

# Commentary on candidate evidence

The candidate evidence has achieved the following marks for each section of the assignment.

## Candidate 1

### 1 Aim

The candidate was awarded **1 out of 1 mark** because the aim describes clearly the purpose of the investigation.

### 2 Underlying environmental science

The candidate was awarded **3 out of 3 marks** because a good holistic understanding of relevant environmental science is demonstrated, at a level appropriate to at least Higher level. This includes nutrients essential for plant and algae growth and the value of individual nutrients, and in particular the potential for eutrophication if fertilisers enter waterways.

### 3 Data collection and handling

The candidate was awarded **2 out of 5 marks**. The marks were awarded as follows:

- 3(a) **1 out of 1 mark** was awarded because the nature of the experiment can be visualised from the brief description.
- 3(b) **0 out of 1 mark** was awarded because insufficient raw data have been collected from the experiment. It would have been appropriate to repeat the counts for each sample.
- 3(c) **1 out of 1 mark** was awarded because data, including derived values, are presented in correctly produced tables.
- 3(d) **0 out of 1 mark** was awarded because no data/information from an internet/literature source or a second experiment are included. The investigation compared the effects of two samples of fertiliser, but this constitutes just one investigation.

The nutrient composition of the commercial plant feed is provided in the report, but this is not relevant to the stated aim of the investigation.

- 3(e) **0 out of 1 mark** was awarded because a secondary source of internet/literature data or information has not been provided. This is required where only one investigation is carried out.

This mark can only be awarded for referencing underlying science where two experiments/fieldwork investigations have been carried out.

## 4 Graphical presentation

The candidate was awarded **1 out of 4 marks**. The marks were awarded as follows:

- 4(a) **1 out of 1 mark** was awarded because a box plot is an appropriate format for displaying discrete data such as counts.
- 4(b) **0 out of 1 mark** was awarded because the  $x$ -axis lacks an appropriate axis label in place of the scale, that is 'algae only', 'algae + commercial' or 'algae + worm tea'.
- 4(c) **0 out of 1 mark** was awarded because the  $x$ -axis lacks an appropriate label, such as 'algae sample'.
- 4(d) **0 out of 1 mark** was awarded because it is not possible to check the accuracy of the plotting. A graphing package has been used to create the boxplot, but minor gridlines have been omitted.

## 5 Analysis

The candidate was awarded **0 out of 2 marks**. The marks were awarded as follows:

- 5(a) **0 out of 1 mark** was awarded because the omission of data from a second experiment means that the analysis must be a comparison of the experimental data with data from an internet/literature source.

Analysis provided by the candidate relates only to the primary experimental data; also, the IQR and boxplot outcomes specifically show greater variation in the middle 50% of the data and not necessarily in the overall data.

- 5(b) **0 out of 1 mark** was awarded because although an appropriate, correctly calculated, extended or statistical calculation is included, the formula and a sample of working are not included.

The conversion of values for algae cell numbers in  $0.02 \text{ mm}^3$  to  $1 \text{ cm}^3$  is disregarded as this does not constitute an extended calculation at Higher level.

## 6 Conclusion

The candidate was awarded **1 out of 1 mark** because the conclusion relates to the aim and is supported by all the data in the report.

## 7 Evaluation

The candidate was awarded **2 out of 3 marks** because two valid evaluative statements are included. These relate to the increased reliability of results if each culture had been sampled more than once, and the NPK (nitrogen, phosphorus and potassium) analysis of the worm tea might have suggested which, if any, of the nutrients was responsible for worm tea producing the highest algae cell count.

The statement relating to five counts from each sample providing a representative sample is incorrect, as counting cells in five squares on the haemocytometer represents only a partial count of cells present in an aliquot collected from each culture.

Discussion of the use of the same cell counting procedure throughout is disregarded, as an incorrect conclusion is drawn that this would have improved accuracy of the counts, when it would actually have increased the validity of the procedure.

## 8 Structure

The candidate was awarded **1 out of 1 mark** because the report is clear and concise and has an informative title.

## Overall

The candidate was awarded a total of **11 out of 20 marks**.

## Candidate 2

### 1 Aim

The candidate was awarded **1 out of 1 mark** because the two aims stated describe the purpose of the investigation clearly.

### 2 Underlying environmental science

The candidate was awarded **2 out of 3 marks** because a reasonable understanding of environmental science is demonstrated. This includes the classification of seaweeds according to their colour and pigment content, and the efficiency of the pigments in harnessing light energy for photosynthesis and determining where the three types of algae are found.

The underlying science could have been improved by making more direct links to the environmental science course.

### 3 Data collection and handling

The candidate was awarded **3 out of 5 marks**. The marks were awarded as follows:

- 3(a) **0 out of 1 mark** was awarded because the experimental procedure is provided in too much detail and does not meet the requirement to summarise.
- 3(b) **1 out of 1 mark** was awarded because the raw data from the experiment are sufficient and the grouped results represent repeat measurements.
- 3(c) **0 out of 1 mark** was awarded because no unit is provided for light absorbance. This should be expressed as 'light absorbance at 580 nm' or similar.
- 3(d) **1 out of 1 mark** was awarded because data relevant to the experiment have been obtained from an internet/literature source.
- 3(e) **1 out of 1 mark** was awarded because the internet/literature source of data is cited within the body of the report (through use of a superscript number), and an appropriate reference is included at the end of the report.

## 4 Graphical presentation

The candidate was awarded **1 out of 4 marks**. The marks were awarded as follows:

- 4(a) **1 out of 1 mark** was awarded because the graphing format used is appropriate to the data.
- 4(b) **0 out of 1 mark** was awarded because the 75% value is omitted from the  $x$ -axis.
- 4(c) **0 out of 1 mark** was awarded because 'mean' is omitted from the  $y$ -axis label.

The light absorbance unit is not included in the  $y$ -axis label but has already been penalised in 3(c).

- 4(d) **0 out of 1 mark** was awarded because the plotted points are too large to check.

## 5 Analysis

The candidate was awarded **0 out of 2 marks**. The marks were awarded as follows:

- 5(a) **0 out of 1 mark** was awarded because there is no comparison of data from the experiment with data from the internet/literature source.

Discussion of the experimental setup is disregarded since it does not involve comparison of the two sets of data.

- 5(b) **0 out of 1 mark** was awarded because no extended or statistical calculation based on the experimental data is included. Mean values have been calculated but are not sufficient at Higher level.

## 6 Conclusion

The candidate was awarded **0 out of 1 mark** because the conclusion does not address all aspects of the aim.

## 7 Evaluation

The candidate was awarded **2 out of 3 marks** because two valid evaluative statements are provided and are supported by appropriate justification.

The statement referring to reliability of results was disregarded, since reliability would have been improved had each person in the group repeated the experimental process, then shared the results.

## 8 Structure

The candidate was awarded **1 out of 1 mark** because the report is clear and concise and has an informative title.

## Overall

The candidate was awarded a total of **10 out of 20 marks**.

## Candidate 3

### 1 Aim

The candidate was awarded **0 out of 1 mark** because the aim does not describe clearly the purpose of the investigation: understanding of the size of alcohol is unclear.

### 2 Underlying environmental science

The candidate was awarded **1 out of 3 marks** because limited understanding of the underlying science is demonstrated: most of the information provided is not of higher standard or is irrelevant.

### 3 Data collection and handling

The candidate was awarded **1 out of 5 marks**. The marks were awarded as follows:

- 3(a) **0 out of 1 mark** was awarded because although the description was brief, it does not mention the key equipment used.
- 3(b) **0 out of 1 mark** was awarded because the raw data are not sufficient, as no replications were made.
- 3(c) **0 out of 1 mark** was awarded because although the first table is correctly produced, there is an error in the second table: the units for temperature difference is omitted in the column heading.

Although the data are presented as two tables, they refer to the same experiment.

- 3(d) **1 out of 1 mark** was awarded because the second source is appropriate to the experiment.
- 3(e) **0 out of 1 mark** was awarded because the reference is given in full rather than cited.

## 4 Graphical presentation

The candidate was awarded **2 out of 4 marks**. The marks were awarded as follows:

- 4(a) **1 out of 1 mark** was awarded because a bar graph is appropriate for the data.
- 4(b) **1 out of 1 mark** was awarded because the axes scales are appropriate.
- 4(c) **0 out of 1 mark** was awarded because the *y*-axis unit is incorrect.
- 4(d) **0 out of 1 mark** was awarded because minor gridlines are not included and therefore it is not possible to check the accuracy of plotting.

## 5 Analysis

The candidate was awarded **1 out of 2 marks**. The marks were awarded as follows:

- 5(a) **0 out of 1 mark** was awarded because it is not possible to compare the candidate's data and the data from the second source, as the units differ. The candidate would need to explain the relationship between grams and moles.
- 5(b) **1 out of 1 mark** was awarded because the calculation is correct and is appropriate to Higher level.

## 6 Conclusion

The candidate was awarded **0 out of 1 mark** because the conclusion is not supported by the data. There is no indication of the size of the alcohol, that is the number of carbons.

## 7 Evaluation

The candidate was awarded **1 out of 3 marks** for the evaluative statement about energy loss to the environment.

The statement about reliability was disregarded because this would be good experimental practice at Higher level.

The statement about the second source is disregarded because this cannot be regarded as an evaluative statement with appropriate justification.



## **8 Structure**

The candidate was awarded **1 out of 1 mark** because the report was clear and concise and the title was informative.

## **Overall**

The candidate was awarded a total of **7 out of 20 marks**.