

## PHYSICS - Sample B Youngs modulus

**TOTAL MARKS (out of 24) FOR THIS INVESTIGATION = 16**

**PERSONAL ENGAGEMENT: Best-fit Mark = 1**

**Evidence of personal engagement:** PE is hard to tell with this investigation because there are so many online reports about the same experiment. There is nothing unique or special here. The lack of clear understanding suggests that the student is following detailed procedure. There is much over-thinking, and too much detail following a cookbook approach; does overthinking qualify as PE? Not in this case. (Markband 1)

**Justification given for research question:** There is no evidence or reason for the given investigation. In fact, it takes about 8 pages before a defined research question appears. (Markband 0)

**Evidence of personal input and initiative in designing, implantation or presentation:** Again, this is very hard to determine as a quick Google reveals dozens of details lab instructions on Young's Modulus. However, because of the attention to so many details the moderator suggests that there is a hint of evidence here for initiative. (Markband 1)

**EXPLORATION: Best-fit Mark = 3**

**Topic of investigation identified, research question described:** The topic is clear, the title provides a research question, and by page 8 a detailed research question is given. Focus and clarity are weak as the student waffles around somewhat. It is never clear why the student does this. (Markband 5)

**Background information:** Apart from Wikipedia there is no in depth appreciation of the theory. Indeed, what is explained appears to be paraphrased from the Internet. No genuine understanding is apparent, but we do know the quantities in the equation, so this descriptor earns something. (Markband 1)

**Appropriate methodology, consideration of reliability and sufficiency of data:** Given the situation, five masses and three repeated reading seems basic appropriate. The controlled variable of placing masses in the same position is missing, and this is important. (Markband 4)

**Evidence of significant safety or environmental issues:** A brief survey of the same experiment online reveals safety issues in all commentaries. The student failed to recognize this, although not too serious of an issue. (Markband 0)

## ANALYSIS: Best-fit Mark = 5

**Sufficient raw data for a valid conclusion:** There is basic but sufficient raw data to support a detailed conclusion with an appropriate uncertainty given the limited scope of this investigation. (Markband 6)

**Data processing, accuracy and consistent:** Processing was done in an appropriate way but there were some inconsistent significant figures expressed. (Markband 5)

**Impact of uncertainties on the analysis:** There was detailed appreciation of the impact of uncertainties. Uncertainties as a percentage was kept at 3 significant figures in order to round off final values. We allow some leeway with SF here. Perhaps markband 6 but the moderator went for 5. (Markband 5)

**Interpretation of processed data:** More appropriate analysis. The uncertainty in the graph gradient is probably larger than the data suggests, but the student is following a basic high school method here. The final uncertainty should have been written to only 2 (not 3) significant figures, but this alone does not harm the level of achievement. (Markband 5)

## EVALUATION: Best-fit Mark = 4

**Conclusion statement, detailed, justified and supported by data:** A numerical value is started with uncertainty. This is nicely done. The conclusion is indeed supported by the data. (Markband 6)

**Conclusion and accepted theory, described and justified:** There is no attempt to determine if the value is reasonable or not. The teacher when reading the first draft should have addressed this. (Markband 0)

**Strengths and weaknesses, limitations of data and method:** The student has given this a lot of attention, some relevant and detailed comments but some other comments are superficial and others are not related directly to the overall data analysis. (Markband 4)

**Realistic and relevant improvements and extensions:** Some appropriate comments are made in line with the strengths and weakness, but often they are over thought. There are no extension comments other than another ruler might have a different value. What about placing the weights at a different position in the same ruler? Would the same conclusion be reached? Moderators will read the expectation of “extensions and improvements” as “extensions or improvement” if either aspect is thoroughly addressed. (Markband 4)

## COMMUNICATION: Best-fit Mark = 3

**Presentation of investigation and errors affecting understanding, focus and outcome:** Although we understand the purpose and the logical flow is relevant there is still the feeling that it could be better focused. There is too much waffle (technical details, redundant comments) in the various sections. (Markband 3)

**Report structure, focused and coherent:** The sections flow, and the material is presented in a coherent way. The weakest part is the beginning of the investigation, where the student should have explained Young's Modules in their own words and what and why they were doing this investigation. There are a few sentences that are confused. All the other investigation information is there. (Markband 3)

**Report relevance, concise, focus on outcome:** Although the many details can be seen as focused, much of the report is far from concise. What is going on, however, is understood. There is no penalty for brevity. (Markband 3)

**Terminology, subject specific:** Although the student correctly follows the technical terminology, the reader nonetheless feels that the student is not totally aware of the meaning of what is going on, other than procedural concerns. The vertical displacement of the metre stick is not a 'bend' as such. A number of sentences are confusing, such as "When weights are added, the lengths of the meter ruler nearer the table will not bend as much as the lengths of the ruler at the edge." The instructions are far too wordy. Nonetheless, the ambiguities do not hamper the overall understanding. (Markband 3)