Errors and Uncertainty

There is always uncertainty around your data. Uncertainty represents whether your data were collected accurately and precisely. Two factors influence uncertainty: the limits of your equipment (quantitative error), and poor planning (qualitative error).

Key Facts

✓ Uncertainty is a measure of how many errors are in your results.

✓ Quantitative errors (numeric errors) and qualitative errors (non-numeric errors) contribute to uncertainty.

✓ Uncertainty in your results can be corrected using the formula shown below.

Choosing equipment

Quantitative errors can be avoided by choosing equipment that can measure things as precisely as possible. A piece of equipment's ability to measure precisely is called its resolution. For example, if you need to measure liquids in quantities of 1 ml, choose a pipette that can measure amounts in single milliliters.

This pipette measures liquid in increments of 10 ml, so is imprecise for the needs of this experiment.
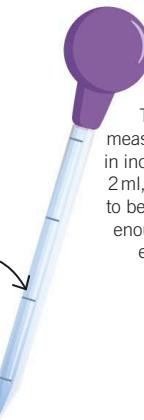
This pipette measures liquid in increments of 2 ml, so is close to being precise enough for this experiment.
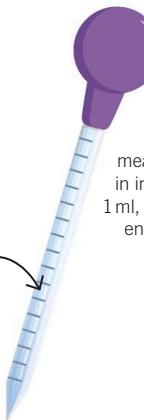
This pipette measures liquid in increments of 1 ml, so is precise enough for this experiment.

| 10 ml ✗ | 2 ml ✗ | 1 ml ✓ |

Avoiding random errors

You may accidentally measure a liquid inaccurately, especially if the measurements are very small. This might mean your results are slightly different each time you take a measurement, and is unavoidable.

1ml

First try

1ml

Second try
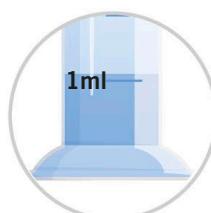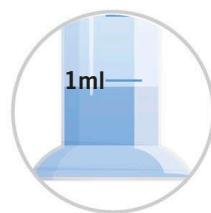
Uncertainty formula

$$\text{uncertainty} = \frac{\text{range}}{2}$$

Accounting for uncertainty

If you measure 1 ml of liquid with a measuring cylinder, the range of possible values may be anything between 1.5 and 0.5 ml. The uncertainty formula takes this into account.

$$\pm\, 0.5 = \frac{1.5 - 1}{2}$$