

Exercise walk-through

6.1

Planning A2 investigations (Unit 6 spec, planning section)

Pearson Edexcel · International A-Level · Biology

1

The method

Method — 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.

Method — 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.

Exercises 2.1·2.3

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]

Exercises 2.1·2.3

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

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

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

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.

Exercises 2.4·3.1

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

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]

Exercises 2.4·3.1

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

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 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]

3.1 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.

Exercise 3.2

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]

Exercise 3.2

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]

3.2 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.

Exercise 3.3

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]

Exercise 3.3

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]

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).