

Webinar for the new Biology in Practice Investigation

The assessment of Leaving Certificate Biology comprises of two components:

1. Final written examination
 2. Biology in Practice Investigation
- The Biology in Practice Investigation is worth 200 marks, which is 40% of the overall marks for Leaving Certificate Biology. The remaining 300 marks (60%) are for the final written examination.
 - The coursework must be carried out and submitted to the class teacher by 26th February 2027 and will then be submitted to the SEC



Introduction:

- Your report should contain no more than **1500 words**. This word count does not include words used in references, in data tables, in formulae or equations, or as labels.
- You may use appropriate images in your report to support your communication. Your report should **contain no more than 20 images**. The number of images permissible should be seen as a limit and not a target.
- Images should be inserted where appropriate and with due regard to effective and relevant communication. Images should not be used as a means to include additional text. It is advisable not to use images where a person or persons in these images may be identifiable. The inclusion of videos is not allowed.
- Graphs, diagrams, images, etc. may be produced using appropriate software, captured from secondary sources, photographed directly, or hand-drawn. These can be embedded in your report as photographs or partial screenshots



Introduction:

- As you carry out your investigation, you are strongly encouraged to keep an investigative log. This can be used to keep a record of your thoughts on the investigation and reflect on how they change over time. It can also be used to keep a record of your research references and resources. Your log may be of use to you as you complete your investigation and your report.
- You should not submit your log to the SEC.



Introduction:

Your Biology in Practice Investigation should involve the following six stages:

- **Stage 1:** Initial Response to the Investigation Brief **(1 – 2 hours)**
 - **Stage 2:** Background Research **(2 – 3 hours)**
 - **Stage 3:** Designing and Planning the Experiment **(2 – 3 hours)**
 - **Stage 4:** Conducting the Experiment **(2 – 3 hours)**
 - **Stage 5:** Data Analysis and Conclusions **(2 – 3 hours)**
 - **Stage 6:** Finalising the Biology in Practice Investigation Report **(4 hours)**
- **Note** – Some stages may take longer than the suggested times and this is why 20 hours is the recommended time for the Biology in Practice Investigation.



Mark Allocation

	Content / Criteria	Marks
<p>A</p> <p>Title and Introduction</p> <p>Background Research</p> <p>References</p>	<ul style="list-style-type: none"> • Title / Introduction / Research Question • Hypothesis • Background Research (Secondary Data) • Evaluation of Secondary Data • Referencing 	50
<p>B</p> <p>Designing and Planning</p> <p>Conducting the Experiment</p>	<ul style="list-style-type: none"> • Experimental Design • Experimental Method • Safety • Fairness • Accuracy • Selection of Equipment 	50



Mark Allocation

C Data and Data Analysis Conclusions	<ul style="list-style-type: none">• Experimental Observations (Primary Data)• Data Presentation• Data Analysis• Conclusions	50
---	--	-----------

The criteria listed below are not distinct sections of your report, they should be evident throughout.

D Scientific Literacy	<ul style="list-style-type: none">• Communication• Coherence• Relevance• Reflective Approach	50
--	---	-----------



Report structure for your Biology in Practice Investigation

Write your report using the following headings:

- Title and Introduction
- Background Research
- Designing and Planning
- Conducting the Experiment
- Data and Data Analysis
- Conclusions
- References



Structure of written report

1. Main Heading – Title and Introduction

Subheading – Title

Subheading – Introduction

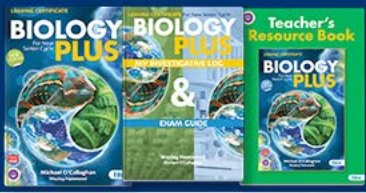
Subheading – Research question

Subheading – Hypothesis

2. Main Heading – Background research

3. Main Heading - Designing and Planning

- **Subheading** – Prediction
- **Subheading** – Variables (independent, dependent and control variables)
- **Subheading** – Materials and Equipment
- **Subheading** – Safety



Structure of written report

4. Main Heading – Conducting the Experiment

(include how reliability, accuracy and fairness was achieved also)

Include images for the method – make sure they're clearly titled

5. Main Heading - Data and Data Analysis

Subheading - Experiment observations (tables that include primary data)

Subheading - Data Presentations

Subheading - Data Analysis: Explanation of patterns in the data

Subheading - Evaluating Results

6. Main Heading – Conclusion

7. Main Heading – References (Bibliography)

Suggestions for possible word count

Section	Approx. word count
Title	20 – 30
Introduction, Research Question, Hypothesis	100 – 150
Background Research	300 – 350
Design and Planning	100 – 150
Conducting the Experiment	200 – 350
Data (Results) / Data Analysis	350 – 450
Conclusion and Evaluation	250 – 350



Ideas for the Biology Investigation Brief

What type of plant tissue might be suitable? Potato, carrot, radish, cucumber

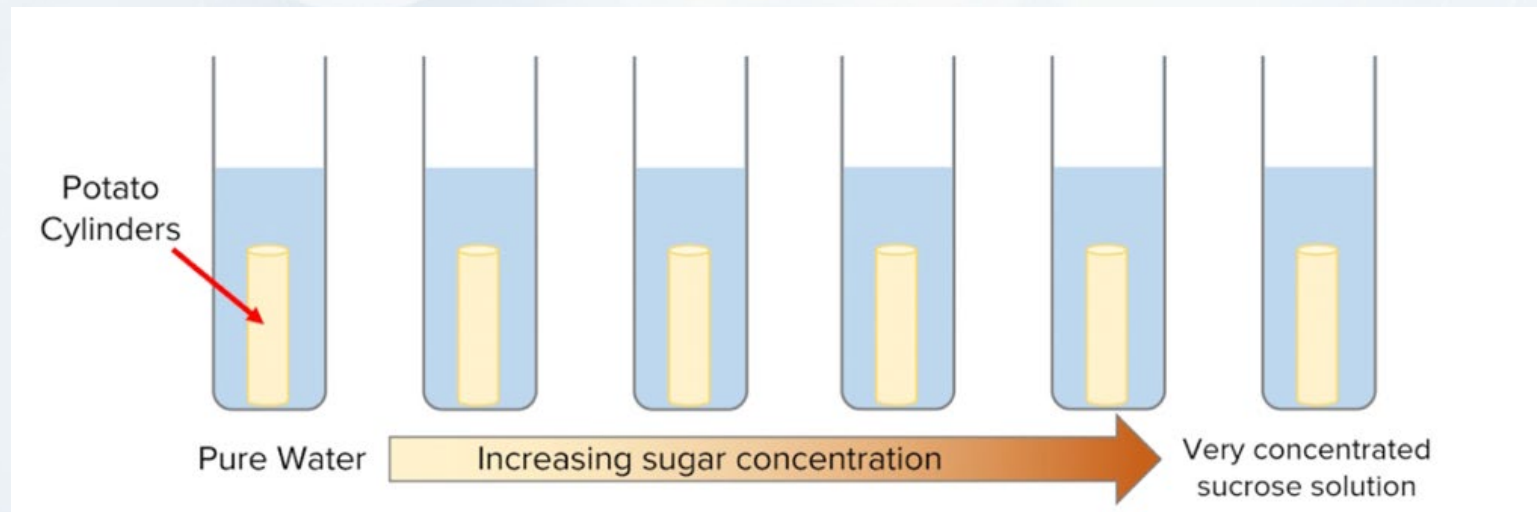
Note – these examples are especially popular in osmosis practical's because their tissues are large, firm, and easy to cut (e.g., into cylinders or cubes), **making mass changes easier to measure.**

What factors affect the rate of osmosis in terms of food preservation?

- Solute concentration
- Temperature
- Surface area
- Time of immersion
- Type of solute

Ideas for the Biology Investigation Brief

- **What solutes might you use?**
- Salt (curing or brining)
- Sugar or syrups (glucose, fructose, sucrose)
- There is other solutes that can be used





Mark Allocation - Part A

	Content / Criteria	Marks
A Title and Introduction Background Research References	<ul style="list-style-type: none">• Title / Introduction / Research Question• Hypothesis• Background Research (Secondary Data)• Evaluation of Secondary Data• Referencing	50

Part A - Main heading - Title and Introduction

Subheading - Title:

What makes a good title?

- Clearly identifies **independent variable**
- Clearly states the **dependent variable** (rate of osmotic water loss)
- Uses correct scientific terminology
- Clear and concise

Example - An investigation into the effect of solute concentration and immersion time on the rate of osmotic water loss from plant tissue in relation to food preservation.

Subheading - Introduction:

- A brief overview of the topic
- Why the investigation is important or interesting
- The **aim** (what you are trying to find out)

Part A

Main heading - Title and Introduction

Subheading - Research Question:

- Research question should start with words 'Could' or 'How does' or 'Should' or 'Can' to gather interest
- A good question clearly identifies independent and dependent variables

Subheading – Hypothesis

- A hypothesis is a suggested explanation for an observation that allows for a prediction that can be tested.

How should a strong hypothesis be written?

- Write it as a statement that is clear and testable.
- It should include the following:
 - The independent variable (what you change)
 - The dependent variable (what you measure)



Part A - Main heading - Background Research

- Make sure to use an investigate log to maintain a record of your research. This may include references from your research or some reflections.
- Good background research is essential for a strong scientific investigation. It shows that you understand the science behind your experiment and that your research question is based on reliable evidence.
- **Get the attention of the examiner.** Make them excited about reading ahead.
- **Must discuss how research question is relevant to the brief.**
- **Present it logically** – there needs to be an order to the information. You don't just copy and paste information from a website. Write in your own words.

Good background research explains:

- How your research helped you design your method
- Why you chose certain variables



Part A - Main heading - Background Research

Phrases to highlight research gaps

If you want to show why your investigation matters, you can use:

- *Despite extensive research...*
- *However, previous studies have not...*
- *There is limited research on...*
- *This study aims to address...*
- *This research aims to determine...*

Remember for background research:

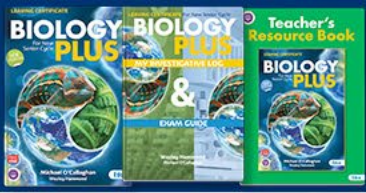
- Do not include unnecessary information. Every section should help explain your investigation.
- When finding and using useful resources make sure to evaluate these sources in your background research.



Part A -Main heading - Background Research

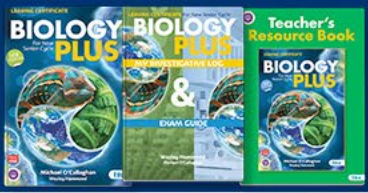
- **Try to incorporate the three cross cutting themes (Health, sustainability and technology) in the background research.** A few strong sentences linking these themes to your investigation is important
- **Important to evaluate your secondary data for your background research.**

For example – the 5 background sources that you are going to use – reference a quote and explain how this backs up your argument or how it is of relevance to the experiment.



Part A -Main heading - Background Research

- **Use reliable and credible sources**
 - Textbooks
 - Scientific journals
 - Newspaper articles
 - Discussions with food scientists (or quality control technicians)
 - TV programmes such as Jimmy's Food Factory (BBC), Food Unwrapped (Channel 4), Science on the Ground – Food Preservation (BBC) and The History of Food (Apple TV)
- **For a high-quality investigation:**
 - Aim for 4–6 strong sources
 - Use a mix (e.g., textbook + journal + website)
 - Compare or link ideas from different sources
 - Using only one source is weak research.



Part A -Main heading - Background Research

For a high-quality investigation:

- **Include proper in-text citations**
- All information that is not your own knowledge must be referenced.
- Use the **Harvard style**



Suggestions for research:

- BBC Bitesize
- Royal Society of Biology
- World Health Organisation
- National Institute of Health
- Khan Academy
- PLOS
- American Chemical Society



Suggestions for research:

- **Osmotic dehydration process for preservation of fruits and vegetables – Journal of food research**
A scientific article explaining the process and advantages of osmotic dehydration in preserving fruit and veg, with more context on mechanisms and benefits.
<https://ccsenet.org/journal/index.php/jfr/article/view/16751>
- **Obsessed with: pickles – why it’s crunch time on London’s culinary scene” —**
Explores the cultural and historical significance of pickling — a preservation method — and why it is gaining popularity. [Obsessed with: pickles – Financial Times](#)
- **“Save on food with traditional preservation techniques” —** Discusses why traditional preservation techniques (like drying, salting, pickling) are useful for reducing spoilage and food waste. [Save on food with traditional preservation techniques – Yahoo Lifestyle](#)

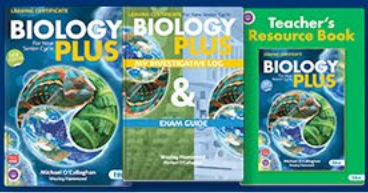


Mark Allocation - Part B

<p>B</p> <p>Designing and Planning</p> <p>Conducting the Experiment</p>	<ul style="list-style-type: none">● Experimental Design● Experimental Method● Safety● Fairness● Accuracy● Selection of Equipment	<p>50</p>
--	---	------------------

Part B – Main Heading - Designing and Planning

- **Subheading** – Prediction
- **Subheading** – Variables (independent, dependent and control variables)
- **Subheading** – Materials and Equipment
- **Subheading** – Safety



Part B – Main Heading - Designing and Planning

Main Heading – Conducting the Experiment (include how reliability, accuracy and fairness was achieved also)

- **Include images for the method** – make sure they're clearly titled



Part B - Main Heading - Designing and Planning

Subheading – Prediction – include a prediction that is associated with your title and hypothesis.

Subheading - Variables

Clearly state the independent, dependent and control variables.

- **Independent variable** (what you change)
- **Dependent variable** (what you measure)
- **Include all controlled variables** (what you keep the same)



Part B - Main Heading - Designing and Planning

- **Subheading - Materials and Equipment (or Selection of Equipment)**
- A good **list of equipment** in a scientific investigation tells exactly what materials and tools are needed so someone else can repeat the experiment accurately.
- **Subheading – Safety**
- Try to include safety precautions that link directly to your investigation)

Some examples

- Always cut **away from your body and fingers**.
- A scalpel and cork borer were handled carefully to avoid injury.



Part B - Main Heading – Conducting the Experiment

What should you include in your procedure?

- **Clear step-by-step** - write in a logical order using numbered steps. Each step should be easy to follow
- **Make sure to include a control experiment and explain why a control is used**
- **Specific and detailed** – include precise information such as measurements (e.g., 50 ml, 10 cm, 30°C), time intervals or equipment used.
- **Must be repeatable** – no steps should be missing

Explain what you:

- Changed (independent variable)
- Measured (dependent variable)
- Kept the same (control variables)

Use correct style – try to avoid personal language like “I” or “we”

- State how many times you repeat the experiment to improve accuracy
- State and justify how you ensured accuracy
- State and justify how you ensured precision
- State and justify how you ensured reliability and reproducibility
- State and justify how you ensured fairness



Part C: Data and Data Analysis / Conclusions

<p>C</p> <p>Data and Data Analysis</p> <p>Conclusions</p>	<ul style="list-style-type: none">• Experimental Observations (Primary Data)• Data Presentation• Data Analysis• Conclusions	<p>50</p>
--	--	------------------



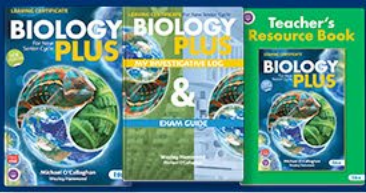
Part C: Main Heading - Data and Data Analysis

- **Subheading** - Experiment observations (tables that include primary data)
- **Subheading** - Data Presentations
- **Subheading** - Data Analysis: Explanation of patterns in the data
- **Subheading** - Evaluating Results



Part C: Main Heading Data and Data Analysis

Section	What it means?	What to include?
Experimental Observations (Primary Data)	The raw data you collected directly from the experiment. Nothing is processed or interpreted yet.	Measurements, readings, notes from the experiment (e.g., initial mass, final mass, temperature readings)
Data Presentation	Organising the raw data so it is clear and easy to understand.	Tables, graphs, charts, labelled diagrams showing the results
Data Analysis	Examining and processing the presented data to identify patterns or relationships.	Calculations (mean, % mass change, rate), trends, comparisons between treatments
Conclusions	The final statement explaining what the results mean and whether they support the aim or hypothesis	Summary of findings, explanation of what the results show about osmosis and the variables tested



Part C: Main Heading - Data and Data Analysis

Subheading - Experiment observations (primary data)

- You should draw your table before carrying out your practical work and leave space for each piece of data you are planning to obtain, including repeats and a mean value if appropriate.
- Have you written the full heading at the top of each column?
- Have you included units at the top of each column?
- Does each value in the same column have the same number of decimal places?



Part C: Main Heading Data and Data Analysis

Below are some possible calculations you may decide to carryout.

Calculations 1 – How to calculate the average (or mean) final mass?

- Add the three final mass results and divide by three

Calculation 2 – average change in mass

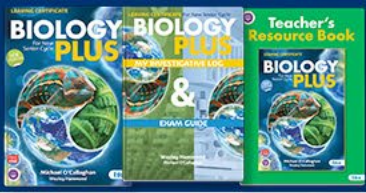
- Average change in mass = Final mass – initial mass

Calculation 3 – Percentage change in mass

- Percentage change in mass = $(\text{Change in mass} \div \text{Initial mass}) \times 100$

Calculation 4 – Rate of osmosis

- Rate of osmosis = $\text{Change in mass} \div \text{Immersion Time}$



Part C: Main Heading - Data and Data Analysis

Subheading - Data Presentations

- **Graphs (generated by excel, GeoGebra or hand drawn)**
- Have you drawn the correct type of graph? Line graph, bar chart, scatter plot, histogram
- Have you put the independent variable on the horizontal x-axis and the dependent variable on the vertical y-axis?
- Have you used appropriate regular scales so that your graph fills at least half of your graph paper?
- Have you labelled each axis with the variable and the units?
- Have you plotted your points or bars accurately?
- If you have drawn a line graph, have you drawn a line of best fit that ignores any anomalous results and goes through as many of your points as possible?



Part C: Main Heading - Data and Data Analysis

Subheading - Data Analysis: Explanation of patterns in the data

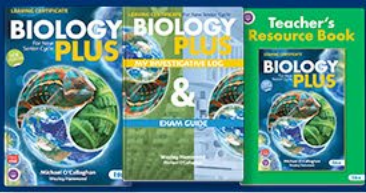
- **Data analysis should include:**
- **Reference to the results**
- Mention the **tables or graphs** used to present the data

Description of trends or patterns

- Explain the **relationship between the variables.**
- **Example:** how solute concentration affected the rate of osmosis

Comparison of results

- Compare **different conditions or treatments.**
- Example: low vs high solute concentrations.



Part C: Main Heading - Data and Data Analysis

Scientific explanation

- Explain the trend using the **scientific principle** involved (e.g., osmosis, concentration gradient)

Comment on consistency

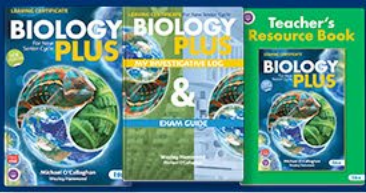
- Mention **repeated trials and averages** to show reliability

Have you identified and accounted for any anomalous results?

- Anomalous results are caused by random error such as wrongly recording a measurement, spilling some of the reaction mixture etc. Writing that an anomalous result is caused by 'human error' is too vague and will not gain marks.

Data analysis should not include

- Final statements about whether the aim was achieved (this is part of the **Conclusion**).
- Sources of error or improvements (these belong in **Evaluation**).



Part C: Main Heading - Data and Data Analysis

Subheading - Evaluating Results

- **Sources of error** - What **limitations** have you recognised in the experiment? E.g sample size/ human error/ bias / procedural error etc.

Examples:

- The plant tissue pieces may not have been cut to exactly the same size or surface area.
- Surface moisture may not have been fully blotted before weighing, affecting mass measurements.
- Balance precision may have introduced measurement error.
- Temperature was not strictly controlled, which could influence diffusion rate

Part C: Main Heading - Data and Data Analysis

Strengths of the investigation

- Repetition increased reliability
- Control used?
- Was there calculations to enable quantitative comparison
- Were your results repeatable and reproducible?

How precise were your results?

- Precision is different to accuracy. Precise results are grouped closely around the mean value whereas accurate results are close to the true values. It is possible to have precise results that are not accurate.

Improvements and refinements

- Use a cork borer to ensure uniform size and diameter of tissue samples.
- Use a more precise digital balance (± 0.001 g)

Extensions - Broader implications or applications

- Mention how your findings relate to real-world biology or future research.



Part C - Main Heading – Conclusion

A conclusion in a **biology investigation** should clearly summarise your findings and reflect on their significance. A conclusion should try to include the following:

- **Restate the hypothesis (or aim) of the investigation**
- Briefly remind the reader what the investigation was trying to find out.
- **Link to hypothesis - State whether your hypothesis was supported or not, and explain why.**
- **Interpretation of results - What can you logically conclude from your data? What do these results mean?**
- Explain what the results mean in a biological context, using scientific reasoning.
- **Summary of key results by highlighting most important findings from data.**
- **Can you link your findings back to your initial background research?**



Part C - Main Heading – Conclusion

- **Compare your primary data (from experiment) to secondary data you might have found during your research**

Have you stated how this investigation relates to science in society. Have you stated how your investigation relates to the cross cutting themes (health, sustainable and technology). Understanding how certain factors affect the rate of osmosis also has applications in areas such as:

- Food processing industries
- Agricultural storage



Main Heading - References

- **What style of referencing is used mostly in Ireland?** Harvard style of referencing.
- **Important guidelines for the referencing process**
- You need to reference both within the report (in-text citation) and in the reference section at the end of the report.
- You should use a in-text citation whenever you use statistics, or wherever you quote, paraphrase or summarise research and ideas that are not your own.

Note: Remember for every in-text citation in your report, you must have a corresponding reference in the list of references section at the end of report.



Main Heading - References

- **Bibliography**
- References should be put into **alphabetical order**.



Part D - References should be put into alphabetical order.

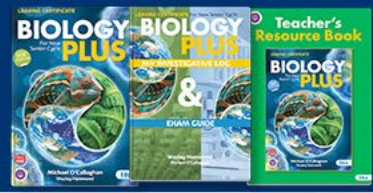
- **Scientific literacy** will be a very important aspect in your written investigation report. It is essential you structure your writing and reflect on how clearly you communicate scientific ideas. The key features (communication, coherence, relevance and reflective approach) have to be incorporated throughout the entire written report.

The criteria listed below are not distinct sections of your report, they should be evident throughout.

<p>D</p> <p>Scientific Literacy</p>	<ul style="list-style-type: none"> • Communication • Coherence • Relevance • Reflective Approach 	<p>50</p>
---	--	------------------

Communication

- To achieve high marks for communication, scientific ideas must be clearly and accurately expressed.
- **How to achieve good communication throughout the report?**
- Use language that is clear and concise (make sure to avoid unnecessary complexity).
- Use essential scientific terminology that is required to explain your investigation. Examples may include - osmosis, solute, solvent concentration gradient, water potential, selectively permeable membrane, cell membrane, microbial growth.
- Present all of your data in clear graphs, tables and images that are titled and well laid out.
- Use diagrams that are clearly labelled.
- Use correct units and symbols



Coherence

To achieve marks for coherence, your written investigative report should follow a logical flow so the examiner can easily follow the investigation.

- **How to achieve coherence throughout the report?**
- Your written report needs to follow a certain scientific structure:
 - Title
 - Introduction
 - Research Question
 - Background research and evaluation of this research
 - Hypothesis
 - Experimental design (e.g variables, safety, selection of equipment)
 - Experimental method
 - Results (primary data)
 - Data analysis
 - Conclusion
 - Evaluation
 - References

- Use clear headings and subheadings
 1. **Main Heading** – Title and Introduction
 - Subheading** – Title
 - Subheading** – Introduction
 - Subheading** – Research question
 - Subheading** – Hypothesis
 2. **Main Heading** – Background research
 3. **Main Heading** - Designing and Planning
 - Subheading** – Prediction
 - Subheading** – Variables (independent, dependent and control variables)
 - Subheading** – Materials and Equipment
 - Subheading** – Safety
 4. **Main Heading** – Conducting the Experiment (include how reliability, accuracy and fairness was achieved also)
|
 5. **Main Heading** - Data and Data Analysis
 - Subheading** - Experiment observations (tables that include primary data)

 - Subheading** - Data Presentations
 - Subheading** - Data Analysis: Explanation of patterns in the data
 - Subheading** - Evaluating Results
- Include images for the method – make sure they're clearly titled
6. **Main Heading** – Conclusion
 7. **Main Heading** – References (Bibliography)

Relevance

- To achieve high marks for relevance it is important you only include information that directly relates to your research question, hypothesis and the investigation.

How to achieve relevance throughout the report?

- Only include data that is related to the variables and link it back to the hypothesis
- For data and analysis only include explanations related to the variables
- When interpreting results, clearly link them back to the **scientific concept being investigated**
- Avoid unnecessary background research information

Relevance

Reflective approach

- It is important you demonstrate critical thinking throughout the written report.

How might you achieve a reflective approach in your written investigation?

- Try to evaluate the reliability and validity of the results.
- Suggest possible improvements (extensions) to the method
- Make it clear on whether the evidence supports or rejects the hypothesis and why.
- Try to identify sources of error or limitations in the investigation.



Report formatting rules

The report you produce must adhere to the following formatting rules:

Section headings	Each section should be numbered and begin on a new page of the report. The heading should use the following font: Arial, black, font size 14 and bold. Refer to Section 6 for section heading names.
Main body text	Arial, black, font size 12 with 1.5 line spacing.
Text editing features permitted	Bold, italics, numbering, and bullets.
Text editing features not permitted	Coloured text (black text only), highlighted text, different fonts (Arial only).
Page orientation	Portrait only.
Page numbering	Bottom-centre of each page.
Page margins No work should appear in the margins as it may not be visible to an examiner.	Left margin 20 mm Right margin 20 mm Top margin 20 mm Bottom margin 20 mm
Images, tables, graphs	Refer to Section 4 .

A word count is prescribed for the report and this must be adhered to. If material is presented in excess of the prescribed word count you may lose marks.