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| **IB Physics Internal Assessment**  **Comments on Student Script “F”**  Research Design, Data Analysis, Conclusion, Evaluation | SafariScreenSnapz001.tif |

**“How the drop height of a metal ball affects the**

**diameter of a crater formed in fine sand”**

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| --- | --- | --- | --- | --- |
| **Research**  **Design 0 – 6** | **Data**  **Analysis 0 – 6** | **Conclusion**  **0 – 6** | **Evaluation**  **0 – 6** | **Total**  **0 – 24** |
| **6** | **6** | **6** | **6** | **24** |

#### Research design assesses the extent to which the student effectively communicates the methodology (purpose and practice) used to address the research question

**Research Design Assessment** is at the top, Level 6.

**Research Design 1st Descriptor**

The aim of the investigation is to derive a theoretical relationship and then to experimentally confirm this. The first section of the report states an interesting and focused research question, with variables, and a statement of the conclusion.

**Research Design 2nd Descriptor**

The methodology is nicely explained, with detailed and thoughtful comments about procedures. For example, the student takes care when measuring the crater diameter by incorporating a lamp to produce a shadow. The theory section is excellent, clear and focused. The range is sufficient and three repeated values is acceptable.

**Research Design 3rd Descriptor**

This investigation can be easily reproduced. Although the Method section is brief it is to the point and detailed. No serious safety issues are relevant here.

#### Data analysis assesses the extent to which the student’s report provides evidence that the student has recorded, processed and presented the data in ways that are relevant to the research question.

**Data Analysis Assessment** is the top level again, Level 6.

**Data Analysis 1st Descriptor**

The raw data is recorded in a clear and precise way. The data table includes quantity, symbol, units, and uncertainties with units. For simple processing, like averaging, we do not expect an illustration. Often such basic functions can be done in a spreadsheet.

**Data Analysis 2nd Descriptor**

Uncertainties are appreciated in all aspects of this investigation. Although the student indicated the least count for the individual diameter measurement uncertainties, they express the difficulties in making such measurements and increase the uncertainty to a larger value, a value larger than the traditional one-half the range value. Detailed comments explain the treatment of uncertainty, and uncertainty bars are included for the dependent variable when graphed. Minimum and maximum gradients are constructed properly and clearly appreciated. Uncertainties with logs is explained. The student is overly cautious with their final uncertainties but self-justified. The examiner thinks the data is better than what the student believes. Overall, an excellent appreciation of uncertainties.

**Data Analysis 3rd Descriptor**

The series of graphs is an interesting way to process the data. Perhaps a log/log graph from the start would have been easier, but the student’s approach is clearly explained and properly understood. The log-log graph comes later in the report. In all respects the analysis stays focused on the research question and the theory developed. A more appropriate and accurate approach is hard to imagine.

#### Conclusion assesses the extent to which the student successfully answers their research question with regard to their analysis and the accepted scientific context.

**Conclusion Assessment** is again at the top level. Level 6.

**Conclusion 1st Descriptor**

The conclusion nicely aligns with the derived theory and the data. The quality of data is surprising, as one would expect more variation. However, the student demonstrated a most thoughtful, careful, insightful, and determined investigation. A true scientist. Errors and uncertainties were appreciated in a relevant way.

**Conclusion 2nd Descriptor**

The student’s results were justified both within the derived theory (amazing, the fourth power was a legitimate theory) and in a larger scientific context. The student was aware of the limitations and specificity of their investigation. Other similar investigations obtained different exponential powers, and this was acceptable because there are numerous parameters that influence the investigation.

#### Evaluation assesses the extent to which the student’s report provides evidence of evaluation of the investigation methodology and has suggested improvements.

**Evaluation Assessment** is also 6. Top marks are for student who address all the descriptors statements in a competent and insightful way. Top marks do not mean perfection.

**Evaluation 1st Descriptor**

The student correctly addressed the key issues relating to both the theory and the experimental results. Procedures issues were identified. Although the basic method of dropping a mass on sand was not evaluated, it seems to be the best method for investigating craters when resources are limit to the physics classroom. The scope and limit of the study was nicely appreciated.

**Evaluation 2nd Descriptor**

Realistic and relevant improvements were explained. The IB does not expect an exhaustive list of improvements, but rather an appreciation of one or two key issues affecting the experimental results. The “Problems and Improvement” section cover this.

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07 August 2024