Unit 3: Practical Skills in Biology I

Pearson WBI13 · core practicals 1–9 (Units 1–2) · written practical skills; bench work stays class work.

Write about what your hands did

Your turn

You rinsed beetroot pieces until the water ran clear before putting them in alcohol.

A. Why rinse at all?

B. What would the colorimeter have measured without rinsing?

C. How would you write that step to earn the mark?

Three roles for variables

Role	Meaning	Beetroot example
independent	what you change	alcohol concentration
dependent	what you measure	absorbance of leaked pigment
control	kept the same, with a reason	temperature, as it changes membrane fluidity
control treatment	the change left out	water instead of alcohol

What repeats can and cannot do

Repeats improve

Reliability, and a mean less affected by one odd reading.

An estimate of spread (SD, range, **error bars**).

Repeats cannot fix

A **systematic error**, such as a balance zero error.

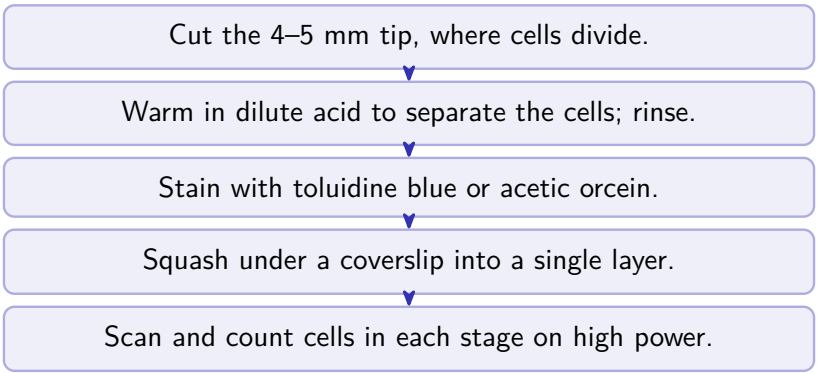
It shifts every reading the same way, so the mean is shifted too.

The nine core practicals

Core practical	What is measured
1 sugar and starch	colour match against serial-dilution standards
2 vitamin C	DCPIP decolourised, compared with a standard
3 membrane permeability	absorbance of beetroot pigment
4 enzyme rate	initial rate from a time course
5 and 7 microscopy, plant sections	**graticule** measurements; plan and cell drawings
6 root-tip squash	cells in each mitotic stage; **mitotic index**
8 and 9 fibres, antimicrobials	mass at break; zone of inhibition

exercises.lol exercises.com.cn

The root-tip squash



Aseptic technique

Step	Reason
work near a Bunsen updraught	airborne microbes are carried away
flame loops and bottle necks	kills microbes on them
open plates briefly	fewer microbes land on the agar
tape the lid, do not seal it	oxygen gets in, so anaerobes do not thrive
incubate inverted, below 30 °C	condensation stays off the agar; human pathogens grow less

A vitamin C plan, as the marks are paid

1. **Standardise** Count drops of 1 % ascorbic acid that decolourise 1 cm^3 of DCPIP, say 10.
2. **Controls** Same DCPIP volume and concentration; one dropper throughout; room temperature.
3. **Safety** Low hazard; avoid skin and eye contact.
4. **Process** A juice needing 5 drops: $10/5 \times 1\% = 2\%$ vitamin C.

Decision

Tabulate the repeats with a mean column; compare the juices in words.

Fewer drops, more vitamin C



drops to decolourise 1 cm^3 DCPIP; half the drops means twice the vitamin C

juice: $\frac{10}{5} \times 1\,\% = 2\,\%$

10 drops of 1 % standard and 5 drops of juice decolourise the same DCPIP, so the juice is 2 %.

Uncertainty and significant figures

1. **Reading** A ruler in millimetres reads 40 mm, $\pm$ 0.5 mm (half a division).
2. **Percentage** $0.5/40 \times 100\% = 1.25\%$
3. **Combine** Add percentage **uncertainties** for products and quotients; absolute ones for sums and differences.
4. **Figures** 12.70 has four **significant figures**; a trailing zero can count.

Decision

State which uncertainty convention you use, half a division or one division.

Tables that earn the marks

Alcohol concentration / %	Permeability / a.u.
0	0.12
20	0.25
40	0.61

Use the evidence

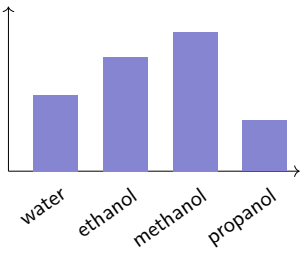
Draw the table first, **independent variable** on the left; a.u. means arbitrary units.

Bar chart or line graph?

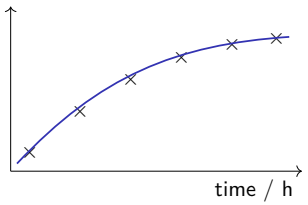
Label both axes with quantity and unit; plot sharp crosses; no broken axis.

- Categories → **bar chart** with gaps.
- Continuous variable → **line graph**.

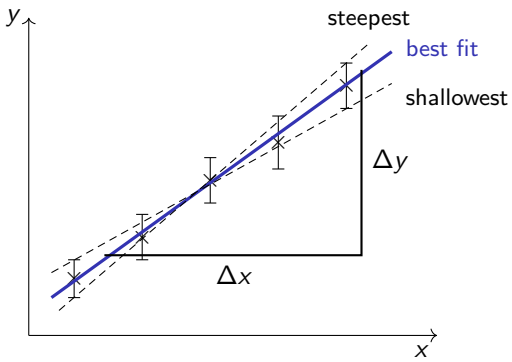
categories: bar chart



continuous: line graph



Gradients and error bars



Gradient $= \Delta y / \Delta x$ from a large triangle, with the units divided out too.

- Draw a large triangle on the best-fit line.
- Steepest and shallowest lines give the gradient's range.

The percentage family

1. **Difference** $33.65 - 29.64 = 4.01$ g per 100 g
2. **Mean** $(33.65 + 29.64)/2 = 31.645$
3. **Percentage** $4.01 \div 31.645 \times 100 = 12.67$ %
4. **Cells** 80 % of 98 cells $= 78.4$, reported as 78 cells.

Decision

12.70 % is wrongly rounded; the value is 12.6718…, so 12.67 % at 4 s.f.

Evaluate, improve, extend

Improvement	Why it helps
colorimeter, not colour matching	quantitative; removes judgement
zero on plain solvent	removes a systematic offset
more values inside the range	narrows interpolation
repeats with SD and **error bars**	shows spread and overlap
different individuals, same conditions	measures variability between organisms

Use the evidence

Conclude only inside the range measured.

Written practice has limits

> Clean aseptic technique, patient focusing and a good squash are learned at the bench.

- Only written evidence is assessed.
- Practise the real practicals, then describe them.

Check yourself

Your turn

Answer without notes, then check.

A. Why were some seedlings placed in solvent without trifluralin?

B. 98 cells are seen; 80 % are in metaphase. How many cells, and why a whole number?

C. Which graph for four named liquids, and which for permeability against time?

D. State two things repeat readings improve and one they cannot remove.

E. Why is 12.70 % rejected when 12.67 % is accepted?