

Experimental programme · supported focus

Supported focus · HL

Supported scope

- Supported HL focus. First assessment 2026; current SL/HL brief acquired. Remaining guide, assessment and practical requirements retain their recorded holds.
- State model conditions and distinguish fictional data from measurements.

Uncertainty · 1.1

Reasoning

A line passing near every data point is useful, but its gradient can still be uncertain. A graph is evidence for a model within the measurement range. Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

Uncertainty · 2.1

Reasoning

Random variation makes repeated readings differ. Systematic error shifts results consistently. Absolute uncertainty has the measured unit; relative or percentage uncertainty compares uncertainty with the measured value. uncertainty: A quantified limitation on a measured result; systematic error: A consistent measurement bias.

Uncertainty · 3.1

Reasoning

For a product or quotient, adding fractional uncertainties is a common maximum-uncertainty approximation. For a difference, add absolute uncertainties. A nonzero intercept can reveal an offset or an incomplete model. Show units on axes and choose a sensible scale. Plot uncertainty bars where justified, draw a best-fit line rather than joining every point, and estimate steepest and shallowest plausible gradients when the course method calls for them.

Uncertainty · 4.1

Reasoning

State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution. Known: length = 50.0 mm with uncertainty 1.0 mm. Percentage uncertainty = $\text{absolute uncertainty}/\text{value} \times 100 = 1.0/50.0 \times 100 = 2.0\%$. For a quotient of two independently measured quantities with maximum percentage uncertainties 2% and 3%, the summed maximum estimate is 5%.

Uncertainty · 4.2

Reasoning

A 40 cm reading has an absolute uncertainty of 1 cm. Find percentage uncertainty.

Use the same sequence: known quantities $\rightarrow$ model $\rightarrow$ relation $\rightarrow$ substitution $\rightarrow$ unit and interpretation.

Uncertainty · 5.1

Reasoning

Repeating readings reduces random uncertainty in a mean but does not automatically remove a zero error. Do not quote more decimal places than your measurement can support. Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Uncertainty · 5.2

Reasoning

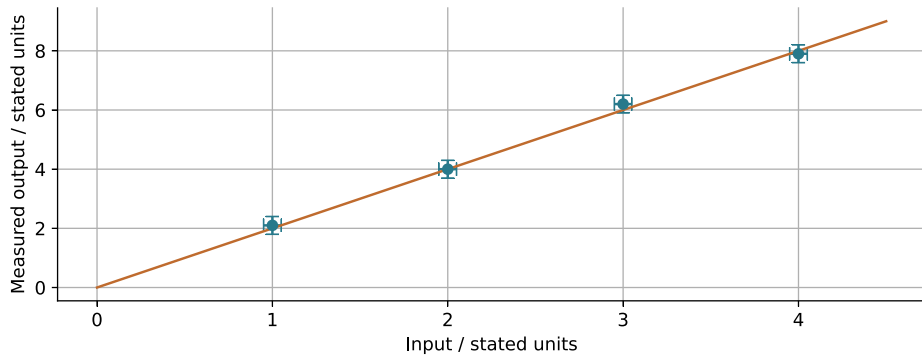
Repeating a measurement always removes a calibration offset. This claim is false: Repeating readings reduces random uncertainty in a mean but does not automatically remove a zero error. Do not quote more decimal places than your measurement can support.

Uncertainty · 5.3

Reasoning

Uncertainty, gradients and model testing: For a product or quotient, adding fractional uncertainties is a common maximum-uncertainty approximation. For a difference, add absolute uncertainties. A nonzero intercept can reveal an offset or an incomplete model.

Uncertainty · diagram



- Original teaching diagram: Uncertainty, gradients and model testing
- Use the labels and the stated model together.

Uncertainty · original transfer

Your turn

Lengths are (50 ± 1) mm and (20 ± 1) mm. Estimate the quotient and its maximum percentage uncertainty; distinguish this convention from independent standard-uncertainty propagation.

Uncertainty · transfer reasoning

Method and interpretation

Quotient 2.5. Maximum estimate $2\% + 5\% = 7\%$, absolute $0.175 \approx 0.18$. Independent standard uncertainties instead combine in quadrature, about 5.39% ; declare which convention the data support.

Check yourself

- Explain systematic error using the stated model.
- Explain uncertainty using the stated model.
- Change one value in the original transfer; explain which assumption still matters.