

# 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 'to find out if changing the particle size affects the rate of reaction', clearly describes the purpose of the investigation and is given separately from the title.

### 2 Underlying chemistry

The candidate was awarded **3 out of 3 marks** because they have demonstrated a good understanding of the relevant chemistry, including some explanation of collision theory with respect to particle size, a description of what is needed to calculate rate and descriptions of line slopes. They also have some information about neutralisation. The remainder of the underlying chemistry is a description of how the method was carried out and this information is repeated in that section.

The candidate has made an incorrect statement regarding the definition of an alkali 'if a base cannot dissolve in water it is an alkali'.

### 3 Data collection and handling

The candidate was awarded **4 out of 6 marks**. The marks were allocated as follows:

- 3(a) The candidate was awarded **1 out of 1 mark** because the description of the approach used is brief but sufficient to visualise the experiment.
- 3(b) The candidate was awarded **1 out of 1 mark** because there is sufficient raw data provided, for example, three different sizes of particles investigated with a repeat for each.
- 3(c) The candidate was awarded **0 out of 1 mark** because there are incorrect table headings and units given. The first raw data table should have 'Mass' with units of grams and not 'attempt' 1 or 'attempt 2'. The second table has a heading of 'CaCO<sub>3</sub> lost' but this should be CO<sub>2</sub> lost, and the third table repeats the incorrect CaCO<sub>3</sub> and also has incorrect units for rate – g instead of gmin<sup>-1</sup>.

- 3(d) The candidate was awarded **0 out of 1 mark** because an incorrectly calculated value has been given. The small particles 2nd attempt sample has an incorrectly calculated/rounded value of 0.45, this should be 0.46.
- 3(e) The candidate was awarded **1 out of 1 mark** because relevant information from an internet source has been provided in the form of a graph of mass lost against size (small and large particles). This is not an exact match for the sample range but does encompass it.
- 3(f) The candidate was awarded **1 out of 1 mark** because a reference, sufficient for a third party to retrieve, is provided and it appears beside the source.

## 4 Graphical presentation

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

- 4(a) The candidate was awarded **1 out of 1 mark** because a bar graph has been provided which is appropriate for the experimental data collected.
- 4(b) The candidate was awarded **1 out of 1 mark** because a suitable scale has been used.
- 4(c) The candidate was awarded **1 out of 1 mark** because the axis label, although incorrect, matches table three.
- 4(e) The candidate was awarded **1 out of 1 mark** because the bars have been correctly plotted.

## 5 Analysis

The candidate was awarded **1 out of 1 mark** because a correct and valid relationship has been identified, 'the small chips react faster than the large chips'. Similarities between source and experimental data have also been given.

## 6 Conclusion

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

## 7 Evaluation

The candidate was awarded **0 out of 2 marks** because they have not identified a factor that could significantly affect the experiment. The candidate identified the use of a stopwatch to time the experiment, however, this is not sufficient for a mark to be awarded since this would be standard practice when carrying out this experiment. The candidate has also said each attempt has been controlled for

two minutes, again this would be expected in terms of control of variables. As no factor has been identified the second mark cannot be awarded.

## 8 Structure

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

8(a) The candidate was awarded **1 out of 1 mark** because an informative title has been given.

8(b) The candidate was awarded **1 out of 1 mark** because the report is clear and concise.

## Overall

The candidate was awarded a total of **16 marks out of 20 marks**.

## Candidate 2

### 1 Aim

The candidate was awarded **1 out of 1 mark** because the aim 'to investigate the burning of fuels and how much energy would be released', although very generic would be considered candidate loose language.

### 2 Underlying chemistry

The candidate was awarded **1 out of 3 marks** because a limited understanding of the relevant chemistry has been demonstrated. The candidate has given some information regarding homologous series. General formulae have been attempted, however both given are incorrect. Names and structures have been given for three alcohols and balanced combustion equations have been attempted however there are errors present in two of the three given. The equation for methanol is correct however the ethanol equation given is the combustion of ethane and similarly for propanol, the combustion of propane has been given.

### 3 Data collection and handling

The candidate was awarded **3 out of 6 marks**. The marks were awarded as follows:

- 3(a) The candidate was awarded **1 out of 1 mark** because they have given a brief description of their approach to collect the data.
- 3(b) The candidate was awarded **0 out of 1 mark** because raw data relevant to their aim, of measuring the energy released, has not been provided.
- 3(c) The candidate was awarded **0 out of 1 mark** because the 'average' column has no variable or units present.
- 3(d) The candidate was awarded **1 out of 1 mark** because they have correctly calculated the average values.
- 3(e) The candidate was awarded **0 out of 1 mark** because the source chosen is not relevant to the experimental data. The candidate has measured the time taken to achieve a temperature rise of 10 °C whereas the source data is regarding enthalpy values.
- 3(f) The candidate was awarded **1 out of 1 mark** because a reference, sufficient for a third party to retrieve, is provided and it appears beside the source.

## 4 Graphical presentation

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

- 4(a) The candidate was awarded **1 out of 1 mark** because a bar graph has been provided which is appropriate for the experimental data collected.
- 4(b) The candidate was awarded **1 out of 1 mark** because a suitable scale has been used.
- 4(c) The candidate was awarded **1 out of 1 mark** because the axes of the graph have suitable labels and units.
- 4(d) The candidate was awarded **1 out of 1 mark** because the bars have been correctly plotted.

## 5 Analysis

The candidate was awarded **0 out of 1 mark** because no analysis has been given.

## 6 Conclusion

The candidate was awarded **0 out of 1 mark** because the conclusion does not relate to the aim. The aim was regarding the energy released by burning fuels and not time taken.

## 7 Evaluation

The candidate was awarded **0 out of 2 marks** because they have not given any relevant factors having (or methods to minimise) any significant effect on their experiment.

## 8 Structure

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

- 8(a) The candidate was awarded **1 out of 1 mark** because an informative title has been given.
- 8(b) The candidate was awarded **1 out of 1 mark** because the report is clear and concise.

## Overall

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

## Candidate 3

### 1 Aim

The candidate was awarded **1 out of 1 mark** because the aim, 'To find out how increasing the acid concentration alters the rate of reaction', clearly describes the purpose of the investigation and is given separately from the title.

### 2 Underlying chemistry

The candidate was awarded **3 out of 3 marks** because a good understanding of the relevant chemistry has been demonstrated. This includes explanations covering collision theory with respect to concentration, dilution of acids and how this affects pH, and neutralisation reactions. The candidate has given word and balanced formulae equations for their reaction. They have given a diagram of the apparatus as an example of how to determine the reaction rate.

### 3 Data collection and handling

The candidate was awarded **5 out of 6 marks**. The marks were awarded as follows:

- 3(a) The candidate was awarded **0 out of 1 mark** because their description is too detailed as it includes values for the number of chips added and the volume of acid used and so is not an appropriate summary.
- 3(b) The candidate was awarded **1 out of 1 mark** because sufficient raw data has been provided. There are three different concentrations of acid investigated and carried out in duplicate.
- 3(c) The candidate was awarded **1 out of 1 mark** because the experimental data has been correctly presented in a table with correct headings and units.
- 3(d) The candidate was awarded **1 out of 1 mark** because they have correctly carried out all average and rate calculations.
- 3(e) The candidate was awarded **1 out of 1 mark** because they have provided data from an internet source that is relevant to their experiment. The source is not an exact match for their sample range but illustrates a pattern expected in the experimental data.
- 3(f) The candidate was awarded **1 out of 1 mark** because a reference, sufficient for a third party to retrieve, is provided and it appears beside the source.

## 4 Graphical presentation

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

- 4(a) The candidate was awarded **1 out of 1 mark** because a scatter graph has been provided which is appropriate for the experimental data collected.
- 4(b) The candidate was awarded **1 out of 1 mark** because a suitable scale has been used.
- 4(c) The candidate was awarded **1 out of 1 mark** because the axes have been given correct labels and units.
- 4(d) The candidate was awarded **1 out of 1 mark** because the line drawn is a reasonable attempt of a line of best fit. The points have been correctly plotted.

## 5 Analysis

The candidate was awarded **0 out of 1 mark** because a valid comparison of the experimental data with the internet source data has not been given. The candidate has only restated the variables used in both.

## 6 Conclusion

The candidate was awarded **0 out of 1 mark** because the concentration of a product doesn't affect reaction rate and the second sentence is contradicted by the second source.

## 7 Evaluation

The candidate was awarded **0 out of 2 marks** because they have not identified any relevant factors having a significant effect on their experiment. The factors they have identified are those that are intrinsic to the experiment as good practises. For example, avoiding air bubbles, measuring volume of acid and recording the volume of gas at the correct time.

As no factor has been identified the second mark cannot be awarded.

## 8 Structure

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

- 8(a) The candidate was awarded **1 out of 1 mark** because an informative title has been given.
- 8(b) The candidate was awarded **1 out of 1 mark** because the report is clear and concise.

## Overall

The candidate was awarded a total of **15 marks out of 20 marks**.



## Candidate 4

### 1 Aim

The candidate was awarded **1 out of 1 mark** because the aim 'To investigate the voltage released by different metals in the Electrochemical series' is acceptable.

### 2 Underlying chemistry

The candidate was awarded **2 out of 3 marks** because they have demonstrated a reasonable understanding of the underlying chemistry relevant to the investigation. This includes some explanations with respect to losing electrons, cells and salt bridges.

### 3 Data collection and handling

The candidate was awarded **3 out of 6 marks**. The marks were awarded as follows:

- 3(a) The candidate was awarded **0 out of 1 mark** because the method provided does not allow the experiment to be visualised (without using the diagram provided in the underlying chemistry section). The candidate has included too much detail such as volumes and 'concentration' of sodium chloride solution and has provided names of all the independent variables.
- 3(b) The candidate was awarded **1 out of 1 mark** because they have provided sufficient raw data, testing four metals in triplicate.
- 3(c) The candidate was awarded **0 out of 1 mark** because they have only given average (v) and not average voltage (v).
- 3(d) The candidate was awarded **0 out of 1 mark** because there is incorrect rounding of the zinc sample average. This should be either 0.347 or 0.35 but the candidate has given 0.346.
- 3(e) The candidate was awarded **1 out of 1 mark** because they have provided a relevant source. Although the source data is clearly incorrect, this is not penalised.
- 3(f) The candidate was awarded **1 out of 1 mark** because a reference, sufficient for a third party to retrieve, is provided and it appears beside the source.

## 4 Graphical presentation

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

- 4(a) The candidate was awarded **1 out of 1 mark** because a bar graph is appropriate for the data provided.
- 4(b) The candidate was awarded **0 out of 1 mark** because the scale on the axis is inconsistent. In the lower section of the y-axis, the scale is 0.02 (V) per 5 boxes but higher up after 0.1, then 5 boxes are equal to 0.2 (V).
- 4(c) The candidate was awarded **1 out of 1 mark** because labels have been provided on the y-axis. These are the same incorrect units that have already been penalised at section 3(c).
- 4(d) The candidate was awarded **0 out of 1 mark** because it is not possible to check the accuracy of plotting because of the inconsistent scale provided.

## 5 Analysis

The candidate was awarded **0 out of 1 mark** because they have not identified a valid relationship or made a valid comparison of the experimental data with the internet source data. They have stated 'similar result' but have not given any indication as to how they are similar and so this is not valid. They have also stated that magnesium had a much higher voltage than copper which is not reflected in the source data.

## 6 Conclusion

The candidate was awarded **0 out of 1 mark** because a valid conclusion relating to the aim has not been given.

## 7 Evaluation

The candidate was awarded **0 out of 2 marks** because they have not identified any relevant factors having a significant effect on their experiment or given any methods to minimise any effect. The candidate has described getting a 'wider range of results' which would not affect their experimental results. They also suggest a completely different investigation by changing the electrolyte concentration.

## 8 Structure

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

- 8(a) The candidate was awarded **1 out of 1 mark** because an informative title has been given.

8(b) The candidate was awarded **1 out of 1 mark** because the report is clear and concise.

### **Overall**

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