

- The internal assessment criteria
- Guidance for the use of the internal assessment criteria

Assessed student work

- Overview
- Investigation 1: The real and the apparent positions of the stars in Orion (Database and spreadsheet)
- Investigation 2: Investigating the lift force of a toy helicopter (Hands-on)
- Investigation 3: Obtaining Wien's displacement law of electromagnetic radiation (Simulation)
- Investigation 4: Investigating the force on an electric charge moving through a magnetic field (Simulation)
- Investigation 5: Determining solar characteristics using planetary data (Database)
- Investigation 6: Physical and mathematical models of the greenhouse effect (Hands-on and mathematical models)
- Investigation 7: Exploring the relationship between the pressure of the ball and coefficient of restitution (Hands-on)
- Investigation 8: The exponential nature of a bouncing ping-pong ball (Hands-on and modelling)
- Investigation 9: Investigation water depth pressure (Hands-on)
- Investigation 10: How temperature affects the vibration rate of a tuning fork (Hands-on)

Appendix

- Changes in the syllabus content

Investigation 3: Obtaining Wien's displacement law of electromagnetic radiation (Simulation)

To view the various elements of this example, please use the icons at the side of the screen.

Note: The comments in the annotated examples match the labelling on teacher forms.

Examiner comments

| | Personal engagement | Exploration | Analysis | Evaluation | Communication | Total |
|---|---------------------|-------------|----------|------------|---------------|-------|
| | x/2 | x/6 | x/6 | x/6 | x/4 | x/24 |
| 2 | | 6 | 6 | 5 | 4 | 23 |

Personal engagement

This criterion assesses the extent to which the student engages with the exploration and makes it their own. Personal engagement may be recognized in different attributes and skills. These could include addressing personal interests or showing evidence of independent thinking, creativity or initiative in the designing, implementation or presentation of the investigation.

Mark

Descriptor

The evidence of personal engagement with the exploration is clear with significant independent thinking, initiative or creativity.

- 2
- The justification given for choosing the research question and/or the topic under investigation demonstrates **personal significance, interest or curiosity**.
 - There is evidence of **personal input and initiative** in the designing, implementation or presentation of the investigation.

Moderator's comment

- Moderator's award
- 2
- The student is focused and clearly interested, even excited, about the investigation. The student found inconsistencies in several textbooks and wanted to clarify these. There is evidence of enthusiasm, passion and independent thinking. This approach shows initiative and curiosity, and this kind of involvement is encouraged in internal assessment work.

Exploration

This criterion assesses the extent to which the student establishes the scientific context for the work, states a clear and focused research question and uses concepts and techniques appropriate to Diploma Programme level. Where appropriate, this criterion also assesses awareness of safety, environmental, and ethical considerations.

| Mark | Descriptor |
|------|--|
| 5–6 | <ul style="list-style-type: none"> • The topic of the investigation is identified and a relevant and fully focused research question is clearly described. • The background information provided for the investigation is entirely appropriate and relevant and enhances the understanding of the context of the investigation. • The methodology of the investigation is highly appropriate to address the research question because it takes into consideration all, or nearly all, of the significant factors that may influence the relevance, reliability and sufficiency of the collected data. • The report shows evidence of full awareness of the significant safety, ethical or environmental issues that are relevant to the methodology of the investigation.* |

Moderator's comment

- Moderator's award
- 6
- This is an interesting, relevant and engaging investigation. Various sections clearly and concisely state the relevant scientific context, and this dovetails nicely with the physics syllabus. The student researched this well and mentions a number of interesting applications of Wien's law. The graphs, data selection and method of analysis are all appropriate and what one would expect. Although the use of a simulation for the investigation (compared with a hands-on investigation) was not addressed in depth, the

student was keen to use a simulation to establish the proportionality constant. As a hands-on experiment, this is something that is not normally done in high school, so the use of a simulation is most appropriate; moreover, the student appreciated the limitations of using a simulation. In this context, the student was justified in making use of a simulation. There are no significant safety or ethical issues here.

Analysis

This criterion assesses the extent to which the student's report provides evidence that the student has selected, recorded, processed and **interpreted** the data in ways that are relevant to the research question and can support a conclusion.

| Mark | Descriptor |
|------|--|
| 3–4 | <ul style="list-style-type: none"> The report shows evidence of some consideration of the impact of measurement uncertainty on the analysis. |
| 5–6 | <ul style="list-style-type: none"> The report includes sufficient relevant quantitative and qualitative raw data that could support a detailed and valid conclusion to the research question. Appropriate and sufficient data processing is carried out with the accuracy required to enable a conclusion to the research question to be drawn that is fully consistent with the experimental data. The processed data is correctly interpreted so that a completely valid and detailed conclusion to the research question can be deduced. |

Moderator's comment

Moderator's award 6

There is no doubt that the student has selected, recorded, processed and then interpreted the data in a way that directly addresses the question. The range of data is adequate (indeed, with a simulation the range may or may not be a significant issue). The accuracy of the data was appreciated when the student rejects a simulation with an analogue scale. The student exaggerated the precision of the reciprocal of wavelength but did not use this in the conclusion. The gradient and origin off-set were used as a measure of uncertainty when compared with theory, and this approach is often appropriate when working with simulations. When the student states that the uncertainty is an academic exercise, he or she is in full awareness of the limitation of a simulation. In such cases we would not expect the assumption of the last count as the uncertainty in the raw data. Such detail might move the focus beyond the research question and into traditional lab analysis methods, which are not relevant here. Finally, in this type of investigation there is no call for qualitative data. Despite one bullet point falling in the 3–4 markband, the best-fit method is still applied.

Evaluation

This criterion assesses the extent to which the student's report provides evidence of evaluation of the

investigation and the results with regard to the research question and the accepted scientific context.

| Mark | Descriptor |
|------|--|
| 3–4 | <ul style="list-style-type: none"> The student has described some realistic and relevant suggestions for the improvement and extension of the investigation. |
| 5–6 | <ul style="list-style-type: none"> A detailed conclusion is described and justified which is entirely relevant to the research question and fully supported by the data presented. A conclusion is correctly described and justified through relevant comparison to the accepted scientific context. Strengths and weaknesses of the investigation, such as limitations of the data and sources of error, are discussed and provide evidence of a clear understanding of the methodological issues involved in establishing the conclusion. |

Moderator's comment

| | |
|-------------------|---|
| Moderator's award | <p>The student's conclusion of the investigation clearly addresses the research question and it appreciates in a qualitative sense the degree of accuracy. However, strengths and weakness are not given the depth that one would like, although there is the expression of the academic nature of the simulation results. Perhaps expecting more is beyond the scope of a simulation exercise. No improvements are mentioned, although the student considered this aspect and a relevant extension was suggested, therefore the bullet item relating to improvement and extension may be an outlier. We can read between the lines a justification for the conclusion in terms of accuracy and theory, so the student has the benefit of doubt here. The student has done well and addressed all the bulleted items.</p> |
| 5 | |

Communication

This criterion assesses whether the investigation is presented and reported in a way that supports effective communication of the focus, process and outcomes.

| Mark | Descriptor |
|------|--|
| | <p>The presentation of the investigation is clear. Any errors do not hamper understanding of the focus, process and outcomes.</p> |
| 3–4 | <ul style="list-style-type: none"> The report is well structured and clear: the necessary information on focus, process and outcomes is present and presented in a coherent way. The report is relevant and concise thereby facilitating a ready understanding of the focus, process and outcomes of the investigation. The use of subject specific terminology and conventions is appropriate and correct. Any errors do not hamper understanding. |

Moderator's comment

Moderator's award The report is well written, organized and fully documented. It is a little excessive in places, however, but one can feel that the student was enjoying the work. The Wilhelm Wien historical section is not required but adds some interesting background.

4 Terminology and scientific conventions are properly followed, and the purpose and outcome are clearly presented. The moderator feels that the 3–4 markband is most appropriate for this interesting and nicely presented investigation and the mark awarded here is based on the idea that a 4 does not mean perfection.



Student work (PDF)



Annotated student work (PDF)



Examiner comments

© [International Baccalaureate Organization](#) | [Mission statement](#) | [Learner profile](#)

