

Commentary on candidate 2 evidence

Assessors awarded the candidate evidence the following marks for each section of the project.

Abstract

Section 1 A brief abstract stating the main aim(s) and overall findings/conclusion(s)

The candidate was awarded **1 out of 1 mark** because the aim and findings are consistent with the main project.

Introduction

The candidate was awarded **5 out of 5 marks** for this section.

Section 2(a) A clear statement of the aim(s) together with relevant hypotheses

The candidate was awarded **1 out of 1 mark**.

- Independent variable = turmeric concentration
- Dependent variable = penicillin's inhibition of *M.luteus*
- Inhibition = prevents growth
- Hypothesis is directional

Section 2(b) An account of the underlying biology, with justification of the biological importance of the project

The candidate was awarded **4 out of 4 marks**.

- Relevance – the underlying biology is relevant to the aim.
- Clear and accurate – the candidate presents and explains a complicated story, and specific explanations are clear.
- Appropriate depth – significantly above Advanced Higher level.
- Importance justified – in paragraphs 2.3.4, 2.3.5, and 2.3.7, the candidate links the outcome of their experiment to further application in the future.

Procedures

The candidate was awarded **7 out of 9 marks** for this section.

Section 3(a) Procedure(s) are appropriate to the aim(s)

The candidate was awarded **1 out of 1 mark** because the procedure is appropriate to the aim. The pre-treatment of both removes disc-diffusion issues, as penicillin concentration remains constant.

Section 3(b) Procedure(s) described in sufficient detail to allow the investigation to be repeated

The candidate was awarded **1 out of 2 marks**.

- **1 mark** was awarded because the procedure was described in sufficient detail to allow it to be repeated.
- **0 mark** was awarded because the dependent variable isn't clear in terms of measurements taken, so the second mark was not awarded.

The independent variable is clear, although 100% turmeric solution is actually 100% of a 4.4% stock solution (this was not penalised).

Section 3(c) Appropriate controls are identified

The candidate was awarded **1 out of 1 mark** because the removal of turmeric as a negative control is appropriate for the aim.

Section 3(d) Control of confounding variables is described

The candidate was awarded **0 out of 1 mark** because the temperature for the two-hour interaction of broth with different turmeric concentrations could and should have been controlled but was not described as such.

Section 3(e) Sample size is appropriate

The candidate was awarded **1 out of 1 mark** because four discs per plate is acceptable. Each penicillin disc is independent from the other three.

Section 3(f) Independent replication is described

The candidate was awarded **1 out of 1 mark** because the way in which independent replication was achieved is fully detailed, by describing the use of fresh solutions and new discs.

Section 3(g) Description of how the pilot study informed the development of the final procedure(s)

The candidate was awarded **1 out of 1 mark** because they clearly described the changes/improvements to inform their final procedure in light of their piloting.

Section 3(h) Procedures show complexity, creativity or accuracy

The candidate was awarded **1 out of 1 mark** because both complexity and creativity are evident. Only one of these is needed to gain the mark.

Results

The candidate was awarded **6 out of 6 marks** for this section.

Section 4(a) Data is relevant to the aim(s)

The candidate was awarded **1 out of 1 mark** because the data is relevant to the aim.

Section 4(b) Raw data is recorded and within the limits of accuracy of measurement

The candidate was awarded **1 out of 1 mark** because the raw data is present to one decimal place.

The candidate was not awarded the second mark in section 3(b) for the lack of clarity of the instrument used to measure, so is not penalised here.

Section 4(c) Results presented appropriately

The candidate was awarded **1 out of 1 mark** because the table and line graphs are appropriate.

Section 4(d) Overall results calculated and presented

The candidate was awarded **1 out of 1 mark** because an overall mean has been tabulated (combined replicate table 4.1.3) and presented as a graph.

Section 4(e) Presentation of tables and graphs is correct and accurate

The candidate was awarded **2 out of 2 marks**.

- **1 mark** was awarded for the tables, as the means of the raw data are correct and to the same number of decimal places. Table headings and units are correct.
- **1 mark** was awarded for the graphs – suitable scales, labels and units and is plotting accurate. Computer generated is acceptable and the trend is clear.

Discussion (conclusion(s) and evaluation)

The candidate was awarded **3 out of 7 marks**.

Section 5(a) Conclusion(s) relevant to the aim(s) and supported by data in the report

The candidate was awarded **1 out of 1 mark** because the conclusion is appropriate to the aim and results.

Section 5(b) Conclusion(s) is valid

The candidate was awarded **0 out of 1 mark** because the conclusion is not valid. The issues noted at 3(b) and 3(d) prevent the candidate from being awarded this mark.

Section 5(c) Evaluation of procedures with justification

The candidate was awarded **1 out of 2 marks**.

This section was marked holistically.

- Page 13, paragraph 1, point 7 is **weak**. They have described and reasoned their control. No further link was provided.

- Page 13, paragraph 2, point 10 is **weak**. There is insufficient discussion of temperature, they do not discuss why control of temperature is important, but the point was awarded for the discussion of cell number fluctuations across repeats.
- Page 13, paragraph 3, point 6 – insufficient discussion of why an independent replicate was carried out.
- Page 14, paragraph 1, point 4 is insufficient. An attempt was made, but it wasn't what the candidate actually did/showed.
- Page 14, paragraph 2, point 1 is **weak**. The candidate attempted to discuss why the changes were made following the pilot study.
- Page 14, paragraph 3, there was nothing to note here.
- Page 14, paragraph 4, point 2 is **weak**. The candidate attempted to discuss consistency of direct variable measurements.
- Overall, **1 mark** was awarded for points 1, 2, 7 and 10 since weak discussion in four areas meets the threshold for credit.

Section 5(d) Results analysed and interpreted, and findings discussed critically and scientifically

The candidate was awarded **1 out of 3 marks**.

Analysis of results

Page 15, paragraph 1, point 1. The analysis is descriptive, comparing repeats and replicates, and a simple trend, but does not develop further, for example, it does not mention any variation about a mean. Analysis is restricted by a limited data set. Overall, this is a weak analysis.

Interpretation of results

Page 15, paragraph 2, point 2. The candidate attempted to discuss reasons for data trends but there is an insufficient link back to the procedure. Overall, this is weak interpretation.

Critical and scientific discussion of the findings

Page 15, paragraph 3, point 3. There are good links to other research and the introduction is adequate. The claims about curcumin action are beyond the scope of this project, as pure curcumin was not used.

Overall, **1 mark** was awarded for a weaker discussion of all three areas.

Presentation

The candidate was awarded **1 out of 2 marks** for this section.

Section 6(a) Appropriate structure, with informative title, contents page and page numbers

The candidate was awarded **1 out of 1 mark** because the title, structure and contents are appropriate.

Section 6(b) References cited in the text and listed using Harvard or Vancouver referencing systems

The candidate was awarded **0 out of 1 mark** because only reference 10 is correct. For the other references, page numbers are missing, or the reference is not findable.

Overall, the candidate was awarded **23 out of 30 marks**.