Course notes

International Baccalaureate · IB Diploma · Sports, Exercise and Health Science · HL

IB IB Diploma · Sports, Exercise and Health Science · HL: teaching notes

Version: First assessment 2026

These notes cover selected topics of the course; they are not the whole specification.

Assessment and course boundaries

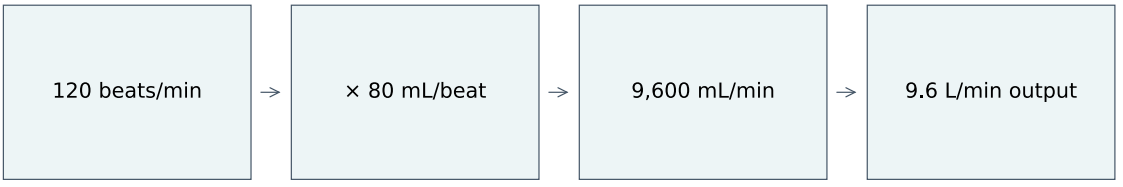
- Three themes: exercise physiology/nutrition, biomechanics, sports psychology/motor learning. No old optional-topic model.
- SL Paper 1: 1.5 h, Paper 2: 1.5 h; HL: 1.75 h, 2.5 h. Weights 36% and 40%; individual investigation 24%, maximum 3,200 words.
- Practical work 40 h, collaborative sciences project 10 h and investigation 10 h.
- Investigations use informed consent, school risk assessment, voluntary low-risk tasks and privacy; do not provoke injury, dehydration, maximal exertion or psychological distress.

Exercise physiology: responses and recovery

Official-unit focus: A.1 Communication; A.3 Response

Heart rate increases during a short exercise bout, then recovers. This time course connects energy demand, oxygen transport and cardiovascular regulation.

Cardiac output is heart rate multiplied by stroke volume. Ventilation supports gas exchange, while blood transport delivers oxygen to working tissues. ATP demand changes as muscle activity changes.



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An acute response occurs during or soon after exercise. A training adaptation develops over repeated sessions. A lower post-exercise heart rate cannot alone establish greater fitness without comparable workload and participant conditions.

Use voluntary informed participation, school supervision and an approved low-intensity protocol. Record baseline, a standardized workload and timed recovery measurements. Stop for discomfort and do not use maximal exertion or health diagnosis as a classroom task.

■ Checked worked case

Known: heart rate is 120 beats per minute and stroke volume 80 millilitres per beat. Cardiac output = heart rate × stroke volume = 120×80 = 9,600 millilitres per minute = 9.6 litres per minute.

■ Common error

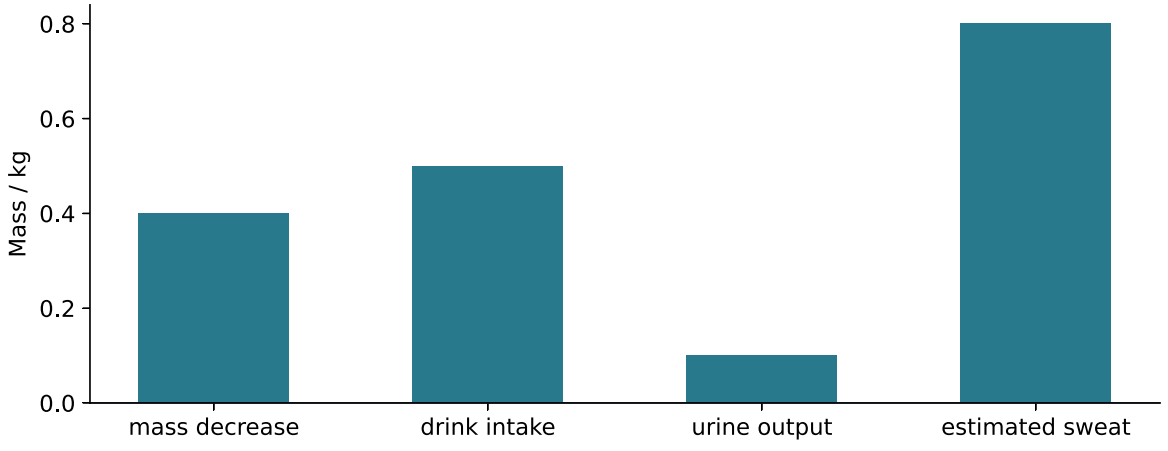
A heart-rate monitor measures one response, not every dimension of performance. Hydration, stress, medication and recent activity can confound comparisons.

Hydration: interpret balance without forcing dehydration

Official-unit focus: A.2 Hydration and nutrition

Body mass can change during activity, but the change is not a direct measurement of sweat alone. Drinking, urine, clothing and scale uncertainty affect the estimate.

Water balance compares inputs and outputs. During exercise, heat production can increase sweating, while thirst and hormonal regulation contribute to fluid balance. Hydration needs vary with activity, environment and the person; a classroom calculation cannot prescribe a universal intake or diagnose a health condition.



For a simplified field estimate, sweat loss in kilograms is approximately pre-activity mass minus post-activity mass plus drink mass minus urine mass. Express the estimate per hour only after recording duration. This approximation omits some respiratory and metabolic mass changes and assumes comparable dry clothing and a suitable

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balance.

Analyse fictional or consented teacher-approved low-risk data. Record balance resolution, time, intake and whether clothing conditions match. Students need not exercise or disclose personal body mass. Never restrict drinking or induce dehydration to create a result. Compare uncertainties and alternative explanations before interpreting a difference.

■ Checked worked case

Known: fictional mass is 60.0 kg before and 59.6 kg after one hour; drink intake is 0.50 kg and urine output 0.10 kg. Estimated sweat loss = 60.0−59.6+0.50−0.10 = 0.80 kg, approximately 0.80 L using 1 kg/L. The 0.40 kg body-mass decrease alone would underestimate this modelled loss.

■ Common error

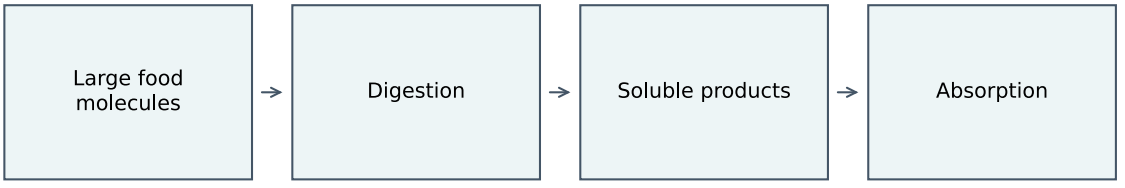
A change in mass is not necessarily a change in body fat. A modelled sweat estimate does not justify fluid restriction, diagnosis, or a one-size-fits-all sports recommendation.

Digestion, transport and health evidence

Official-unit focus: A.2 Hydration and nutrition

Two foods can have the same mass but provide different nutrients. A health claim must distinguish the nutrient measured from the health outcome inferred.

Large insoluble food molecules are digested into smaller soluble molecules. Carbohydrases form sugars, proteases form amino acids, and lipases form fatty acids and glycerol. Bile emulsifies lipids and helps neutralize acidic stomach contents.



Absorption moves soluble products into blood or lymph. Thin exchange surfaces and a large surface area shorten diffusion paths and increase transfer. Enzyme activity and transport are different processes.

Use Benedict reagent with controlled heating for reducing sugars, iodine for starch,

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Biuret reagent for protein, and the ethanol emulsion test for lipids. Keep ethanol away from flames. Use positive and negative controls.

■ Checked worked case

Known: 6 of 24 study participants report a condition. Proportion = cases / total. Percentage = $6/24 \times 100 = 25\%$. The percentage describes this sample. It does not establish that one food caused the condition; confounders and how the sample was chosen matter.

■ Common error

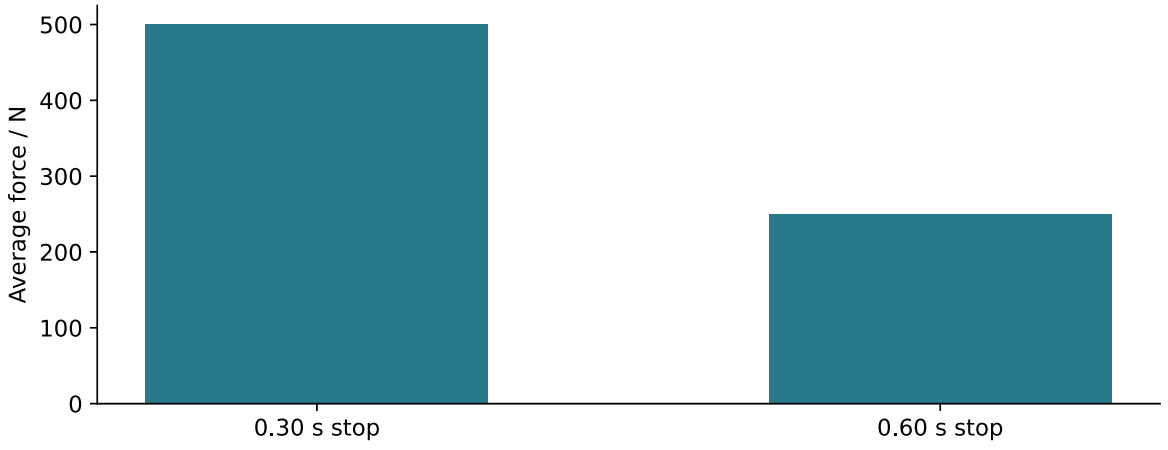
Bile is not an enzyme. A positive food test identifies a component under the test conditions; it does not show that a food is healthy or unhealthy in every diet.

Biomechanics: movement and impulse

Official-unit focus: B.1 Generating movement in the body; B.2 Forces, motion and movement

Landing with bent knees increases the time over which momentum changes. The movement can reduce average impact force for the same momentum change.

Joint movement results from muscle forces acting through lever systems. The centre of mass and base of support affect stability. Impulse connects force-time evidence to momentum change.



A biomechanical analysis must define the segment, direction and phase of movement. Net force and a single muscle force are not interchangeable. A longer lever arm can change torque without changing applied force.

Use teacher-approved video of a safe movement with consent. Calibrate distance and time, identify frames consistently, and avoid making medical claims from a two-dimensional recording. Camera perspective can bias apparent joint angles.

■ Checked worked case

Known: momentum changes by 150 kg metres per second. Average force magnitude = momentum change/stopping time. For 0.30 s, force = 150/0.30 = 500 N. For 0.60 s, force = 150/0.60 = 250 N. This idealized average excludes the detail of a changing force curve.

■ Common error

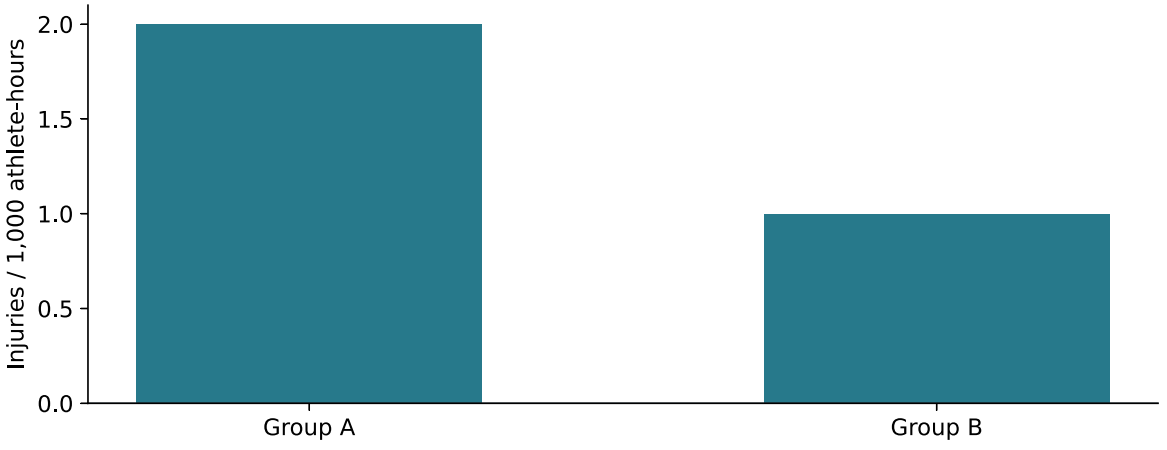
The largest force is not the same as average force. A school movement study should not deliberately create high-impact landings to test a prediction.

Injury evidence: compare exposure as well as counts

Official-unit focus: B.3 Injury

A team records more injuries after adding training sessions. A larger count does not necessarily mean a larger risk per hour of exposure.

Injury surveillance requires an explicit injury definition, consistent recording and an exposure denominator. Acute injuries follow a particular event; overuse injuries can develop through repeated loading. Mechanism, tissue capacity, previous injury, equipment and environment can contribute, so one observed association rarely establishes a single cause.



An incidence rate divides new injury events by exposure time, often expressed per 1,000 athlete-hours. Use the same case definition and exposure method in comparisons. Severity, recurrence and missing records also matter; two groups with equal incidence can have different time lost or different injury types.

Use anonymized fictional surveillance tables. Identify what counts as an injury and how training or match exposure was recorded. Calculate comparable rates, check sample sizes and reporting changes, and propose prevention hypotheses for qualified staff to evaluate. Students do not induce injuries, diagnose peers or decide return-to-play clearance.

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■ Checked worked case

Known: group A has 6 injuries in 3,000 athlete-hours, rate 2 per 1,000 hours. Group B has 8 injuries in 8,000 athlete-hours, rate 1 per 1,000 hours. Group B has the larger count but the smaller recorded exposure-normalized rate. Different reporting systems or injury severity could still make the comparison misleading.

■ Common error

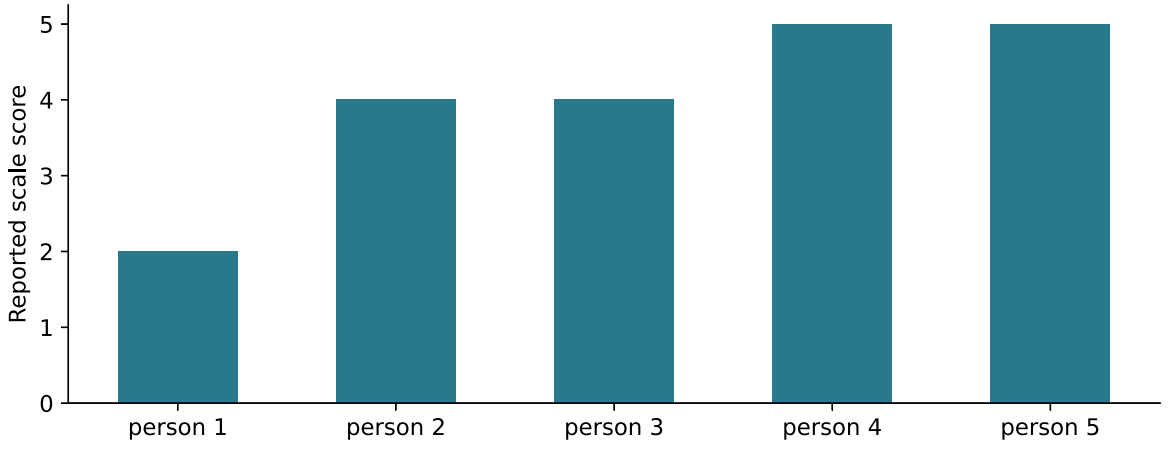
A rate estimate from a small number of events is uncertain. A low recorded rate can reflect under-reporting, and exposure-normalized association is not proof of a prevention intervention's causal effect.

Motivation, stress and evidence in sport

Official-unit focus: C.1 Individual differences; C.3 Motivation; C.4 Stress and coping; C.5 Psychological skills

Two athletes can react differently to the same competition. Their appraisal, experience and coping strategies affect the response.

Motivation concerns initiation, direction and persistence of behaviour. Stress depends partly on the relationship between perceived demands and perceived resources. Arousal and anxiety are related but distinct constructs.



A self-report scale measures reported experience under its design. It does not diagnose a disorder or establish a universal relationship between arousal and performance. Analyse within-person and between-person variation separately.

Use anonymous voluntary questionnaires approved by the school, avoid sensitive personal disclosure, and allow withdrawal. Compare the same task and time point, define the scale and explain its limitations.

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■ Checked worked case

Known: reported scores are 2, 4, 4, 5 and 5. Mean = sum/count = 20/5 = 4. Range = maximum-minimum = 5-2 = 3. The mean summarizes this sample and scale, without proving why the participants differ.

■ Common error

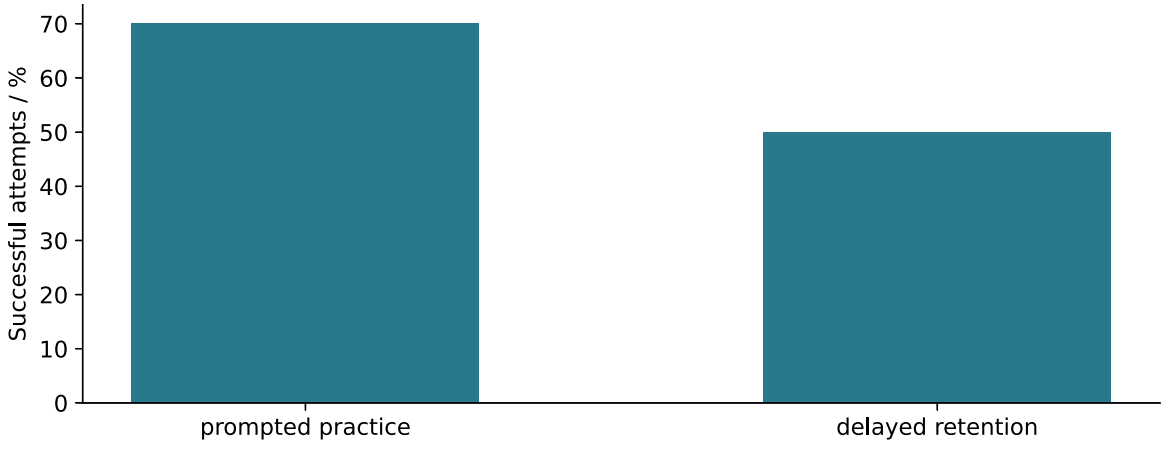
Correlation does not prove that stress caused a performance result. Students should not induce distress to investigate coping.

Motor control: feedback, timing and evidence

Official-unit focus: C.2 Motor learning

A learner adjusts a slow movement after seeing an error, but a very fast action may end before visual feedback can change it. Timing constrains the role of feedback.

Open-loop control emphasizes a pre-organized command during an action; closed-loop control uses feedback to compare the result with a goal and modify control. Many sporting actions combine feedforward preparation with feedback. Intrinsic feedback arises from the performer's sensory information, while augmented feedback is additional information supplied by another source.



Distinguish knowledge of results from knowledge of performance. A score reports the outcome; a description of arm position reports movement features. Feedback can guide practice, yet immediate success with continuous prompts may not persist when prompts are removed. Retention and transfer therefore provide stronger learning evidence than one practice score.

Use a voluntary, low-risk seated target or tracing task. Define the outcome, keep practice opportunities equal, give an agreed feedback schedule and assess delayed performance without feedback. Counterbalance group order where feasible and use anonymous records. Do not claim the task completely models elite performance.

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■ Checked worked case

Known: one trial provides 20 attempts and 14 successes, or 70%. A delayed no-feedback test provides 20 attempts and 10 successes, or 50%. The decline is 20 percentage points, not a 20% relative decline; relative decline is $(14-10)/14 \times 100$, approximately 28.6%. The observation supports investigating dependence on prompts, not a guaranteed explanation.

■ Common error

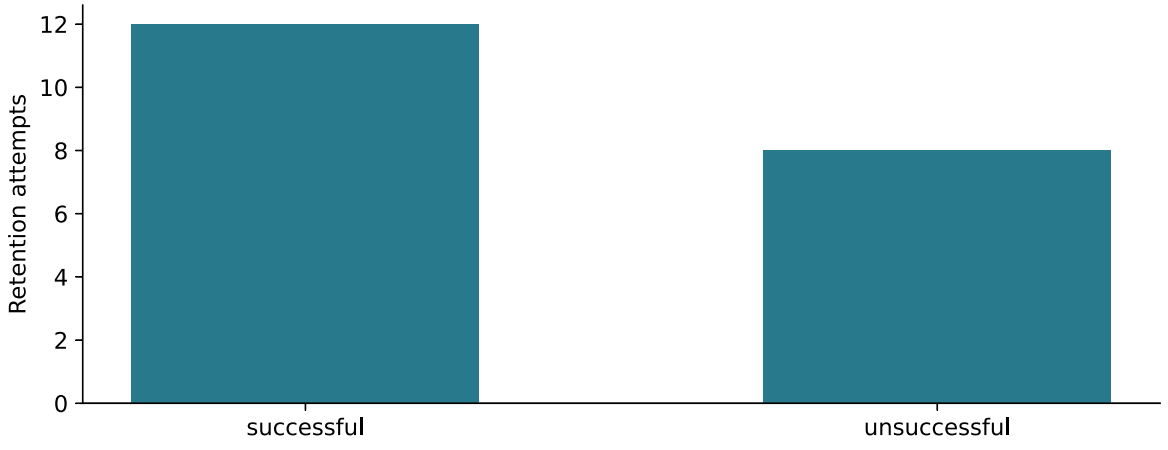
Open-loop and closed-loop are models, not a claim that an athlete's nervous system uses only one mechanism. Feedback timing, task complexity and sensory availability affect what can be inferred.

Motor learning, feedback and retention

Official-unit focus: C.2 Motor learning

A learner performs well while a coach gives constant instructions, then struggles the next day. Immediate performance and retained learning are different outcomes.

Motor learning is a relatively lasting change in movement capability from practice. Knowledge of results concerns the outcome; knowledge of performance concerns movement quality.



A retention test after a delay and without the same assistance can provide evidence of learning. Practice conditions, prior experience and task difficulty need control before comparing feedback methods.

Use a low-risk target task, equal practice time, random or balanced assignment, and a delayed retention test. Record outcome accuracy separately from movement quality. Seek consent and avoid labels about a participant ability or personality.

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■ Checked worked case

Known: 12 of 20 throws hit a target during retention. Accuracy = successful attempts/total attempts ×100 = 12/20×100 = 60%. Another group at 70% is not automatically superior without sample variability and comparable starting performance.

■ Common error

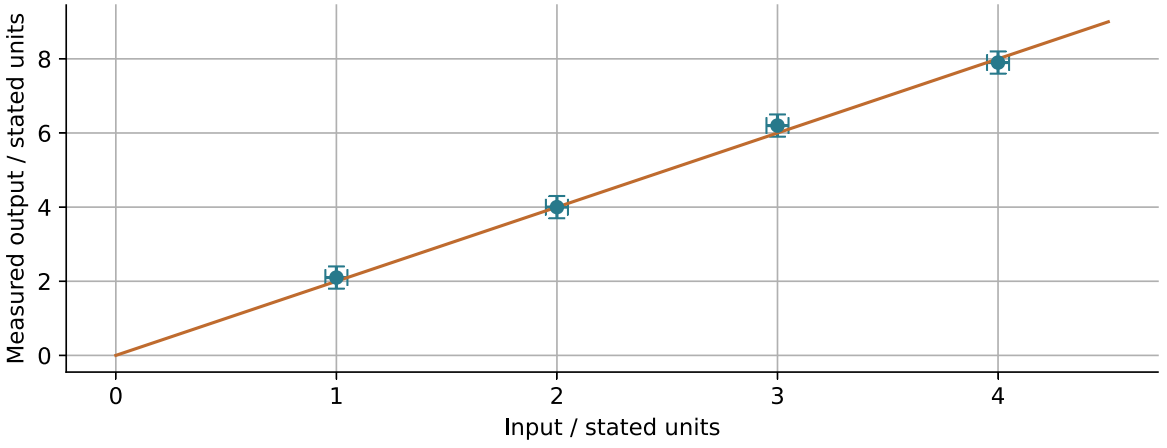
More feedback is not always better for independent performance. A short-term improvement alone does not demonstrate a lasting learning change.

Uncertainty, gradients and model testing

Official-unit focus: Practical Experimental programme

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.

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.



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.

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■ Checked worked case

Known: length = 50.0 mm with uncertainty 1.0 mm. Percentage uncertainty = absolute uncertainty/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%.

■ Common error

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.

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