

Physics extended essay

Grade boundaries

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

Extended essay

The range and suitability of the work submitted

Extended essays (EE) need to have a correct format. Often several issues are found in the documents uploaded, from images missing to issues with the pages numbered or the layout observed. A final proofreading of the work immediately before uploading should prevent this. Most essays presented are suitable EEs in Physics with a clear majority based on experimental investigations. The biggest danger seems to be related to choosing broad topics without a clear narrow focus, a topic with multiple dependent variables chosen unnecessarily, or theoretical issues which go clearly beyond the possibilities or understanding of the students. A few students use simulations or secondary sources instead of hands-on experiments and those options usually paid off as they were quite successful. Topics covered a good range of diversity, from typical lab experiments as factors affecting the formation of craters, oscillations of all kinds, magnets falling and induced emfs, water rockets, thermal conduction or calculations of constants as refractive indices to more personalized experiments related to the personal interests of students, usually connected to sound and musical instruments or sports

Student performance against each criterion

Criterion A: focus and method

The key of this criterion is strongly centred on the research question, so it is vital to give this question a deep thought, both in terms of its choice as in terms of its wording. Although a few students opted for questions that were too broad, either due to the choice of more than one dependent variable or the extensive nature of the topic, most questions seen were appropriate and led to successful investigations. It is important to highlight the pattern observed of trying to justify the investigation with a subjective approach rather than an objective one, where many students fail to highlight the relevant physics principles or do so incompletely. Personal reasons going back to childhood are often irrelevant or just lack any significance at all. It is also desirable that the choice of methodology is explained more in relation to why the methodology was chosen and convenient over others.

Criterion B: knowledge and understanding

The range of knowledge and understanding displayed went from good to excellent. Many essays develop relevant and appropriate theoretical models, however a few tend to skip steps to show the clear understanding of too complex models chosen. It is important to highlight that the knowledge displayed needs to be presented and explained in a way that shows the understanding of the meanings implied in the steps followed. Although not mandatory, it is convenient to work in SI units or justify the use of alternative units if chosen to do so. The use of clearly and carefully annotated diagrams for set-up, theory and analysis is a useful tool of communication and should be part of the student's physics language as part of this criterion.

Criterion C: critical thinking

The quality of the work seen here ranged from adequate to excellent. The treatment of uncertainties in the analysis was most of the time addressed but not always fully justified or explained. Most included a sample of the calculations performed although some still insist in only showing this, inappropriately, in the appendices. A clear trend to rely on statistical analysis is seen, not always effectively handled or appropriately interpreted. The majority of students are able to develop a good reasoned argument with a valid conclusion, but not always do they remember to refer to literary sources, if relevant or available, to frame the investigation carried out. Generally, discussions and evaluations are qualitative, where key problems or limitations are identified but their quantitative impact is not considered or even not consistent with the conclusions presented. Purely empirical investigations without supporting sources tend to score lower than those where a comparison with existing theories can be easily performed. Tables to analyse every aspect of the procedures tend to be performed in a routine fashion, while critical reviews of one's investigation producing convincing essays are seen and prove to be enjoyable to read.

Criterion D: presentation

This criterion usually scores high, although a surprising number of essays are seen with simple format issues, like missing either the topic of the research question on the cover page or not stating the research question appropriately. A few students used a very basic structure and layout and some included an abstract, which is not required. Regarding the structure, the reader-friendly approach must be kept in mind. Listing instruments or equipment or presenting experimental procedures without any attempt to integrate this to the story told is usually seen and does not favour the reading. Excessive use of colour blocks or unreadable legends on diagrams, or lack of proof-reading, are details that can be easily improved. In regards to multiple variables, if chosen, at least this should be carried out by completing one from start to finish and then change, rather than mixing information and analysis that tends to obscure the results and the findings. It is convenient and advisable to take into account and plan the presentation early in the investigation instead of waiting until the last stage to organize it.

Criterion E: engagement

The communication seen in this criterion was most of the time at least good with some excellent, fluid and vibrant texts. As usual, the advice goes in the line of suggesting students to take notes related to the key steps and decisions made, representative of the thinking involved, to provide specific examples in the reflection process communicated.

Recommendations for the supervision of future students

Read both previous EEs and scientific papers to become familiar with the structures and lines of thinking needed while getting ideas of what to do. Once a topic is chosen and narrowed down, try to word the research question in a way that can be clearly communicated and try it on by explaining it to someone else, to judge its appropriateness. Proofread the work, once produced, reading it all holistically as to judge on the flow of the text and the clarity of the presentation written.

Further comments

The whole process of the EE should be enjoyable for the student, and that will be a fact if the topic chosen and the research question narrowed are given a deep thought until decided. Then, telling the story as

carried out explaining clearly what was meant to investigation and what was reached are the key aspects to consider