Convert 14500 mg to kg $mg = 10^{-3} g$ $Kg = 10^{3} g$

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

Convert 0.147 cm^2 to m^2 $cm = 10^{-2} m$

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

$(0.000147\ m^2)$

Folr squared units, we need to convert BOTH PARTS of the unit. We'll use the factor TWICE. It helps if you think of the squared unit as

cm x cm

... and you just cancel out each centimeter. For CUBED units, apply the factor three times.

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

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

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

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

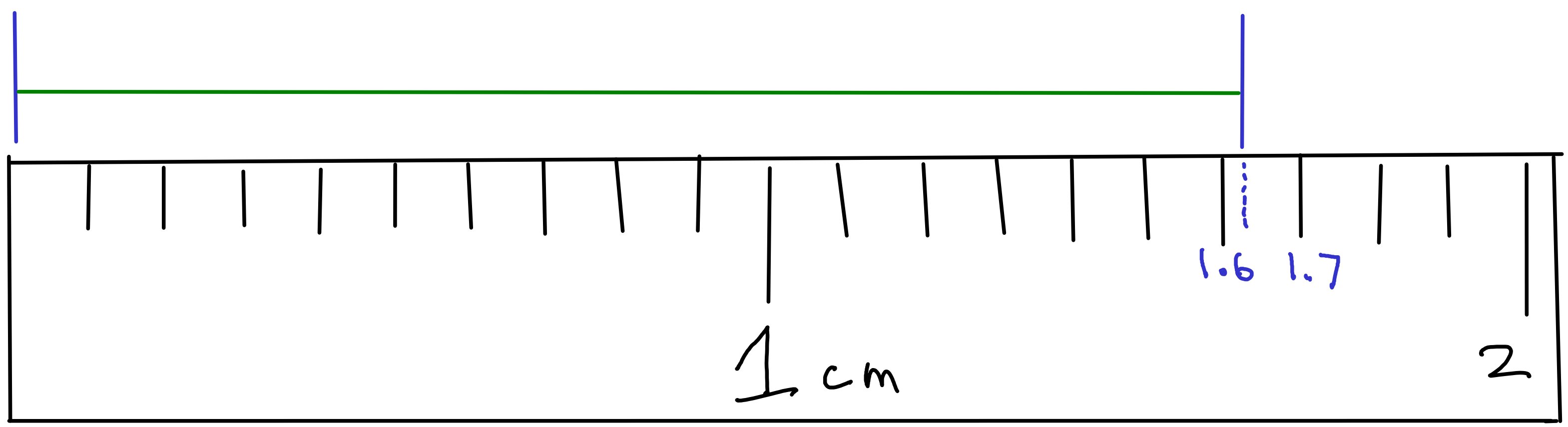
More on precison

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	7
1.63	13
1.64	1
1.65	1

22 measurements

Overall average

$\bar{x} = 1.6281818\,18$ cm (unrounded)

$= 1.63 \pm 0.01$ 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.