



Tips for the Life Sciences Practical Exam



- Read your **INFORMATION SHEET** very carefully! The info sheet provides a **CONTEXT** and background for the practical you are about to do. Some answers come from this information.

The experimental method

- **Hypothesis** – a **statement** (prediction) about what you think is going to happen. Do not provide explanations in your hypothesis. Usually asked at the start of Section B when you are told to design an experiment. The hypothesis must be one single sentence that combines both the independent and dependent variables.
- **Aim – to prove** whatever your hypothesis is. Must also include the independent and dependent variables.
- **Independent variable (input)**– the variable you deliberately change at the start of the experiment. On the x-axis of the graph; usually to the left of the dependent variable in a table.
- **Dependent variable (outcome)**– the variable that is being measured; it is the result of your experiment. (What happened when you completed your experiment). On the y-axis of the graph, usually to the right of the independent variable in a table.
You need to explain it well for 2 marks.
- **Fixed variables (controlled variables)** – variables that are kept the **SAME** during your experiment to ensure fair testing.
You need to mention **WHAT** the fixed variable was, **HOW** you measured it and **HOW MUCH** you measured. Very important to say all three, even for 2 marks.
Choose fixed variables that are **RELEVANT** to the study.
- **The control** – The element that remains unchanged or unaffected by the other variables. It is the part of the experiment where the independent variable has been left out. It is used as a **point of comparison** against which the other test results are measured. It is to ensure that it is the independent variable that is causing the results of your experiment and not some other variable.

When answering this question, be sure to refer specifically to the given experiment. Avoid a vague answer.

- **Results**

1. **Quantitative results**

Can be measured numerically. These are objective results.

2. **Qualitative results**

Cannot be measured numerically; these are subjective results – e.g. colour change, observing textures, firmness, lumps etc.

Sometimes - results may be incomplete or inconclusive (this means you cannot form a conclusion) – don't panic if you can't form a conclusion and don't make one up!

- **Conclusion**

Base this specifically on your observations and results.

Refer to specific data you obtained (qualitative or quantitative)

Avoid a vague answer.

Estimating values:

1. Interpolate – predict a value in between two known data values.
2. Extrapolate – predict a value that is outside your given values; you estimate this value based on the current trend of your existing data.

How to improve the design of your experiment:

Here are some suggestions – choose the one appropriate to your experimental setup:

1. Repeat the experiment several times and average the results to see if the same result is achieved.
2. Use a wider range of samples or replicates of your samples to see if the same result is achieved.

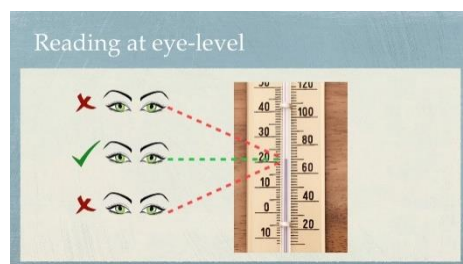
3. More dilutions / different range of dilutions can be made and tested to see if the same result is achieved.
4. Use more accurate measuring equipment, e.g. electric water bath or electronic scale.

How to improve the reliability of an experiment

1. Repeat the experiment several times and average the results.
2. When a scientist repeats an experiment with a different group of people or a different batch of the same chemicals and gets very similar results, then those results are said to be reliable.
3. Reliability is measured as a percentage – if you get the same results every time, then the results are 100% reliable

How to improve validity of an experiment

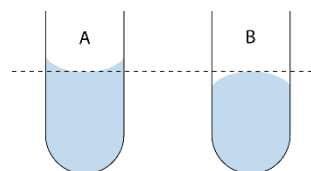
1. Have more fixed variables.
2. Improving your measurement technique.
3. Use random samples to reduce sample bias.
4. Adding a control.



How to improve accuracy of an experiment

Accuracy refers to how close a measurement is to the true or accepted value.

1. Make sure you measure everything correctly.
2. Make sure your equipment is accurate.
3. Measure liquid levels in beakers at eye level on a flat surface to avoid error of parallax.
4. Read measurement from bottom of meniscus (not sides).
5. Tap syringes to remove air bubbles; read at eye level.
6. Read thermometers at eye level.
7. You must know the correct units for common measurements like temperature ($^{\circ}\text{C}$), length (mm, cm or microns (μm), mass (mg, g, kg), rate (m/sec), time (sec, min or hours).



PS A suitable syringe measures the exact volume of liquid that fills it up.

NB – You must be able to recognise a possible flaw in the design of the experiment AND give constructive criticism of the design of apparatus or the experimental method.

Lab safety/ lab precautions

1. Wear gloves/ masks/ goggles/ eye protection during testing.
2. Do not consume any part of the experiment.
3. Wash hands after handling certain samples.
4. Do not discard the samples down the drain / dispose of them correctly – e.g. don't pour yeast solutions or infected solutions or other hazardous solutions down the drain.
5. Be careful when working with glass, knives, scalpels, boiling water etc.
6. You must adopt procedures that minimise specific laboratory hazards, e.g. protective gear with caustic substances (e.g. when boiling liquids, working with acids and bases etc.) or biohazardous substances like viruses, bacteria, poison, venom etc

Recording skills

1. Tables

- Must have headings (include description of all information that is presented in the table including indicators, if applicable)
- Columns/Rows also need headings.
- Independent variable – left/middle column
- Dependent variable – right column
- No units in table EXCEPT in column/row headings.

2. Graphs

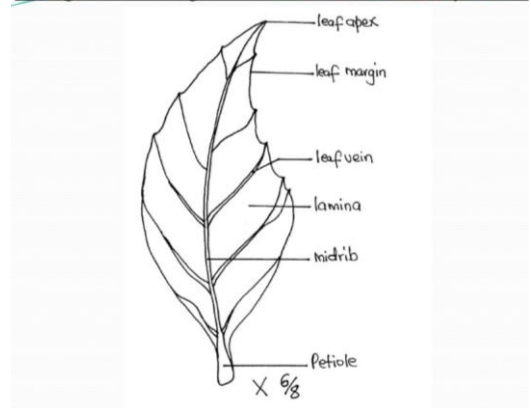
- You must be able to draw line graphs, charts, bar graphs and histograms.
- Give graph a suitable heading (includes the information you are presenting on both x and y-axes.
- x-axis – independent variable + unit
- y-axis – dependent variable + unit
- Choose a suitable scale.

- Don't start plotting at zero unless your given data starts at zero.
- Use a pencil in case you make a mistake.

3. Biological diagrams

- Give diagram a suitable heading.
- Draw in pencil, no shading or colouring.
- Drawing must be in proportion.
- Label lines must NOT have arrow heads; don't cross label lines.
- Sometimes a magnification is needed.

A diagram showing external features of a simple leaf.



Calculations

1. Using a scale bar:

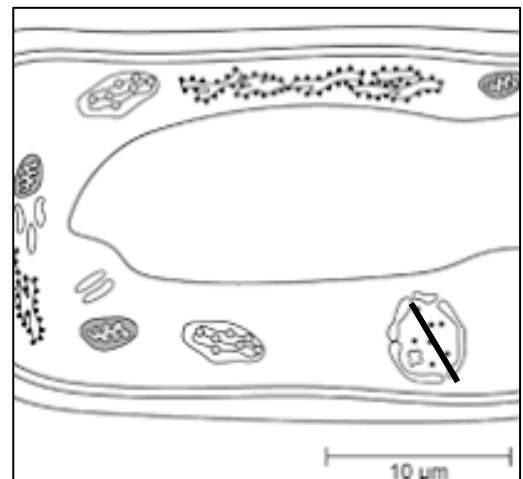
$$\text{Actual length} = \frac{\text{measured length of object (mm)}}{\text{measured length of scale bar (mm)}} \times \text{scale number}$$

The scale bar has a scale number of $10\mu\text{m}$.

Measure this scale bar.

AND measure the line of the object given (in this case a nucleus).

Make sure that the units of the 2 lines you measure are the same.



2. Using magnification:

$$\text{Actual length} = \text{image length} \div \text{magnification}$$

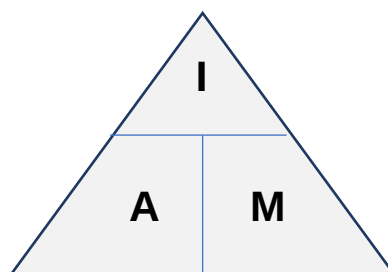
$$\text{Magnification} = \text{image length} \div \text{actual length} \text{ (both lengths must be in the same unit)}$$

I AM ... Awesome!

I = image length

A = actual length

M = magnification



3. Involving %, using grids to estimate area etc

Sections

1. Cross section/transverse section (side to side)
2. Longitudinal section (top to bottom)



Ethics in science - honesty and integrity in all stages of scientific practice.

1. Ensure privacy and confidentiality of your participants.
2. Aim to do good to others (cause no harm).
3. Informed consent.
4. Openness and transparency.
5. Non-discrimination and non-exploitation.
6. No conflict of interest.

How the Experimental Design section of the practical is marked.

This is marked as follows. Remember the acronym LAM.

L – Layout – neat, tidy (no asterisks) and points must be numbered. (1 mark)

A – Aim – must relate to the prescribed experiment and achieve the required result. You usually need to have your independent variable and fixed variables correct here to earn the two marks. (2 marks)

M – Method:

- i) Must be an original experiment (not a rehash of the experiment you performed earlier in the practical) (1 mark)**
- ii) Discuss what equipment you are using. Make sure that your equipment is appropriate and used correctly. Remember that a big test tube holds only 50 ml of liquid. Make sure that you have mentioned the equipment that measures your dependent variable, as well as other variables. (1 mark)**
- iii) Make sure that you have only changed one variable and all other variables are fixed (unchanged). (1 mark)**
- iv) Your instructions must be valid, complete and achieve the desired result. (1 mark)**
- v) Discuss what specific change you are observing (ie observations) and say that you will record your results in a table. (1 mark)**

Total: 8 marks

This entire design should not be more than 12 lines/instructions. If it is, something is probably wrong!