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

**“Diodes and Temperature”**

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| **Research**  **Design 0 – 6** | **Data**  **Analysis 0 – 6** | **Conclusion**  **0 – 6** | **Evaluation**  **0 – 6** | **Total**  **0 – 24** |
| **5** | **5** | **6** | **4** | **20** |

#### 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 in the top mark band because of the appropriate details and operational approach. There is some ambiguity in the text and the specific context of temperature (key to the RQ) was not addressed. We can award level 5 as best fit.

**Research Design 1st Descriptor**

The **first descriptor** addresses the research question or topic, the aim of the study, as well as a specific and appropriate context. The basic nature of a diode (functional, not the quantum mechanical aspects), the context in the real world, and then the research question were all nicely addressed. Reference is given to an authoritative context so that the hypothesis is well known. However, the specific context of temperature was not addressed (indeed, there is a known equation relating temperature to the function of a diode; this should be included).

**Research Design 2nd Descriptor**

The **second descriptor** addresses methodological considerations associated with collecting relevant and sufficient data to address the research question. The method and procedures are described. Measurements over a temperature range are mentioned. Each temperature is tested three times, and this is what step 7 in the Method is telling us. However, how do we know the temperature is precisely the same for repeated measurements or perhaps the voltage adjustments repeated at the given temperature. Is there a delay between repeated measurements? Risk assessment is addressed. The student tells us that the current is controlled to minimize heating of the diode. Isn’t that the purpose here? The voltage is variable, as it needs to be to get the required data, and yet the schematic does not show this. Voltage does not “go through” the diode. Despite some confusions, we know what is going on. A little more detail would have been helpful.

**Research Design 3rd Descriptor**

The **third descriptor** addresses the details needed to reproduce this investigation. As mentioned just above, we know what is going on and yet there are some ambiguities.

#### 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 a solid level 5. Some examiners might want to give this criterion top mark, but 5 is still in the top mark band. More appreciation of raw data uncertainties is expected. Although minimum and maximum gradients could have been attempted, the student addressed the meaning of the gradient with an appropriate degree of uncertainty.

**Data Analysis 1st Descriptor**

The **first descriptor** addresses the communication of the recorded and processed data. Both the raw data and the processed data tables are clear and precise. Table 2 (page 3), the raw data, should include uncertainties. The basic method of determining processed uncertainties is expressed, but there should be a level of uncertainty in the determination of the threshold voltage itself, not just one-half the range of three measurements.

**Data Analysis 2nd Descriptor**

The **second descriptor** addresses the appropriate processing of data and the consideration of uncertainties. One-degree uncertainty (“± 1°C”) for temperature with a precision of a tenth of a degree was nicely justified. However, it should have been written as “±1,0°C” to be consistent with the data. The ±0,01 V uncertainty is justified but experience tells the examiner there is slightly more variability here. Uncertainties for the dependent variable are graphed. The treatment of uncertainties follows the basic method expected at the IB level. Uncertainty bars were graphed but no attempt at determining minimum and maximum gradians is made. Doing so would have been helpful in the conclusion. The student addresses the issue accurately although without too much detail.

**Data Analysis 3rd Descriptor**

The **third descriptor looks** at the data analysis as to how it supports the research aim. The focus of the analysis directly addresses the reach question, and the graph is appropriate. However, an uncertainty in the gradient was missing, as this is an essential part of the analysis.

#### 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 Level 6. The student nicely addresses the assessment expectations.

**Conclusion 1st Descriptor**

The **first descriptor** addresses the conclusion and how well the interpretation and analysis of the data supports the conclusion. The student’s reading of the data as graphed is insightful. The correct interpretation of the temperature coefficient is understood. And the data is excellent (although lacking an uncertainty range in the coefficient). The negative 2 mV per C° is confirmed.

**Conclusion 2nd Descriptor**

The **second descriptor** addresses the justification for the conclusion within accepted scientific knowledge. Not only does the conclusion answer the research question, but the numerical value of the temperature coefficient is confirmed by the commercial value. We can say the conclusion is justified by both the analysis and the accepted scientific context. The lack of an uncertainty here was criticized under Data Analysis.

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

**Evaluation Assessment** earns a **best-fit** assessment at level 4. The student made a minimal effort at an evaluation of the methodology (mostly looking at the data). However, the temperature of the diode in the oil plus internal heating was mentioned and was relevant. The descriptors do not nicely align with the student’s work in this IA example. Teachers should make sure students understand the criteria expectations and follow these as guidelines when writing a report.

**Evaluation 1st Descriptor**

The **first descriptor** addresses the evaluation of the methodology and explains the impact of methodological and procedural weaknesses and limitations. The methodology as such was not addressed because of the good data. It was a simple method, but one could imagine another method of heating and a datalogging method of obtaining data. The student focused on the high quality of data and the consistency with the accepted value. A distinction between the coefficient with resistance and with voltage was appreciated. One procedural issue was mentioned. Reaction time in the collection of data and a variable temperature (cooling down in the moments data was recorded) was observed as a random error. This counts as recognizing a weakness. The systematic error suggested was not properly understood.

**Evaluation 2nd Descriptor**

The **second descriptor** addresses the possible improvements to the issues explained in the first descriptor. There was no suggested improvement for the recognized random error mentioned above. A systematic error of the diodes internal resistance was mentioned. It was suggested to be insignificant (within one degree for an error bar). It is more likely to be a property of the diode and not affecting the gradient of the graph (hence not affecting the coefficient value).

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07 August 2024