Units and Significant Figures

Learning Intentions

To be able to:

- Include correct **units** after quantities
- Use consistent and appropriate **decimal places** for experimental measurements
- Write calculated values with the correct number of **significant figures**

Units

All quantities (numbers) in Physics must have units written after it.

Example: A measurement of "7" doesn't mean anything by itself. It could be:

- 7 feet, the height of a tall person.
- 7 km, the distance from the school to Tea Tree Plaza.
- 7 kg, the mass of a reasonably heavy object.
- 7 minutes, the time it takes to walk around the oval twice.
- Or many other things.

Some quantities and their units are listed below:

Distance or radius	m	metres
Force (push or pull)	N	newtons
Mass	kg	kilograms
Time	s	seconds
Speed	$m\ s^{-1}$	metres per second
Acceleration	$m\ s^{-2}$	metres per second per second

Measurement

Whenever a measurement is made, there is a level of uncertainty in the result.

When using a ruler with 0.1 cm (1 mm) markings, you could say confidently that the result was around 15.3 cm, because there's a marking on the ruler that shows you exactly where 15.3 cm is.

If the measurement was a bit past the 0.3 mark, you could say it was about 15.31 cm but you'd be uncertain because there's no mark to tell you exactly. The "1" is an uncertain digit. You are only allowed to have one uncertain digit in a measurement and it must be the rightmost digit.

The number of decimal places you write measurements to is determined by the resolution (detail) of the equipment. Measurements using the same piece of equipment should always have the same number of decimal places. Equipment with better resolution allows for greater precision in an experiment, meaning if you repeat the measurement you should be close to the same value every time.

Significant Figures (s.f.)

The first significant digit is the first non-zero digit (reading from left to right). For example:

2154   0.00000156   0.400013

↑   ↑   ↑

Digits to the right of the first significant digit are all significant, unless stated otherwise. Therefore the number of s.f. in the above examples is 4, 3, and 6 respectively.

Calculations

A final result for a calculation must be written with units matching the input and to rounded to the same number of s.f. as the least precise input.

When you *multiply or divide* numbers:

- You must round your final answer off to the least s.f. in the values used.
- The final unit will be the original units multiplied or divided, using index rules where possible.

When you *add or subtract* numbers:

- You must round your final answer off to the least decimal places in the values used.
- You can only add or subtract values that have the same units, and the final unit will be the same.

Special Cases

If you wish to give a final answer that have more digits than significant figures (like writing 4459 to 2 s.f.) you must round off the value and write the significant figures next to your answer.
Example: 4500 (2 s.f.)

Numbers that are exact, not measurements, can be considered to have an infinite number of significant figures, for example the 2 and the π in "C = 2πr" are exact, you don't need to round off to one significant figure.