Unit 6: Practical Skills in Biology II

Pearson WBI16 · core practicals 10–18 (Units 4–5) · plans, statistics and evaluation; bench work stays class work.

Plan, test, conclude

Your turn

You are handed a hypothesis you did not choose, and a half-complete statistics table.

A. What must a full plan name, in what order?

B. Which statistical test fits the question?

C. What three sentences finish a statistical conclusion?

The A2 core practicals

Core practical	**What is measured**
10 photosynthesis	gas volume per minute
11 habitat ecology	**abundance**; **abiotic** factors
12, 13 development; culture	rate per temperature; growth curve
14 antibiotics	**zones of inhibition**
15 yeast respiration	time to indicator colour change
16 respirometer	O_2 uptake; RQ $= CO_2 \div O_2$
17, 18 ventilation; amylase	recovery time; amylase activity

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Redox indicators and the respirometer

CP15 redox indicators

Methylene blue and DCPIP lose their blue colour.

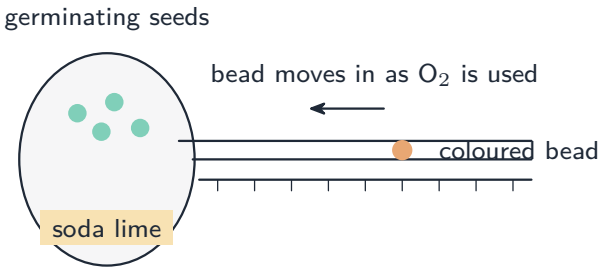
TTC turns from colourless to red.

CP16 respirometer

With soda lime, the fluid marker moves as O_2 is used.

Run with and without the absorber to find CO_2 produced, then RQ $= CO_2 \div O_2$.

Reading a respirometer



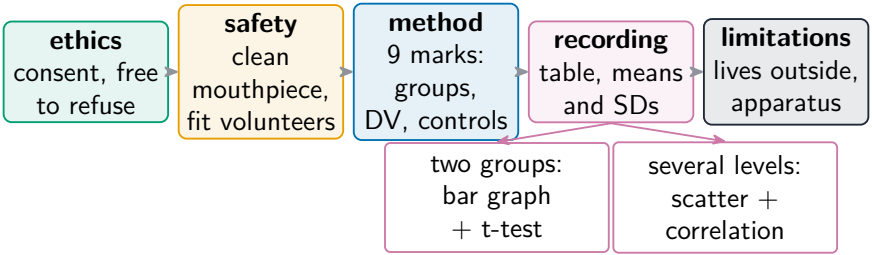
With CO_2 absorbed, the bead's movement measures oxygen uptake by the seeds.

The 16-mark plan in blocks

Block	What earns the marks (fitness and recovery)
ethics	**informed consent**; no one is forced to take part
safety	sterilise or replace the mouthpiece; volunteers healthy enough
method (9)	two groups; DV = time to return to resting rate and **tidal volume**; resting values first; same exercise
controls	two control variables and how one is controlled; repeats, means and SD
analysis	raw-data table; bar graph and t-test, or scatter and correlation
limitations	lives outside the study; leaks or exhausted soda lime

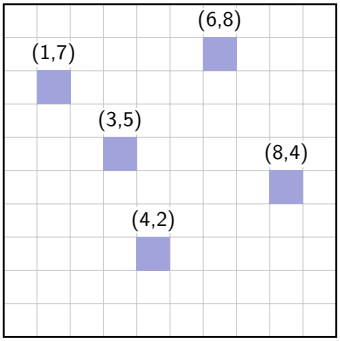
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Five blocks, in the order the marks are paid



Two groups mean a bar graph and t-test; several levels mean a scatter graph and **correlation**.

Random sampling, with a method



coordinates from random numbers

> Grid first, random coordinates second, quadrat last.

- "Sample at random" earns nothing on its own.
- Record the **abiotic** factors that matter.

Magnification from a photograph

1. **Image** Earthworm in the photograph $= 5.0$ cm
2. **Actual** Real earthworm $= 13.5$ cm
3. **Divide** $5.0 \div 13.5 = 0.37$
4. **Answer Magnification** $\times\ 0.37$

Decision

Same units top and bottom; a value below 1 means the image is smaller.

Dilution plating, justified

Step	Justification
serially dilute, $1 + 9$	raw samples are too numerous to count
plate a known volume	separate **colonies** can be counted
fixed time and temperature	colonies become visible, comparably
work aseptically	avoids **contamination** and counting errors

Use the evidence

Count $\times$ dilution factor $\div$ volume plated; one colony may come from a clump of cells.

Completing the standard deviation table

1. **Mean** 18.1, 19.7, 16.2, 13.8, 17.1 g; mean $16.98 \approx 17.0$ g
2. **Squares** $(X-\overline{X})^2$: 1.21, 7.29, 0.64, 10.24, 0.01
3. **Sum** $\sum (X-\overline{X})^2 = 19.39$
4. **SD** $s = \sqrt{19.39/4} = \sqrt{4.8475} = 2.2$ g

Decision

Plot mean $\pm$ SD; non-overlapping bars suggest a **significant** difference, but a t-test decides.

A t-test on recovery times

1. **Data** Trained 94 s (s = 11, n = 8); untrained 126 s (s = 14, n = 8)
2. **Calculate** $t = 32 \div \sqrt{11^2/8 + 14^2/8} = 5.08$
3. **Critical** 14 **degrees of freedom**, p = 0.05 $\rightarrow$ 2.145
4. **Conclude** 5.08 $>$ 2.145, so reject the **null hypothesis**.

Decision

The programme significantly shortens recovery time.

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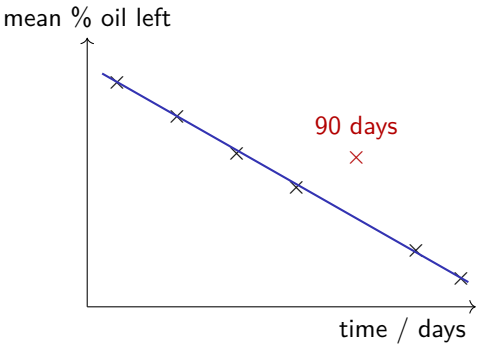
Spearman's rank, in three sentences

1. **Hypothesis** There is no **correlation** between oil remaining and time stored.
2. **Calculate** $r_s = 1 - \dfrac{6 \times 104}{7 \times 48} = -0.857$
3. **Compare** $0.857 > 0.786$, the **critical value** for $n = 7$ at $p = 0.05$.
4. **Conclude** Reject the **null hypothesis**; significant negative correlation.

Decision

Two group means $\rightarrow$ t-test; two measured variables $\rightarrow$ correlation. Never swap them.

The anomalous point



> The 90-day reading (0.65 %) is **anomalous**: the best fit ignores it, and you repeat that sampling.

- Time is **continuous**, so draw a **line graph**.
- The best fit ignores the anomaly.

Written practice has limits

Aseptic technique, reading a live spirometer trace and handling organisms ethically are learned in the room.

- A plan is not a performance.
- The competences are built in class.

Check yourself

Your turn

Answer without notes, then check.

A. What happens to methylene blue and to TTC as yeast respires?

B. Masses 21.4, 19.8, 18.6, 22.1, 20.6 g. Find the standard deviation.

C. Two groups' recovery times, then five fitness levels. Which graph and test for each?

D. Give the two ethics and safety points the spirometer plan needs.

E. An earthworm 13.5 cm long appears 5.4 cm in a photograph. Find the magnification.