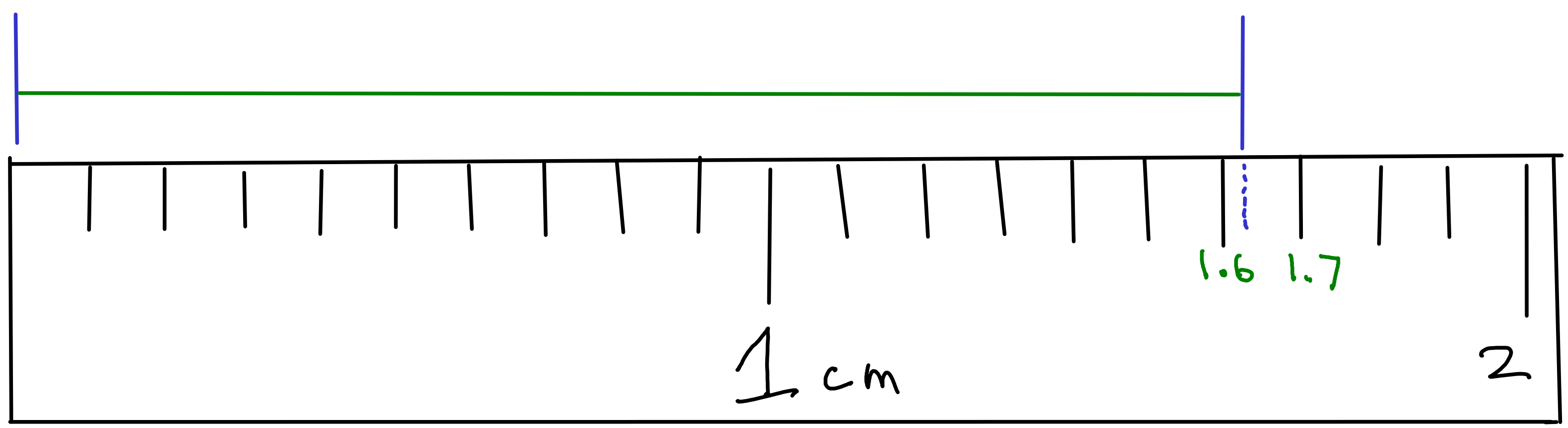
More on precison

Every measurement contains some amount of ERROR, or some amount of deviation from the true value of what is being measured.

RANDOM ERROR is the variability in a measurement that cannot be traced back to a single cause. Random errors cause measurements to fluctuate around the true value, but can be averaged out given enough measurements.

When reporting measurements, we want to indicate how much random error we think is present. How?

Form: X.XX cm



How long is the green line?

Write your answer on the card, then pass the card up to the front!

Our classroom experiment: Results

After throwing away obvious mistakes in reading the scale, we had:

Value	# students
1.62	9
1.63	5

14 measurements

Overall average

$\bar{x} = 1.62357142\,9\text{cm}$ (unrounded)

$= 1.62$ cm (± 0.01 cm)

CERTAIN DIGITS: Appear in nearly all repeats of the measurement

UNCERTAIN DIGITS: Vary.. Variation caused by estimation or other sources of random error.

When reading measurements from a scale, record all CERTAIN digits and one UNCERTAIN (or estimated) digit.

When using a digital device, record all the displayed digits.