

- 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 6: Physical and mathematical models of the greenhouse effect (Hands-on and mathematical models)

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	5	5	4	22

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

The student demonstrates a strong interest in a nicely focused and thoughtful project. We can tell that this is a worthwhile investigation for the student and he or she does an excellent job at expressing the details. The creativity and independent thinking come from the extrapolation of the relevant information and its use in the exploration.

2

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
3-4	<ul style="list-style-type: none"> • The methodology of the investigation is mainly appropriate to address the research question but has limitations since it takes into consideration only some of the significant factors that may influence the relevance, reliability and sufficiency of the collected data.
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 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

The student nicely introduces and explains the topic, and then described a well-defined set of research issues: a qualitative demonstration of the greenhouse effect and then four mathematical models that adjust the variables' parameters to illustrate the resulting effects. Perhaps the student should have considered only one or two models and taken them into more depth and detail. However, for an internal assessment what the student

6

did is admirable. The methodology, given the limited nature of modelling, is most appropriate and indeed proves interesting. However, many of the other significant factors that may influence the relevance, reliability and sufficiency of the data are not addressed. Given the nature of a demonstration and modelling, it is impossible to address all the relevant factors, but the student is well aware of this.

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
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 report shows evidence of full and appropriate consideration of the impact of measurement uncertainty on the analysis. • 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
 First research topic: The analysis of the soda bottle demonstration is appropriate and detailed. The data allows the intended conclusion to be reached. Accuracy and uncertainties are not relevant, so this descriptor is somewhat an outlier here. The mention of a cloud overhead or thermal noise is all there is for an awareness of the impact of uncertainties, but again for this type of research question such a concern is minor. We can say that the greenhouse and the enhanced greenhouse effects have been demonstrated, hence providing a valid and detailed conclusion.

5
 Second research topic: The analysis of the mathematical modelling has also been successful. The descriptors under analysis need to be interpreted in the light of what would be appropriate here. For sure, the selected data based on relevant equations is good, and it is processed and graphed most appropriately. The results are interpreted according to the intended research questions, but the interpretation is basic or rather limited. Perhaps just one model and going into more depth with it would have been more interesting. Accuracy is not an issue here nor is the impact of uncertainties as they provide a comparison to accepted models.

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"> Strengths and weaknesses of the investigation, such as limitations of the data and sources of error, are described and provide evidence of some awareness of the methodological issues* involved in establishing the conclusion. 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.

Moderator's comment

Moderator's award	<p>First research topic: The student's investigation worked well and was repeated with similar results. Subtle variations in the graphed data were addressed and a simple but relevant conclusion was stated. No uncertainty analysis is needed in this type of lab, but the student mentioned sources of error. The moderator appreciated the point in a graph where a cloud came overhead. Interesting extensions were mentioned. Using the best-fit method of assessment for the first topic, the moderator finds nothing to fault.</p>
5	<p>Second research topic: Here we have a series of mathematical models. The results illustrated the given equation, and the data range and graphs were all appropriate. Some interesting results were obtained and briefly commented upon. The limitation of an equation model was appreciated. Although the student addresses all the descriptors under evaluation for the modelling investigation, more attention to the conclusions would be needed for the top mark. Perhaps the teacher should have guided the student to work with just one model and follow this into more detailed analysis. Overall, the mark here is clearly high, and the moderator decided on level 5.</p>

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
3–4	<p>The presentation of the investigation is clear. Any errors do not hamper understanding of the focus, process and outcomes.</p> <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
award

Moderator's comment

4

The style and form of the report fully illustrate effective communication of a focused and purposeful rationale. The process and outcomes are clearly presented, and all scientific terms and equations are explained, even the Excel equations.



[Student work \(PDF\)](#)



[Annotated student work \(PDF\)](#)



[Examiner comments](#)

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

