

# Biology extended essay

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Extended essay

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*For grade boundary information, please refer to the Grade boundaries for Diploma programme coordinators document available on the PRC.*

## Extended essay

This session there was, as expected, a greater than normal share of theoretical essays (based on secondary data), or in some cases essays based on some minimal lab work supplemented by an analysis and evaluation of secondary data. The assessment per se was not affected, as it has always been a permitted approach.

### The range and suitability of the work submitted

In this session essays were submitted across a wide range of biological topics. These included microbiological studies, plant germination and growth, ecological studies, studies relating to human health and physiology, as well as studies based on specific diseases, biochemical topics and topics related to genetics. The vast majority of essays were based on a suitably biological topic although there were some that were more focused on psychology or medicine than biology. In some exceptional cases the topic could have been suitable but was not given a biological treatment. This resulted in a poor performance against the criteria. Studies involving human subjects were carried out appropriately for the most part with candidates paying careful attention to the ethical requirements including the requirement for informed consent. The biggest difficulty here is that these essays are often based on very small sample sizes with the result that statistical analysis becomes inappropriate. Essays based on the antibacterial effects of various oils and extracts were in abundance and most were done carefully. However, a significant number failed to follow the instructions in the guide regarding incubation temperature and the need to safeguard against exposure to pathogens. Still a majority of essays were based at least in part on some kind of practical investigation involving data collection either through experimentation, interview or survey.

There was a substantial increase in library-based essays based on published data or using online databases that were submitted. It was noticeable through the RPPFs that some candidates had to overcome great personal and organizational struggles to complete their essays. Irrespective of the conditions, it is still possible to achieve the top marks in all the mark bands.

### Candidate performance against each criterion

#### Criterion A: focus and method

Topics were suitably biological in most cases and candidates were able to generate research questions that could be investigated and answered effectively for the most part. Candidates had more difficulty presenting clear, detailed accounts of the methodology in a way that would allow the study to be repeated. In some cases, it was clear that a standard protocol had been accessed and used. In these instances, it is difficult for the candidate to justify the steps taken and show any evidence of informed choices or judgements about the data to be collected or the information to be accessed. Few candidates made an effort to outline the thought process involved in the experimental methodology or to present justification for the approach. More attention needs to be paid to conducting suitable positive and negative controls when performing experiments since without these the line of argument is often very weak and the results are often non valid. Students rarely wrote about the process used for the selection of **published sources so that evidence that the selection was “informed” was often lacking. This weakness**

affected library-based essays significantly and often was coupled with a failure to critically evaluate either the sources themselves or the process of selection (affecting criterion C).

When the bulk of the references are in another language it will affect the mark band for this criterion. The methodology used has to do with the range of sources used and while there is a long bibliography it is also not possible to judge whether there is a suitable or limited range. Since the entries in the bibliography cannot be read then it is also not possible to judge whether the selection of sources was informed.

### Criterion B: knowledge and understanding

Using sources effectively and with understanding is often challenging judging by the difficulties apparent in many essays. Knowledge can be displayed by presenting the appropriate kind of material, gleaned from the sources, and showing how this links to the investigation. This can also be the avenue to displaying a command of the terminology. Doing this with understanding requires diligent and detailed in-text referencing. This is often a weakness in the discussion. Candidates rarely neglect to reference the ideas presented in the background but seem to find more difficulty doing this well in the discussion that follows the data. This is where the real understanding will emerge: How do the data and/or ideas gleaned from the data relate to the published works that have been accessed? Weak essays tend not to use any biological language or to present sophisticated language with no explanation. The use of direct quotation from published sources does not indicate any real understanding on the part of the candidate and rarely improves to overall quality of the essay. There were a few essays where the underlying mechanisms were not clearly explained (rather a brief description was given).

In an essay where there are a few sources in a different language, without translation, this can be tolerated. However, when the bulk of the references are in another language criterion B is certainly affected. It is then not possible to judge whether the sources are relevant and appropriately applied. While knowledge of the topic can be judged it is not possible to judge whether the sources are used effectively which is part of the requirement for this criterion.

### Criterion C: critical thinking

Analysis is often a strength of biology essays with many students able to perform and interpret sophisticated statistics. Occasionally statistics are presented with little understanding. More often the justification for the choice of statistical approach is missing. Graphical and/or statistical analysis on their own, are not sufficient to achieve high levels on this criterion. Some explanation and justification are also needed. Weak essays do not go beyond presenting tabulated raw data in the form of graphs. Relegating important data to an appendix is also a weakness. The discussion and evaluation threads are very **challenging. Since it carries “extra weight” any weakness in this aspect of the essay can have a big impact.** A well-researched essay and thoroughly analysed set of data will not achieve high levels if the discussion and evaluation are not **strong. Many candidates proceed straight into a section that they call “conclusion”** at the end of the data analysis section. This leads to some weak thinking and the failure to develop a **line of argument. A better approach is to have a section called “discussion” where the analysis of the data is** elaborated upon and where preliminary ideas / conclusions are presented. This is also where references should be made to data from studies found in the literature, contrasting and comparing results between **the candidate’s study and the others. Strong essays present evaluation before the “conclusion”.** This approach strengthens the argument since the conclusion drawn at the end can be seen and judged in the light of the evaluation. It is a weakness to leave the evaluation of the research to the end since it then becomes a **“what did I do well” type thinking rather than what are the strengths and weakness of the data** and line of argument (the latter is rarely addressed even in strong essays). Evaluations rarely deal with

sources or give a justification as to how sources were selected and how their suitability and/or reliability was judged.

**A strong evaluation also includes comparing the candidate's results** with results and conclusions from the literature. Any deviation or agreement should be mentioned and evaluated, i.e. given a contextual finding. An evaluation merely focusing on the methodology and the execution of the experiment, will not achieve top marks.

#### Criterion D: presentation

Poor presentation of data in tables and graphs are a feature of weak essays. Strong essays use scientific graphing software and pay attention to significant aspects of the data with clear evidence of choices made by the candidate about how the data appears. Most essays, even weak ones, were able to access a reasonable layout and structure.

A text table of variables, for example, may be tolerated, but using numerous ones throughout the text is not acceptable (especially as a way to circumvent the word count). These factors tend to lower the effective communication of the essay. A few, summarizing graphs or tables with good descriptions are far more effective. However, the great majority of the candidates receive a 3 or 4 on this criterion, even if there are certain factors missing or weak, as long as they do not affect the level of communication.

#### Criterion E: engagement

Reflections are mostly descriptive with the candidate describing the meetings they had with the supervisor and the outcomes of these meetings. This style of reflection is often confined to a description **of what the supervisor "told the candidate to do"**. The quality of the reflection seems to improve through the three stages with more analytical and more evaluative statements in the later reflections. In some cases, the third reflection is more comprehensive and as a result has a bigger impact on the overall judgement of the level. It is difficult to judge engagement from the reflective statements alone and in some cases the supervisor comment gives important context, as does the essay itself. In the case of weaker essays there can be a mismatch between the claims regarding engagement and reflection made by the candidate and the message in the supervisor comment. It is difficult to ignore such a mismatch when arriving at the final level to be awarded.

Many students focus their reflections on their interviews with their supervisors in the 3 different stages of work. This means that the voice of the supervisor is very strong and that of the student much less, mainly at a descriptive level throughout the 3 reflections. They should be focusing on how their work has progressed at each stage, the problems they have encountered, and the solutions tried, some successful and others not.

Personal engagement should be shown through choices made and justification of those choices, challenges met, finding experts to assist in background information, etc. Intellectual engagement includes evaluation of the data.

### Recommendations for the supervision of future candidates

Candidates are in need of ongoing guidance about a number of issues:

- The EE is not an IA and requires a different approach. The EE must be firmly based on published research and must integrate ideas and information gleaned from published sources into the argument.
- Candidates (and supervisors) need to pay attention to the changes in the EE that are in place and be familiar with the current EE guide.

- Candidates need guidance on how to reflect in a meaningful way, moving beyond simple descriptive reflection to more analytical and evaluative ideas.

The following points have been made before, but the message is still not heard in all schools:

- Abstract is not a required component
- The appendix should be inserted after the bibliography
- Table of contents and the bibliography are required components
- The essay should have page numbers
- Raw data tables should be included in the appendix
- All figures included in the essay should have relevant captions.

## Further comments

A similar range of topics and approaches was apparent in this session although some examiners reported that the range seemed to be narrower with many microbiology essays and few truly creative pieces of work. It seems that there are fewer entirely inappropriate or very weak essays although there is a tendency for weaker essays to stray away from biology and become more aligned with human sciences. Some centres submitted essays that addressed aspects of the previous EE model including the submission of an abstract. In other cases, essays are clearly and unduly aligned with the protocol for internal assessment. Practical investigations of this type do not score highly against B and C in particular. In the case of B not enough attention is placed on the knowledge surrounding the investigation as gleaned from the sources **either in the introduction or in the discussion. While this "IA" approach can lead to a strong assessment for some aspects of C (analysis in particular) critical evaluation is often confined to an assessment of the sources of experimental error and rarely addresses broader issues such as the overall research approach or the nature and selection process for the sources accessed. Fewer essays use an extensive appendix, which is a welcome development.**

Many of the same issues continue to be apparent in weaker essays. Failure to adhere to protocols involving incubating microorganisms at a safe temperature, failure to seek and provide evidence of informed consent, failure to provide a cover letter when the data are collected at an outside institution. In some cases, the letters or consent forms provided are inadequate. Weak essays are often based on a small number of sources or inadequate data. Strong essays in terms of the clarity of the work and strength of the line of argument were often but not always accompanied by strong reflections. In some cases, weak essays were able to perform better overall because of some strong analytic and or evaluative reflection.

There was an increase in the number of exceptions raised to the IB. In addition to the frequent breaches of microbiological guidelines, missing supporting letters from the academic institutes where the lab work was performed, experimentation involving humans without consent forms, use of hospital data without patient consent, etc. all seemed to increase.