Biology in Practice Investigation

Introduction

The **Biology in Practice (BiP) Investigation** is a new project-based component of Leaving Certificate Biology, worth 40% of your final grade. It runs alongside your two-year course and involves conducting research and an experiment on a biological topic set by an annual Investigation Brief from the State Examinations Commission (SEC).

In Year 2 (6th Year), you will submit a formal report on your investigation to be externally marked. This investigation is designed to showcase your ability to apply biology knowledge and scientific skills to a real-world issue, and to develop skills in inquiry, critical thinking, and scientific communication. It is not just about the final result, but the entire process of learning through investigation – from initial ideas to experimentation, analysis, and reflection. Your BiP Investigation should be integrated with your class learning; in fact, you will find that concepts from all strands of the biology course (especially the 'unifying strand' of scientific investigation) will inform your project.

Timeline Overview

The Investigation Brief is released in Term 2 of Year 1 (around January of 5th Year). From that point, you will work through **six stages** of the investigation, spread over the remainder of 5th Year and into 6th Year. In total, the BiP Investigation is expected to involve about **20 hours** of student work divided across these stages (though every project is different and your teacher will guide the scheduling). The stages are as follows:

Stage 1	Initial Response to the Brief	~1–2 hours	Understanding the brief and brainstorming ideas.
Stage 2	Background Research	~2–3 hours	Researching the topic broadly and refining your focus.
Stage 3	Designing and Planning the Experiment	~2–3 hours	Developing a hypothesis and a practical plan.
Stage 4	Conducting the Experiment	~4–6 hours	Carrying out the experimental work and recording data.
Stage 5	Data Analysis and Conclusions	~1–2 hours	Processing results and drawing conclusions.
Stage 6	Finalising and Submitting the Report	~4 hours	Writing the report, including editing and referencing.

(**Note**: These time estimates are flexible guidelines. You probably will not do each of the stages in separate blocks, or in a strictly linear order – expect to revisit and refine earlier stages as you progress. For example, you might do extra research after seeing your experimental results. Good time management is key, as the work will be spread over weeks or months.)

Stage 1: Initial Response to the Investigation Brief

What It Involves

Once the SEC releases the Investigation Brief, your first task is to understand the brief's context and scope. The brief will outline a general topic or issue in biology and provide some background or stimulus material. It is usually open-ended, meaning there are many possible angles you could investigate within the given theme. In this stage (about 1–2 hours), you brainstorm ideas and react to the brief with an open mind.

Choosing a Topic

Start by asking yourself some guiding questions to connect the brief to your own interests and prior knowledge. For example: 'What do I already know about this topic or issue?' and 'What part of it am I curious about?'. Jot down anything that comes to mind – concepts from class that relate, current issues you have heard about, or personal experiences. The brief's topic might be broad (e.g. a theme like 'Healthy Soil, Healthy Life' or 'Microbial Solutions' – hypothetical examples). Within that, think of sub-topics that excite you. Maybe you recall learning about plant biology and want to explore soil nutrients, or you are interested in microbiology and think about bacteria in compost. List potential research questions or experimental ideas, even if they are very tentative at this stage.

Link to the curriculum: try to identify which Learning Outcomes or topics from the biology course relate to the theme of the brief. This helps ensure that your investigation is rooted in the syllabus. Also consider any cross-cutting themes (like sustainability, health, technology, etc.) that the brief hints at. For instance, a brief on 'Healthy Soil' might connect to ecology (nutrient cycles, ecosystems) as well as societal issues (sustainable agriculture).

Initial Planning

At this stage you are not deciding everything yet, but begin to outline *both* a research direction *and* a potential experiment. Ask yourself:

- 'What research could I do on this issue? Where can I find information?' (Think of textbooks, websites, scientific articles, news, etc.).
- 'What kind of experiment might I conduct? Is there a lab or field experiment we did in class that I could extend or adapt? Could I design a new experiment on this topic?'

Jot down a few possibilities. For example, if the brief is about soil health, you might consider an experiment comparing plant growth in different soil types, or testing the effect of a soil additive on microbial activity. Be creative – the brief is open-ended to allow for your ideas. However, also be practical: think about what can be done with the time and resources available at school or at home. It is wise to discuss feasibility early with your teacher (e.g. raising exotic bacteria might be impractical, but measuring something like growth or fermentation with available equipment could work).

Starting Your Investigative Log

You are expected to keep an investigative log (lab notebook or digital journal) from Day 1. In this log, record all your ideas, notes, sketches and questions. For example, list the initial ideas you came up with, notes on what you already know, and any questions you need answered. This log is your personal working document – it will *not* be submitted to the SEC, so you can use it freely to store rough work, but it will be invaluable when you are writing your final report. Your log can be a copybook, binder or a digital file – whatever format you prefer to organise information.

Tip: organise the log by stages or dates, and save sources (URLs, article titles, etc.) here as you find them. Early on, note how you plan to maintain a record of research sources and ideas (e.g. a dedicated section of your notebook for references or a spreadsheet for sources).

Teacher's Role

Your teacher will also be reviewing the brief and may discuss it with the class. They might use prompt questions (like those above) to get you thinking. They will ensure you understand the requirements of the brief and how it connects to the course. Do not be afraid to share your initial ideas with your teacher – they can give feedback on whether you are on the right track, and help spot any misconceptions or overly ambitious plans early on. This is a great time to get feedback before you dive into deep research.

Checkpoint

By the end of Stage 1, you should have:

- A broad idea of one or two areas within the brief's topic that interest you.
- Some initial thoughts on a research question you might investigate and a possible experiment to perform (these will be refined later).
- An Investigative Log started, with notes on the brief, your brainstorming, and a plan for the next steps (questions to research, etc.).

Stage 2: Background Research

What It Involves

Now that you have a general direction, Stage 2 is all about digging into background research on your chosen issue. This stage is typically ~2–3 hours of work, but in practice you might spread it over multiple sessions or weeks. The goal is to become well-informed about your topic:

- What is already known?
- What are the underlying biological concepts?
- What studies have been done?
- What debates or real-world applications exist?

Developing Your Research Question

As you conduct your research, you will refine your focus into a specific research question (or hypothesis) that you will investigate. The Investigation Brief provides a broad context, but now you need to narrow it down to something that you can handle. For example, if the brief is on soil health and you are interested in soil nutrients and plants, your research question might become '*How does the presence of nitrogen-fixing bacteria affect the growth of bean plants?*' or '*Does adding compost improve the biodiversity of soil microorganisms?*'. A good research question is focused, biologically relevant, and testable. It should arise from your background reading – look for gaps or interesting angles in the information you find.

Research Techniques

Use a variety of secondary sources to gather information. These can include biology textbooks, library books, scientific journals or articles, reputable websites (.edu, .org, .gov sites, or known science outlets), documentaries or podcasts, and even interviews with experts if accessible. When searching online, be critical – choose sources that are reliable (e.g. a site like ScienceDirect or Nature for articles, or educational sites like Khan Academy for concepts). Avoid random blogs or forums for scientific facts unless you can verify the information elsewhere.

As you conduct your research, practice good note-taking: summarise key points in your own words and note the source. Try to gather multiple perspectives or findings related to your question. For instance, one article might say one thing and another might disagree – note both. This will enrich your understanding and later help you discuss different viewpoints.

Logging Your Research Findings

Continue using your investigative log to record research findings. It is very helpful to write down quotes or data points along with the source (and page number or URL) immediately. For example, if you read an online article about compost's effect on soil pH, note the facts you learned and paste the URL with the date. If you find a useful statistic or chart, note where it came from. This habit will save you time later on when you are writing your report and need to cite sources.

Make sure to capture the following: *what information you found, where it came from, and when you accessed it*. According to the official guidelines, you should keep download dates and full references for any source. A simple way is to have a 'References' section in your log where you list each source in a consistent format.

Background Research Scope

Do not limit your research only to what will directly feed into your experiment. The BiP Investigation encourages exploring broader scientific and societal contexts of the topic. For example, in researching soil health, you might learn about the ecological importance of microbes, the agricultural implications, or even media discussions about organic farming. These broader insights can help you write a more robust introduction and discussion for your report, connecting your specific experiment to 'the big picture'. It also demonstrates that you have a good grasp of the issue at large, not just the narrow experiment.

Refining Your Question and Setting Goals

By the end of your research phase, try to formulate a clear research question (if you have not already) that your investigation will address. For example, '*What is the effect of X on Y?*' or '*How does X compare to Y in Z conditions?*'. Along with the question, you should define your investigation's goal – essentially, what you aim to find out or demonstrate. This might be phrased as a hypothesis or a prediction if your investigation is experimental. For example: '*I hypothesise that soils with added compost will have a higher earthworm count than soils without compost, because compost provides more organic matter for them to feed on.*' A hypothesis is an educated guess that answers your research question, grounded in the background research you did. (If your investigation is more observational or research-based without a single testable hypothesis, state the objective, e.g. '*To investigate the microbial diversity in compost-treated soil vs untreated soil.*')

At this stage, check in with your teacher. Share your refined question and proposed approach. They can confirm if you are on a good track or if the scope needs to be adjusted (e.g. making sure it is neither too broad nor too narrow). Teachers are also ensuring the authenticity of your work, so having discussions is part of the normal process.

Referencing Sources

As you conclude Stage 2, take stock of the sources you have gathered. The final report will require you to reference any information that is not your own – so start building a reference list now. There is *no single mandatory format* (you can use any standard style, like Harvard or APA, or a simple format) but you must include enough details so that someone can find the source. Typically, you should record the following: Author, year, title, publisher or URL, and page (if applicable). For online sources, include the date you accessed it.

For example, in-text you might cite a fact as '(Smith, 2023)' and then in your references list you will present it as: 'Smith, J. (2023) *Title of Article*, [Online] Available at: <URL> (Accessed 12 March 2026).' If it is a book, it can be presented like this: 'Author (Year) *Title*, Publisher, page number.' The guidelines give examples like an in-text citation for a book page, for example '(p. 57, McLeskey, 2013)' and the full reference in the list. Consistency and clarity are key. This stage is a good time to practice citing in your notes so it will be easier when writing the report.

Academic Integrity

Remember, plagiarism is strictly forbidden. If you copy any text directly, it must be quoted and referenced. Better yet, try to paraphrase (put it in your own words) and then cite the source to show where the idea/data came from. Also note that AI-generated content (if you used any) must be acknowledged too – the brief or SEC guidance will specify how to reference AI tools if you happen to use them for research (e.g. providing the prompt and a shareable link or description). Your research work should ultimately represent your understanding, supported by references.

Checkpoint

By the end of Stage 2, you should have:

- A solid understanding of your chosen topic, with notes from multiple sources.
- A focused research question (the problem you plan to investigate) and possibly a tentative hypothesis.
- A collection of references and sources, all recorded in your log (with details for citation).
- Clarity on how your question fits within the brief's theme and why it is worth investigating. (This rationale will be useful in your introduction.)

Stage 3: Designing and Planning the Experiment

What It Involves

Stage 3 is where you translate your refined question/hypothesis into a practical experimental design. This stage (~2–3 hours) includes figuring out what exactly you will do to gather data to answer your question. You will devise a detailed plan: the materials you need, the procedure to follow, what variables to measure or observe, and how to ensure the experiment is fair and safe.

From Research Question to Hypothesis

If you have not done so already, clearly state your hypothesis at this point. A hypothesis is a testable statement predicting an outcome, based on your research. For example: '*If compost is added to soil, then the height of radish plants will increase, because compost improves nutrient availability.*' This gives you a focused claim that your experiment will test. Not every investigation requires a traditional hypothesis (some might be exploratory), but it is good practice to have one if possible, as it anchors your experiment's purpose. Make sure your hypothesis is underpinned by biological theory (i.e. it makes sense scientifically, given what is known).

Identifying Variables

Break down your experiment into its key variables:

- **Independent variable (IV)** – the factor *you will change* on purpose (e.g. presence vs absence of compost in soil; or different light intensities if you are testing light on growth).
- **Dependent variable (DV)** – the factor *you will measure* as the outcome (e.g. plant height, number of leaves, rate of oxygen production etc., depending on your hypothesis).
- **Controlled variables** – factors *you will keep the same* to ensure a fair test. These could include temperature, volume of water, type of organism, duration of experiment etc., basically anything that could influence the DV other than the IV. For example, if testing compost's effect on plants, you would use the same plant species, same pot size, same amount of water and light for all groups.

To illustrate, consider a sample experimental design:

Variable	Definition	Example (Plant Growth Experiment)
Independent	The factor you change deliberately	Soil treatment (Group A: with compost; Group B: without compost)
Dependent	The factor you measure as a result	Average plant height after 4 weeks (cm)
Controlled	Factors kept constant to be fair	Same plant species (radish), same pot size, 100 ml water every 3 days, 20°C constant temperature, 6 hours of light daily, etc.

Carefully thinking through your variables ensures that your experiment will actually address your research question validly. A fair test means you change only the independent variable and keep everything else the same, so any difference in the outcome can be attributed to what you changed. If an experiment lacks controls, you might not know whether your independent variable or some other factor caused the results.

Experimental Design

When planning, ask yourself the following:

How will I collect data?

Decide what measurements or observations to take, how often, and with what tools. For quantitative data, plan units and instruments (e.g. use a ruler for height in cm, measure time with a stopwatch, count colonies on a Petri dish, etc.). If qualitative observations are important (e.g. behaviour of animals, colour change, etc.), note how you will record those (written descriptions, photos, etc.).

How will I ensure accuracy and precision?

Accuracy means using good techniques and calibrated instruments so measurements reflect true values (e.g. using a balance that is zeroed for mass). **Precision** means getting consistent results; you might improve this by doing multiple trials. Plan to take at least repeat measurements or replicates if possible – for example, have several samples in each group, not just one plant per condition. Repeating the experiment or having a larger sample size increases the reliability of your data.

What could be sources of error, and how to minimise them?

Consider things like measurement error (human reaction time with a stopwatch), variation in biological materials (seeds might germinate unevenly), and environmental fluctuations (temperature changes). While you cannot eliminate all error, you can take steps. For example, measure three times and take an average (to reduce random error), or use the same person to take measurements each time, etc. Acknowledge these in your plan.

Is the experiment feasible with the available resources and time?

List out all materials and equipment you will need. Check with your teacher or lab technician what is available at school. If something is not available, can you improvise or choose an alternative? For example, you might need to use easily accessible materials: maybe kitchen scales instead of a high-precision balance if none is at hand (noting the impact on accuracy). Ensure your plan fits the time window – some experiments might need days or weeks (e.g. plant growth). That is fine as long as you can monitor within the school schedule. The brief is usually designed so that experiments can be done in a reasonable timeframe. If your experiment is lengthy, plan it so that you can still finish before the deadline (e.g. start early, or choose to measure something that does not require months of data). Your teacher will discuss feasibility and may suggest adjustments if, say, your plan would take too long or requires prohibited substances.

What about safety and ethics?

Identify any safety risks (chemicals, microorganisms, heavy objects, etc.). Plan appropriate precautions (wear goggles, gloves, sterilise after handling bacteria, etc.). If your experiment involves living creatures (even plants or small insects), treat them ethically (no causing undue harm, proper care). If any part of your plan involves field work (going outside school), check permission and safety (never go alone to collect samples without informing someone, etc.). Also consider if you need to comply with any rules (e.g. if surveying people, GDPR/data protection might apply; in most school projects, you would avoid human experiments beyond simple surveys).

Laboratory Methods

Write down a clear plan/procedure in your log:

- A step-by-step method.
- A list of materials required (with specifics like concentrations, sizes, etc.).
- Define how you will handle data. (Will you tally counts, use a table to record measurements each day? Prepare this in advance.)
- If applicable, plan any control group or baseline to compare against. In our example, Group B (no compost) is a control to compare with the compost group. Controls help you interpret if the independent variable truly had an effect.

It is a good idea to have everything ready before you actually do the experiment. For example, gather all materials ahead of time. In fact, the guidelines suggest it is good practice to gather and test materials during planning. This might reveal limitations you need to address (e.g. maybe you discover the thermometer you planned to use only reads to the nearest 5°C, which might not be precise enough – so you find a better one, or adjust your plan).

Revisions and Feasibility

Do not be afraid to revise your plan after discussing with your teacher or even as you gather materials. This is normal – scientists often pilot their methods and make changes. Note any changes in your log and why you made them (e.g. 'Decided to use three seeds per pot instead of five due to limited space – will do more replicates with three each instead.'). If some compromise is needed (like using a different species or slightly different method), record that decision and justification in the log. These reflections will be useful when writing up, to discuss limitations or modifications.

Ownership of Design

While your teacher can act as a sounding board, the investigation is yours. Teachers will not give you a full procedure – you design it. They will step in only if something is clearly unsafe or unworkable. This stage really develops your investigative skills, and having ownership means you understand every step of your experiment. If you find yourself stuck on designing a part of the experiment, you can certainly ask for hints or general guidance, but expect questions in return like, 'How do you think you could measure that?' to prompt your thinking.

By the end of Stage 3, you should have a detailed experimental plan and be prepared to start the experiment. Double-check that you have all the required materials and a clear idea of what data to collect. Ideally, also set a tentative timeline for Stage 4 (e.g. 'Day 1: set up experiment; Days 3, 5, 7: record observations; Day 10: conclude experiment'). Coordination with your teacher is important here, because you might need lab time or equipment booking. Teachers might arrange a lab schedule so that different students can use equipment on different days, etc. Be flexible and communicate your needs.

Checkpoint

By the end of Stage 3, you should have:

- A clearly stated hypothesis or objective.
- Identified variables (independent, dependent, controls) and ensured that your design tests the hypothesis fairly.
- A written experimental procedure with all necessary details (materials, steps, how and when to collect data, safety measures).
- Any logistical issues resolved (materials gathered, schedule planned, teacher approval for safety).
- Recorded any design decisions or changes in your log, with reasons. (This reflection can earn credit for showing how you dealt with challenges.)

Stage 4: Conducting the Experiment

What It Involves

Stage 4 is the hands-on execution of your plan. This is where you carry out the experiment as designed, under your teacher's supervision (especially for lab work or fieldwork during class hours). The time required here can vary widely depending on the nature of your experiment – it could be a single laboratory session of 1–2 hours or multiple shorter sessions, or an ongoing observation over days/weeks. The Investigation Brief is designed to allow experiments that can be done in a school context, so while you might need to be a bit flexible, it should be manageable within school resources and time.

Teamwork and Assistance

The BiP Investigation is an individual task – each student must perform their own experiment and submit their own report. However, that does not mean you cannot get help with logistics. In a lab setting, your teacher might allow students to help each other with non-critical tasks for safety or efficiency (e.g. one student might hold a funnel while another pours, or classmates might help time each other's experiments).

This kind of peer support is fine as long as each student is carrying out their own plan and getting their own results. In fact, assisting peers (and vice versa) can be a learning experience in itself for practical skills. Just be sure that you personally do the core parts of your experiment and produce your own data. Your teacher will be ensuring that what you end up analysing is in line with what you planned and carried out yourself.

Recording Data and Observations

Document everything! During the experiment, keep your investigative log or a data sheet handy to record all results. This includes **quantitative data**: all the measurements you take (with units). It is wise to prepare a table beforehand to fill in as you go. For example, if measuring plant heights for two groups over time, have a table with columns for date and height of each plant. Record data immediately as you measure – do not rely on memory.

Qualitative Observations

Record any notable things you see, hear, smell, and feel (safely) during the experiment. For example, 'On Day 3, noticed mould on soil of two pots', or 'Solution turned blue after 2 minutes', or 'Beetles became more active when light was turned on'. These observations can be crucial for explaining results or errors later. If appropriate, take photographs – e.g. a photograph of your experimental set-up or of a result (like a colour change or growth difference). Photographs can serve as evidence and can sometimes be used in your report. (Remember to label and reference them if you do.)

Deviating from the Plan

It is very unlikely that everything will go as planned and that your results are exactly as you expected. If anything in the procedure did not go exactly as planned, write it down. Maybe a spill happened and you had to restart a trial, or one sample got dropped. Maybe you realised halfway through an experiment that you should have shaken a test tube and forgot to. These notes will help you remember later to mention *sources of error or changes* from the plan. They also support something that is very important – the *authenticity* of your work. You are showing that you acknowledged mistakes, or made an important observation during an experiment, or encountered an unforeseen aspect of your experimental procedure. Unanticipated outcomes and procedural errors are a normal part of science. Recording them shows you were observant and honest, and provide you with more to discuss in your report. Consider it an advantage if you encounter them during your project.

Time Management During Experimentation

Depending on your experiment, you might have waiting times (e.g. waiting for seeds to grow, or for a reaction to complete). Use that downtime wisely – you could start organising data, or even begin some preliminary analysis (like calculating averages as data comes in), or work on other aspects of the project (like continuing background research or refining your plan for analysis). The guidelines note that if not all students can do their experiment at the same time (due to limited equipment, etc.), those not actively experimenting can work on other investigation tasks in the meantime. So, stay engaged – if you are waiting for your turn with the microscope, for example, you could be plotting earlier data on a graph or writing a paragraph in your log about how the experiment is going.

Flexibility

Some experiments, especially those involving biological growth or environmental observations, might need to be spread out over days. You and your teacher can adjust scheduling – perhaps you check on your experiment daily for a week during a break or after class, etc. The key is to ensure you ultimately fit within the approximate hours suggested and do not let it drag on too long. If something truly unexpected happens – say an incubator malfunctions or your first attempt fails – discuss this immediately with your teacher. You might get a chance to redo or adjust the experiment if time permits. Scientists often have to adapt, so do not be discouraged if you encounter a setback. Document what happened and how you will proceed.

Teacher's Role During Stage 4

Your teacher will supervise for safety and fairness, but they are instructed not to interfere with how you conduct the experiment unless there is a safety issue. This means if you make an error in procedure or measurement, your teacher will likely let you make it – and let you discover the consequences. This is to ensure the work and learning are truly yours. So, be prepared and confident in your plan, but also ready to handle minor hiccups on your own. Of course, if at any point safety is at risk, the teacher will intervene (e.g. if you are about to mix chemicals unsafely or if you are handling equipment improperly). Always follow lab safety rules (wear goggles/apron, no eating in the lab, proper waste disposal, etc.) and any specific instructions your teacher gave for your experiment.

Authentication

One reason teachers watch the process is to authenticate that the experiment and data are indeed your own work. By Stage 4, you should be following the plan you shared with your teacher. They will note that your data makes sense given what you did. If you suddenly produced data that does not align with the experiment they saw, it would raise questions. Therefore, make sure you have communicated your plan well and then stick to it (or if you have to deviate, let your teacher know and note why in your log). This is all to ensure integrity of the coursework.

After completing the experiment, tidy up as required (especially in a shared lab). Ensure all data and observations are safely recorded. If you used any samples that need ongoing observation (e.g. leaving plants to grow more, or cultures to develop), mark them clearly with your name and store as instructed, and note when you need to check them next.

Checkpoint

By the end of Stage 4, you should have:

- Primary data collected – all measurements, counts, observations recorded in your log or data sheets (with units, labels, dates).
- Any visual records like photographs or sketches of your set-up/results (with annotations).
- Notes on any unexpected events or errors during the experiment.
- If the experiment is not a one-time event (e.g. ongoing observation), a clear record of what has been done so far and what remains to be done (and a plan to complete it).
- Confirmation that you have enough data to analyse in order to answer your research question. (If not, you may need to collect more or adjust – discuss with your teacher promptly if so.)

Stage 5: Data Analysis and Conclusions

What It Involves

With the experiment finished, Stage 5 focuses on making sense of your data. In roughly 1–2 hours (again, this is flexible), you will organise your results, perform any necessary calculations, create graphs or tables, and interpret what the data are telling you. Ultimately, you will draw a conclusion – basically, answer your research question – and see if it supports your hypothesis or not.

Organising Data

First, tidy up your raw data. This might involve the following:

- **Creating tables** that neatly summarise the results. For example, if you have multiple trials or time points, a table can show the average results, ranges, etc. Tables are great for presenting exact values in your report.
- **Calculating** any derived values, e.g. averages, percentages, differences. If you tested a hypothesis 'Compost increases plant height', calculate the average final height for the compost group and the control group. Calculate growth over time if needed, etc. Show sample calculations in your log (and later you can include them in an appendix or describe in the report). Using maths helps quantify differences.
- If relevant, perform any **statistical analysis** you are comfortable with. (This might not be required at LC level beyond basic maths, but if you know a simple statistical test and your teacher says it is okay, you could apply it. Otherwise, identifying trends and differences qualitatively is fine.)
- **Graphs and charts**: it is often easiest to see patterns by graphing the data. Decide on appropriate graph types:
  - For changes over time, a **line graph** is useful (e.g. plant height vs weeks).
  - For comparing groups, a **bar chart** might be clear (e.g. final average height: bar for compost vs bar for control).
  - For relationships between two measured variables, a **scatter plot** could work (if you measured two continuous variables).

  Make sure to label axes (with units) and give each graph a descriptive title. If you are doing this digitally, you can use software (Excel/Google Sheets or other) to make the graphs. Alternatively, hand-drawn graphs on graph paper are also acceptable – just ensure they are neat and accurate. You can later scan or photograph them if you want to include them in the report, or redraw them digitally.

  The emphasis is on clarity – a good graph can make a trend obvious at a glance, which helps you analyse and also helps the examiner follow your results.

Analysing Patterns

With tables and graphs in front of you, examine them critically:

- **Do you see a pattern or trend?** (For example, 'All plants with compost grew taller than those without compost, by about 5 cm on average.' Or 'Enzyme activity increased with temperature up to 30°C, then dropped sharply.')
- **Are there any outliers or anomalous results?** (For example, one sample did not follow the trend. Think about why: was there an error or some condition affecting it?)
- **Consider accuracy and reliability**. How close are repeat measurements? Did you get similar results across replicates or trials (high reliability), or were they very variable? If variability is high, how does that affect confidence in the conclusion? Think about precision too – if differences are very small relative to measurement error, you might conclude there is effectively no significant difference.
- **Identify any sources of error** that could have affected the results. For example, if two of your compost pots grew poorly because they were accidentally placed in a darker corner, note that as a source of error. If measurement was tricky and likely imprecise, acknowledge that. Differentiate between random errors (natural variation or measurement fluctuations) and systematic errors (a consistent bias, e.g. a scale

that always reads +0.5g too high). In your analysis, you might say 'Given the variability in plant heights, results should be interpreted with caution. Possible errors include …, which could explain why sample 3 did not fit the trend.' etc.

- If you had to modify the procedure as you went, **justify** those decisions here. For example, 'After noticing mould in two samples, those were excluded from final analysis and I focused on the remaining samples.'

Drawing Conclusions

Now formulate your conclusion. This is a statement of what the results indicate in relation to your research question/hypothesis. Be specific and base it on the evidence.

If your hypothesis was supported, say so, *and by how much*. For example, 'The hypothesis that compost increases plant growth was supported: plants with compost were on average 5 cm taller than those without after 4 weeks. This suggests compost provided a significant growth benefit under these conditions.'

If the hypothesis was *not* supported or results were inconclusive, explain that. For example, 'The data did not show a clear increase in growth with compost – two out of five compost-treated plants grew taller, but three were about the same as the control. Thus, the hypothesis is not strongly supported. It is possible that other factors like initial seed quality influenced the outcome.'

Sometimes, you might find an unexpected result unrelated to your original hypothesis – note it if it is interesting, but stay focused on your main question for the conclusion.

Crucially, **connect back to the biology**: use your background knowledge to explain why you got these results. For example, 'This outcome aligns with biological theory that nitrogen from compost aids growth, as compost likely increased nitrogen availability, promoting taller plants. The outlier pot that did not grow well might have had poor drainage, showing how waterlogging can stunt growth.' By interpreting scientifically, you demonstrate understanding.

Reflection

After concluding, **reflect** briefly. Does your conclusion answer the research question adequately? Do you feel confident in it? If there were limitations, you might already start thinking: what could be done differently to get clearer results? (This will be discussed in Stage 6, but you can note ideas now.)

It is a good idea at this point to share your analysis and conclusion with your teacher for a check-in. They need to authenticate that your analysis is consistent with the data from the experiment they supervised. This does not mean they will correct your interpretation, but they might ask questions like, 'Do you think that one high result affected your average a lot?' or 'Have you considered why the control had mould?' to prompt deeper thinking. Use this feedback to ensure you have not missed an obvious point.

Checkpoint

By the end of Stage 5, you should have:

- All results summarised in tables or graphs, neatly and clearly. (These will likely go into your report.)
- Calculations performed (with work shown) such as averages or rates, to support statements about the data.
- Identified any trends, patterns or differences in the data and noted them.
- Listed anomalies or unexpected observations and attempted to explain them.
- A clear conclusion answering your research question, with reference to your data (and a note on whether the hypothesis was supported).
- Initial thoughts on evaluation, i.e. the reliability of your conclusion and what might have caused errors or uncertainties. (This will feed into the report discussion.)

Stage 6: Finalising and Submitting the Report

What It Involves

Stage 6 is the final stage of your Biology in Practice Investigation. It is envisaged that you will spend up to **4 hours** compiling your final report.

At this stage, you should draw on your **investigative log** and the work you completed during Stages 1–5 to produce a clear, coherent and authentic account of your investigation. Your report is the document that will be submitted to the State Examinations Commission (SEC) for assessment; your investigative log is **not** submitted.

The report should not simply be a description of your experiment. It should communicate the complete investigative process: your biological understanding, research, experimental decisions, primary data, analysis, conclusions and reflection. The NCCA guidelines emphasise that students should explain how decisions and refinements made during the investigation affected the work, and should link conclusions and judgements back to their research question and hypothesis.

Required Structure of Your Report

The 2027 SEC brief specifies the exact headings that must be used. Your report must contain these **seven numbered sections**:

1. Title and Introduction
2. Background Research
3. Designing and Planning
4. Conducting the Experiment
5. Data and Data Analysis
6. Conclusions
7. References

Each section must begin on a **new page**.

This means that you should not use a generic scientific report structure such as *Methodology – Results – Discussion* in place of these headings. Use the headings prescribed by the SEC.

1. Title and Introduction

Begin with a concise, informative title that tells the reader what you investigated. Your introduction should establish the purpose and biological context of the investigation. It should make clear:

- What aspect of the SEC brief you investigated.
- Your **research question**.
- The purpose of your investigation.
- Your **testable hypothesis**.
- The biological reasoning behind that hypothesis.

Your hypothesis should not simply be a guess. A strong hypothesis is supported by relevant biological theory and by what you learned from your background research. For the 2027 brief, for example, relevant biological ideas could include selectively permeable membranes, concentration gradients, osmosis, water movement and the biological basis of food preservation. Include only the science that is relevant to **your particular investigation**.

2. Background Research

Present the most relevant findings from the scientific research you carried out in Stage 2. Your background research should help the examiner understand the science behind your investigation and how your thinking developed. Include appropriate **secondary data or other evidence** where it contributes to your argument.

Do more than list information from sources. Show that you have:

- Selected information relevant to your research question.
- Compared or considered information from different sources.
- Evaluated the quality, credibility or usefulness of the evidence.
- Used your research to inform your thinking, hypothesis or experimental approach.
- Developed an **evidence-based argument** in response to the brief.

The investigation is intended to combine scientific research from secondary sources with an experiment that generates primary data. Where appropriate, you may also make connections between your investigation and wider biological applications, the work of scientists or issues affecting society.

Remember: Every idea, fact, dataset, diagram or image taken from somebody else's work must be acknowledged using a reference.

3. Designing and Planning

Explain how you designed your experiment and the reasoning behind important experimental decisions.

Include, where relevant:

- The **independent variable**.
- The **dependent variable**.
- Important **controlled variables**.
- Any control treatment or comparison used.
- Repeats or sample size.
- How you intended to collect appropriate primary data.
- The equipment selected and why it was suitable.
- How you planned to improve **accuracy**.
- How you made the investigation a **fair test**.
- Relevant safety precautions.

Do not just provide a list of equipment followed by a procedure. Show evidence of **experimental design and decision-making**.

If your original plan had to be modified because of equipment, time, materials, safety or another practical limitation, this can be useful evidence of scientific thinking. Explain the decision and why the change was made rather than pretending that the original plan proceeded perfectly.

Reflection and refinement are deliberately part of the investigation process. The NCCA guidelines specifically encourage students to explain decisions relating to matters such as equipment, accuracy, limitations and refinements.

4. Conducting the Experiment

Describe what you **actually did**, rather than simply reproducing the plan you originally intended to follow.

Your account should allow the examiner to understand:

- How the experiment was carried out.
- The materials and equipment actually used.
- How the independent variable was changed.
- How relevant variables were controlled.
- How measurements and observations were made.
- How frequently measurements were taken, where relevant.
- How repeats were carried out.
- Any changes made while carrying out the experiment.
- Any unexpected events or observations that affected the investigation.

Use an appropriate scientific style and be precise about quantities, units, concentrations, temperatures, times and equipment where these matter.

An investigation does **not** have to produce the expected result to be a good investigation. Unexpected observations, anomalies, difficulties and experimental errors are part of real scientific work. What matters is that you recognise and evaluate them appropriately. Your report must remain an authentic account of the experiment that you actually conducted.

5. Data and Data Analysis

This section presents your **primary data** and shows what you did with it. Include the relevant quantitative data and qualitative observations that you collected during your experiment.

Present your data clearly. Use suitable:

- Data tables.
- Graphs.
- Charts.
- Calculations.
- Processed data such as means, rates, percentages or percentage changes, where appropriate.

Tables and graphs should have appropriate titles, units and labels. Choose the form of presentation that communicates your findings most effectively. Do not repeat every number from a table in written sentences. Instead, use your written analysis to identify what is scientifically important.

Analyse the data. Look for:

- Patterns.
- Trends.
- Relationships between variables.
- Differences between treatments or conditions.
- Anomalous results.
- Variability in repeated measurements.

Where relevant, consider the **accuracy, precision, repeatability and reproducibility** of the data. The NCCA guidelines specifically identify these, along with calculations, graphs and the investigation of anomalous results, as important features of data analysis.

Do not simply state that an anomalous result occurred. Consider a scientifically reasonable explanation and what effect, if any, it may have had on your interpretation.

Most importantly, explain **what the data mean biologically**.

Because the SEC report structure does not contain a separate heading called *Discussion* or *Evaluation*, your interpretation and evaluation should be placed logically within **Data and Data Analysis** and/or **Conclusions** rather than creating an alternative report structure.

6. Conclusions

Your conclusions should follow directly from the evidence you collected and analysed. Make sure that you:

- Answer your **research question**.
- State whether your results support or do not support your hypothesis.
- Justify your conclusion using your primary data.
- Relate the result to the relevant biological theory.
- Recognise important limitations or sources of error.
- Explain how significant limitations may have affected the results or the strength of your conclusion.

Avoid claiming more than your data demonstrate. For example, an experiment carried out using one food type, over one concentration range and under one set of laboratory conditions cannot necessarily establish what will happen to every food under every condition.

A particularly strong report will demonstrate reflection. Consider significant decisions, limitations or changes that occurred during the investigation and what you learned from them. Where appropriate, you can also identify how the investigation could be refined or extended.

The NCCA's high-level descriptor expects conclusions to be **justified by the data**, related to the hypothesis and accompanied by thorough evaluation of the investigation, including acknowledgement of sources of error.

7. References

Include all sources that you have referred to in your report. You need both:

- **in-text citations**, showing where information has been used, and
- a **reference list**, giving enough information for the source to be identified.

The NCCA does **not require one particular formal referencing style**. What matters is that sufficient accurate information is provided for the reader to identify and authenticate the source.

References may include books, scientific articles, reports, websites, datasets, diagrams, photographs, audio or video material used during your research.

Use of Artificial Intelligence (AI)

Any use of artificial intelligence (AI) must also be acknowledged and referenced in accordance with the SEC Coursework Rules and Procedures. The 2027 brief explicitly states that research sources, **including any use of AI**, must be acknowledged. Material that is not your own and is not properly referenced may be treated as plagiarism.

The NCCA referencing guidance indicates that an AI reference should identify the tool used, the date, and briefly explain how it was used. Where a shareable record of the interaction exists, it should be provided; otherwise, the prompt used should be recorded.

Note: The **References section is not included in the 1500-word limit**.

The 1500-Word Limit

For 2027, your report must contain **no more than 1500 words**. The following are excluded from the word count:

- References.
- Words contained in **data tables**.
- Mathematical or scientific formulae and equations.
- Labels.

The SEC specifically states that clear communication and '**skilful brevity**' will gain marks, while unnecessary length that damages coherence can result in fewer marks. This is therefore not an exercise in writing as much as possible.

Every paragraph should have a purpose. Ask yourself:

Does this help the examiner understand my biology, my research, my experimental reasoning, my data, my conclusions or my reflection?

If not, it probably does not need to be there.

Images, Graphs and Diagrams

You may include a maximum of **20 images**, but the SEC makes clear that 20 is a **limit, not a target**. Use an image only when it improves communication. Suitable material may include:

- Photographs of apparatus or important experimental observations.
- Graphs.
- Diagrams.
- Relevant images from secondary sources.
- Photographs or partial screenshots of hand-drawn or digitally produced material.

Images must **not** be used as a way of inserting extra written text outside the word limit. Videos cannot be included, and the brief advises against including photographs in which people are identifiable. Mathematical and scientific formulae and equations do **not** count towards the 20-image limit.

Reference any image or diagram that you did not create yourself.

Required Formatting for the Report

The SEC has prescribed the formatting. Your final report must use:

- **Arial**.
- **Black text only**.
- **12-point font** for the main body text.
- **1.5-line spacing**.
- **14-point, bold black Arial** for section headings.
- **Portrait orientation**.
- **20 mm margins** on all four sides.
- Page numbers at the **bottom centre** of each page.

Each of the seven sections must be **clearly identified, numbered and begin on a new page**. You may use **bold**, **italics**, **numbering** and **bullet points**.

You may **not** use:

- Coloured text.
- Highlighted text.
- Fonts other than Arial.

No material should extend into the margins, as material outside the permitted area may not be visible to the examiner.

The SEC Cover Page

The SEC provides an official coursework cover page as a Microsoft Word document. You must:

1. Download the official SEC cover page.
2. Complete the required information.
3. Incorporate it as the **first page of your report**.

The SEC does **not** provide a complete report template. You are responsible for creating and formatting the rest of the report correctly. Keep an up-to-date backup of your report while you are working on it.

Biology in Practice Investigation Mark Allocation

You should understand where the 200 marks of the Biology in Practice Investigation are awarded.

The Investigation is worth **200 marks**, or **40% of the overall Leaving Certificate Biology assessment**.

There are four parts (A–D) worth 50 marks each.

Part A – 50 marks

Title and Introduction, Background Research, References

Evidence includes:

- Title, introduction and research question.
- Hypothesis.
- Background research and secondary data.
- Evaluation of secondary data.
- Referencing.

Part B – 50 marks

Designing and Planning, Conducting the Experiment

Evidence includes:

- Experimental design.
- Experimental method.
- Safety.
- Fairness.
- Accuracy.
- Selection of equipment.

Part C – 50 marks

Data and Data Analysis, Conclusions

Evidence includes:

- Experimental observations and primary data.

- Data presentation.
- Data analysis.
- Conclusions.

Part D – 50 marks

Scientific Literacy

Importantly, **Scientific Literacy is not another section of the report**. The brief explicitly states that these criteria should be evident **throughout** your report.

Scientific literacy includes:

- Communication.
- Coherence.
- Relevance.
- Reflective approach.

So do **not** add an eighth section called *Scientific Literacy*. Demonstrate it in the way you write the entire report.

Reflection Should be Visible Throughout

Reflection does not mean adding a vague paragraph at the end saying that you 'enjoyed the investigation'. Scientific reflection involves showing that you thought critically about what you were doing.

For example:

- Why did you choose a particular method?
- Did something happen that caused you to modify the investigation?
- Did your equipment impose a limitation?
- How confident are you in a particular measurement?
- Did your background research change your original thinking?
- What did an anomalous result make you reconsider?
- How did a limitation affect the strength of your conclusion?
- If you refined the investigation, why did you make that change?

The NCCA guidelines describe investigation as an **iterative process** involving review, refinement and reflection, and recommend that students explain how these reflections informed their decisions.

That is the type of reflection that contributes to scientific literacy.

Your Teacher's Role During Stage 6

Your teacher can clarify the requirements of the brief and provide **general, non-directive feedback**.

However, your teacher cannot edit your report, correct it for you and return it for redrafting, or provide model text or answers for you to include. The final report must remain your own individual work.

This is important because authentication of your work forms part of the SEC assessment process.

Final Checks Before Submission of Report

Before you convert your report to its final PDF, check that:

- I have used the seven SEC headings exactly.
- Every section is numbered and begins on a new page.
- My research question is clear.

- My hypothesis is stated and biologically justified.
- My background research contains relevant secondary evidence and evaluates the sources or evidence used.
- I have explained the important decisions behind my experimental design.
- My method describes what I actually did.
- Safety, fairness, accuracy and equipment selection are addressed where relevant.
- My primary data are presented clearly.
- My analysis identifies and explains important patterns, relationships and anomalies.
- My conclusions answer my research question and are justified by my data.
- I have evaluated significant limitations and sources of error.
- Reflection on my decisions and refinements is evident in the report.
- Every source, including relevant images, data and any use of AI, has been acknowledged.
- My reference list contains all sources cited in the report.
- My report contains no more than **1500 words**.
- I have used no more than **20 images**, and every image included has a genuine purpose.
- The document follows all SEC font, spacing, margin, page-numbering and orientation requirements.
- The official SEC cover page is the first page.
- The report is entirely my own authentic work.

Converting and Submitting Your Report

For the 2027 investigation, all coursework must be completed and submitted to your **class teacher by 26 February 2027**.

When the report is finished:

1. **Convert the final document to PDF**.
2. **Print the PDF and proofread the printed version carefully**. This is important: the SEC warns that anything that is not visible on the printed PDF may also be invisible to the examiner and therefore cannot receive marks.
3. When you are satisfied that the PDF is complete, **submit the digital PDF to your class teacher**. Your teacher will advise you on the required filename in accordance with the relevant SEC Schools Portal circular.
4. The school will retain both a printed and a digital copy.
5. Complete the authentication process by signing **SEC Authentication Form P.2**. Your class teacher and school principal will also sign this form.
6. The **school authority**, not the individual student, submits the coursework to the SEC through the Schools Portal.

One Final Principle

A strong Biology in Practice Investigation report is not necessarily one in which everything worked perfectly.

It is one in which you communicate **clearly and honestly** what you investigated, why you made the decisions you made, what evidence you obtained, what that evidence allows you to conclude, and what you learned from critically examining your own investigative process.

Your aim in Stage 6 is therefore not to make the investigation appear perfect. Your aim is to make your **scientific thinking visible**.

Assessment Criteria and Descriptors of Quality

Your submitted report will be assessed by the SEC using specific **Descriptors of Quality** – a **rubric** that outlines what is considered a high, moderate or low level of achievement in various aspects of the investigation. Understanding this rubric can help you aim for the highest level in each aspect. Here is a student-friendly breakdown of the key criteria and what is expected:

- **Knowledge and Understanding**: this criterion looks at how well you engaged with the biological concepts in your investigation, and how clearly and accurately you explained the science.
- **Demonstrate Investigative Skills (Design and Method)**: this criterion evaluates how well you designed the experiment and the quality of your data collection (methodological rigour).
- **Demonstrate Investigative Skills (Analysis and Conclusions)**: this focuses on how well you made sense of your results and what conclusions you drew.
- **Connection to the Work of Scientists/Society**: this criterion looks at how well you related your investigation to the broader context – scientific work or societal issues. Essentially, it is about reflection and understanding why your investigation matters beyond just getting a result.

How to Use the Rubric

When finalising your work, use the above points as a checklist. For each category, ask yourself: *Have I done what the 'High' description says*? For example, did I explain the science clearly (Knowledge)? Did I design a solid method and gather good data (Skills – Design)? Did I analyse thoroughly and discuss errors (Skills – Analysis)? Did I mention why this investigation matters (Connections)? If you can provide evidence in your report for each of those, you are likely hitting the high-achievement descriptors. If you realise you have missed something – say you forgot to mention any societal connection – you can still add a line or two in your discussion to address that.

Keep in mind that **examiners** will look at your report holistically to decide which descriptor best fits each aspect of your work. It is not points-based like an exam; it is judged on overall quality. So, aim to consistently demonstrate good practice throughout. Often, specific examples make a difference: for instance, explicitly stating a hypothesis grounded in theory, or explicitly noting 'One source of error was X, which would affect the results by …'. These show the **examiner** that you are meeting the criteria.

Also, remember the role of your teacher in authentication: they will have observed your work and must sign off that it is yours. If you meet with them regularly and incorporate their general feedback, you are likely covering the bases.

Finally, integrity and originality are crucial. The work must be *yours*. The descriptors assume you are doing your own thinking. Avoid the temptation to copy any part of another student's work or an online source – aside from being unethical, teachers and examiners are adept at spotting copied text or oddly advanced content that does not match your usual style. It could lead to penalties. It is far better to submit a genuine piece of work that might have a few flaws (which you acknowledge and learn from) than a seemingly 'perfect' report that is not authentically yours.

	Level of Student Achievement		
	High	**Moderate**	**Low**
Knowledge & Understanding	You show a **thorough understanding** of the biology involved. You explain concepts correctly and in-depth, using proper scientific terms. If you posed a hypothesis, it is clear, testable, and solidly based on biological theory. You clearly state the **purpose** of your investigation. ***Bottom Line:*** *Your introduction and discussion demonstrate that you know the biology of your topic – you might reference theory from your course or literature. You did not just do an experiment; you understand it.*	You show **good understanding** of the main concepts, though maybe not as in-depth. You describe the biology correctly for the most part. You likely have a hypothesis that is testable (if applicable) and you outline the purpose of the investigation, though perhaps the explanation could be clearer or more detailed. ***Bottom Line:*** *The biology in your report is mostly correct and relevant, but maybe somewhat general or missing connections. Perhaps you explained what happened but not fully why.*	You show **limited understanding** of the concepts. You might only touch on basic definitions or have some inaccuracies. If there is a hypothesis, you might not have formulated it yourself (e.g. you needed a lot of help or you copied one). The purpose of the investigation may not be clearly stated. ***Bottom Line:*** *Your report's scientific explanations are shallow – maybe you only gave a simplistic statement with little explanation, or you misunderstood some key biology. It might read as if you did an experiment without really grasping the science behind it.*
Experimental Design & Method	You demonstrate a **clear, thorough and appropriate experimental design**. Your methods are well-chosen to reliably collect data. This leads to **high-quality data** – meaning your data is sufficient, relevant and well-presented. You likely accounted for variables and followed a logical procedure, resulting in data that can be analysed effectively. ***Bottom Line:*** *Your experiment had a solid plan: controlled variables, multiple trials, careful measurements. The data you gathered makes sense and is clearly tabulated/graphed. There were no obvious flaws in how you carried out the method.*	Your design and methods are **appropriate and clear** overall, though maybe not as exhaustive as the top level. You collected **good quality data** – perhaps a few minor issues, but generally enough to work with and present. There might be some small mistakes or omissions, but they do not severely undermine the investigation. ***Bottom Line:*** *Maybe you only did minimal repeats or had a slight procedural slip, but overall you did a competent job. Your data has some minor gaps or modest variability, yet you can still draw conclusions from it.*	Your investigative design is **unclear or flawed**. Methods may be inappropriate or not well executed, leading to **limited data**. Perhaps you did not control key variables, or you collected too little data, or data is poorly recorded/presented. ***Bottom Line:*** *The experiment might seem ad-hoc or incomplete. For example, you had a plan but did not follow it closely, or you ended up with results that are hard to interpret because of design issues. Maybe you have a lot of missing data, or perhaps the way you did the experiment cannot really address the question.*

Data Analysis & Conclusions	You **draw valid conclusions** that are well-supported by your data. You do not just state results; you interpret them in the context of your hypothesis or question. You also **thoroughly evaluate** your investigation: you identify sources of error or limitations in your design and discuss their impact. Essentially, you show strong critical thinking about what the data mean and how reliable they are. ***Bottom Line:*** *Your discussion section is excellent – you answer the question, back it up with data (e.g. 'As seen in Table 2 …'), and discuss reliability (e.g. 'One possible error was X, which could explain Y'). You demonstrate that you can judge the quality of your own work.*	You **draw reasonable conclusions** that relate to your hypothesis (if you had one). You identify **some potential errors or issues** in your investigation, but the evaluation might not be very in-depth. Perhaps you mention one or two obvious sources of error but miss others, or you state a conclusion but with less explanation of validity. ***Bottom Line:*** *You do conclude something from your results and it is generally supported by the data, though maybe you do not address one odd result that did not fit. You acknowledge at least one limitation like 'sample size was small' or 'measurement error could occur', but you might not explore how that specifically affected your outcome.*	You **draw only limited or no real conclusions** from the data. You might just restate results without interpreting them, or your conclusion does not actually answer the question. You likely **do not identify errors or limitations** (or you might identify the wrong things). ***Bottom Line:*** *Your report might end with 'The hypothesis was correct' or 'The experiment went well' without justification, or 'We learned X' without data backing. There may be no discussion of reliability or any mention of what could have been improved. This suggests a lack of analysis.*
Relating the Investigation to Science and Society	You provide a **considered reflection** linking the outcomes of your investigation to broader issues or the work of scientists. This means you clearly situate what you did in a larger context. For example, you might compare your approach or findings to real scientific research or discuss implications for society (health, environment, technology, etc.). ***Bottom Line:*** *Perhaps in your discussion or conclusion, you noted something like, 'My investigation on compost and plant growth connects to sustainable agriculture practices that biologists and farmers are interested in. It demonstrates on a small scale how adding organic matter can improve crop yields, a concept used by soil scientists in the field.'*	You **reflect somewhat** on how your investigation relates to a scientist's work or a societal issue. You make a connection, but it may be a bit superficial or not fully developed. ***Bottom Line:*** *You might say 'This experiment is similar to what botanists do to test fertilisers' or 'It is relevant for gardeners', but not go much beyond a sentence or two. The idea is there, just not deeply explored.*	You make **limited or no links** between your investigation and the broader scientific or societal context. Maybe you treat the project as an isolated school task only. ***Bottom Line:*** *Nowhere in your report do you mention how this relates to real-world science or why it might be important outside the classroom. It might read as if it is only relevant to your class. Even if the brief had a societal angle, you might have overlooked discussing it.*