

6.1 Planning whole IA2 investigations

Name: _____ Class: _____ Date: _____ Total: 29 marks

KEY WORDS ethics • dependent variable • standardised exercise

Objective

Write the 16-mark investigation plan WBI16 closes with: ethics, safety, a nine-mark method with controls and monitoring, recording and analysis, and honest limitations. Original practice for the Unit 6 planning criteria, grounded in the Summer 2025 fitness-programme question.

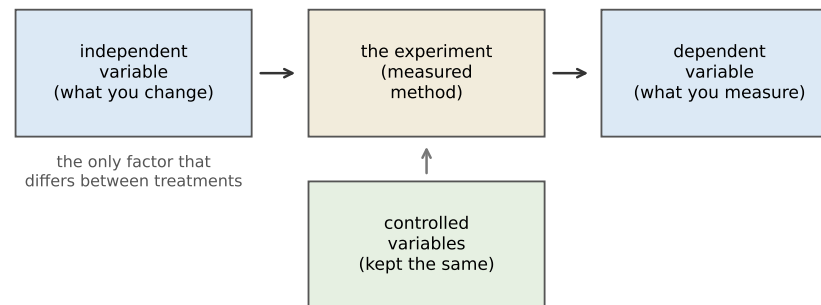
1 Key knowledge and worked examples

■ The plan question pays out in named blocks

Ethics first: informed consent of volunteers; participation is voluntary; organisms (where used) are treated per the specification's ethical-use requirement. **Safety:** the specific risk with its specific control – sterilise or replace the mouthpiece between students (infection); check volunteers can safely exercise.

■ The nine-mark method

Work down a checklist the scheme mirrors: two groups that differ only in the planned programme; the **dependent variable** stated as a measurable time (time for breathing rate and tidal volume to return to resting values); apparatus used correctly and named (spirometer with soda lime, nose clip, practise breaths before recording); resting values measured first; the **same standardised exercise** for every participant; two control variables named (age, sex, BMI, smoking, room temperature...) with the method of control for one; repeats to give means **and** standard deviations.



Beetroot example: alcohol concentration changed, pigment loss measured; temperature, size, volume, time fixed; a water-only treatment is the control.

■ Record, present, analyse

A table of *raw* times with headings and units, means calculated from repeats; a **bar chart** of mean recovery time per group with a **t-test** for the difference – or, with several fitness levels, a scatter/line graph with a **correlation** test. Close with two real limitations: volunteers' diet, stress and prior fitness cannot be fully controlled; apparatus leaks, exhausted soda lime, abnormal breathing through a mouthpiece.

2 Practice

2.1 State the ethical concern and the safety precaution required before a spirometer study on student volunteers. [2]

2.2 A plan measures “recovery rate”. Why does the scheme reject “recovery rate” as the dependent variable, and what should be written instead? [2]

2.3 Give two control variables for the fitness investigation and the method of controlling one of them. [3]

2.4 Explain why “exercise, then rest” is not a standardised exercise, and give a standardised alternative. [2]

3 Exam-style questions

3.1 Plan an investigation of the hypothesis: seedlings given a fertiliser treatment grow taller than untreated seedlings. Include groups, the dependent variable with its measuring technique, two controlled variables with methods, safety, and how repeats are used. [7]

3.2 Devise a method to test whether students who have used a fitness programme recover faster after exercise, using a spirometer. Your method must state how variables are controlled and monitored, and how quantitative results are produced. [8]

3.3 For your method in 3.2, describe how results should be recorded, presented and analysed to draw a conclusion, and give two limitations of the method. [5]

Solutions

Original-task marking: M1 method, A1 accuracy, B1 reasoning.

2.1 Ethics: obtain informed consent – volunteers know the procedure and agree; no compulsion. Safety: sterilise or replace the mouthpiece between students to prevent infection.

2.2 “Recovery rate” is a derived value, not the raw measurement, and the scheme credits the measurable quantity: the time for breathing rate and tidal volume to return to resting values.

2.3 Any two of age, sex, BMI/mass, smoking status, prior fitness, room temperature, time of day; control method e.g. select volunteers in one BMI range, or test everyone in the same room.

2.4 Different students would exercise at different intensities and durations, so recovery differences could reflect the exercise, not the fitness programme; e.g. step on and off a 30 cm bench for one minute at a set rhythm.

3.1 Two groups of seedlings of the same species/variety, grown from the same seed batch – one with the fertiliser treatment, one without. Dependent variable: height of seedling, measured with a ruler from soil surface to shoot tip at fixed intervals. Controls with methods: same soil volume and watering regime – set volumes at set times; same light intensity and temperature – same position in the growth room. Safety: wash hands after handling fertiliser; no eating in the lab. Repeats: at least ten seedlings per group, calculate the mean height with SD at each time point.

3.2 Groups: one that has followed the fitness programme for a stated period, one that has not. Measure resting breathing rate and tidal volume from the spirometer trace first; use soda lime in the canister with a nose clip and a practise breath so the trace is normal; each student performs the same standardised exercise (e.g. one minute of stepping); record the trace continuously and time from exercise end until breathing rate and tidal volume return to the resting values recorded earlier – this time is the quantitative result; control variables: same time of day and room; monitor room temperature with a thermometer; repeat with enough volunteers per group for means and SDs.

3.3 Record: table of raw recovery times per student with units (s), means per group calculated from repeats. Present: bar chart of mean recovery time per group with labelled axes. Analyse: t-test on the two group means; reject the null hypothesis if the calculated value exceeds the critical value at $p = 0.05$; alternatively inspect SD error bars for overlap. Limitations: volunteers’ lives outside the programme (diet, sleep, stress) cannot be controlled; apparatus – leaks, exhausted soda lime, or unnatural breathing through the mouthpiece distort the trace (any two, B1).