GCSE (9-1)

Exemplar Candidate Work

GATEWAY SCIENCE
CHEMISTRY A

J248
For first teaching in 2015

J248/02 Summer 2018
examination series
Version 1

www.ocr.org.uk/chemistry
Introduction

These exemplar answers have been chosen from the summer 2018 examination series.

OCR is open to a wide variety of approaches and all answers are considered on their merits. These exemplars, therefore, should not be seen as the only way to answer questions but do illustrate how the mark scheme has been applied.

Please always refer to the specification https://www.ocr.org.uk/Images/234598-specification-accredited-gcse-gateway-science-suite-chemistry-a-j248.pdf for full details of the assessment for this qualification. These exemplar answers should also be read in conjunction with the sample assessment materials and the June 2018 Examiners’ report or Report to Centres available from Interchange https://interchange.ocr.org.uk/Home.mvc/Index.

The question paper, mark scheme and any resource booklet(s) will be available on the OCR website from summer 2019. Until then, they are available on OCR Interchange (school exams officers will have a login for this and are able to set up teachers with specific logins – see the following link for further information http://www.ocr.org.uk/administration/support-and-tools/interchange/managing-user-accounts/).

It is important to note that approaches to question setting and marking will remain consistent. At the same time OCR reviews all its qualifications annually and may make small adjustments to improve the performance of its assessments. We will let you know of any substantive changes.
Question 6

Exemplar 1 1 mark

Which carbon compound is the mass spectrum from?

A  $\text{C}_2\text{H}_2$  
B  $\text{C}_2\text{H}_5^+$  
C  $\text{C}_3\text{H}_7^+$  
D  $\text{C}_4\text{H}_{10}$

Your answer  D  [1]

Examiner commentary

Not only is this the correct answer, but it is interesting to see annotations which illustrate the candidate’s thought process.

Question 8

Exemplar 1 1 mark

8 Hydrogen gas can be made by reacting methane and steam ($\text{H}_2\text{O}$).

$\text{CH}_4 + \text{H}_2\text{O} \rightarrow 3\text{H}_2 + \text{CO}$

6 g of hydrogen gas can be made from 18 g of steam, $\text{H}_2\text{O}$.

How much hydrogen gas can be made from 3.6 g of steam, $\text{H}_2\text{O}$?

A  0.4 g  
B  0.6 g  
C  1.2 g  
D  6.8 g

Your answer  C  [1]

Examiner commentary

Correct answer. The working suggests that the candidate went through a false start, but then realised that this is an exercise in ratio and produced the correct answer.
Question 11
Exemplar 1

11 Look at the displayed formula of the monomer butene.

What is the formula of the polymer formed from butene?

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>H</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>C</td>
<td>C</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>H</td>
<td>H</td>
<td>n</td>
<td>n</td>
</tr>
<tr>
<td>C</td>
<td>C</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>CH₃</td>
<td>CH₃</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH₃</td>
<td>CH₃</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>H</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH₃</td>
<td>H</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH₃</td>
<td>H</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Your answer [D] [1]

Examiner commentary
This was a common incorrect response. There were two stages to this question. The first stage was to identify which of the possibilities might be butene based, and this part has been carried out successfully. The second stage expected candidates to use their understanding of polymerisation to realise that the double bond would be broken, and so choose option B.
Question 14

Exemplar 1

1 mark

Examiner commentary

Correct answer. The candidate's thought process is shown; this sort of activity shows a careful approach and helps prevent mistakes being made.
Question 15

Exemplar 1

0 marks

15 Look at the information about four different polymers.

<table>
<thead>
<tr>
<th>Polymer</th>
<th>Cost (£ per kg)</th>
<th>Tensile strength (MPa)</th>
<th>Melting point (°C)</th>
<th>Maximum useable temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.74</td>
<td>15</td>
<td>120</td>
<td>85</td>
</tr>
<tr>
<td>B</td>
<td>1.20</td>
<td>78</td>
<td>254</td>
<td>70</td>
</tr>
<tr>
<td>C</td>
<td>0.92</td>
<td>35</td>
<td>176</td>
<td>160</td>
</tr>
<tr>
<td>D</td>
<td>1.42</td>
<td>42</td>
<td>156</td>
<td>160</td>
</tr>
</tbody>
</table>

Which polymer would be best for making a plastic cup to hold hot drinks?

Your answer [D]

Examiner commentary

Incorrect answer. The candidate has seen the high strength and high melting point but has ignored the price and also missed the significance of the maximum useable temperature column.
Question 16(b)(i)

16 The Group 7 elements are called the halogens.

The table shows information about some of the halogens.

<table>
<thead>
<tr>
<th>Name</th>
<th>Atomic number</th>
<th>Boiling point (°C)</th>
<th>State at room temperature</th>
<th>Molecular formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluorine</td>
<td>9</td>
<td>−188</td>
<td>Gas</td>
<td>F₂</td>
</tr>
<tr>
<td>Chlorine</td>
<td>17</td>
<td>−34</td>
<td>Gas</td>
<td>Cl₂</td>
</tr>
<tr>
<td>Bromine</td>
<td>35</td>
<td>59</td>
<td>Liquid</td>
<td>Br₂</td>
</tr>
<tr>
<td>Iodine</td>
<td>53</td>
<td>184</td>
<td>Solid</td>
<td>I₂</td>
</tr>
</tbody>
</table>

Exemplar 1

(b) Astatine is also a halogen. It has the atomic symbol At and an atomic number of 85.

Look at the table.

(i) Predict the state of astatine at room temperature.

 Examiner commentary

Correct answer. Most candidates correctly stated that Astatine would be a solid. However, the question did prove very useful for discriminating between candidates of medium ability and those of low ability.

Question 16(b)(ii)

Exemplar 1

(ii) Predict the boiling point of astatine.

 Examiner commentary

Incorrect answer. The minimum temperature increment shown in the table is 93 degrees. This year the question was addressed at higher ability candidates, so examiners were looking for a value which was consistent with this minimum. This example shows an increase of 36 degrees, so was not enough.
**Question 16(c)(i)**

**Exemplar 1**

1 mark

(c) Sodium, Na, reacts with chlorine. A white solid is made.

(i) What is the name of this white solid?

............................................................................................................. [1]

**Examiner commentary**

Correct answer. Many candidates, as here, were able to name the product as sodium chloride. This was another question which proved useful for discriminating between candidates of medium ability and those of low ability.

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**Question 16(c)(ii)**

**Exemplar 1**

0 marks

(ii) Write down the balanced symbol equation for this reaction.

............................................................................................................. [2]

**Examiner commentary**

Incorrect answer. While the formula of chlorine gas has been suitably transcribed from the table at the start of the question, this response shows a common mistake made by many candidates. An incorrect formula for sodium chloride has been given and so the balancing mark is also unavailable.
Question 17(a)

Exemplar 1

17 A student added 2.4 g of magnesium to hydrochloric acid. She observed that no magnesium was left when the reaction was complete.

The student transferred the solution to an evaporating basin. She heated the solution using a Bunsen burner and evaporated all the water.

(a) Explain how you can tell from the student’s observation that the hydrochloric acid was in excess.

Because after the reaction, magnesium was left but only hydrochloric acid solution.

Examiner commentary

Correct answer. The candidate correctly points to the complete disappearance of the magnesium as the indicator that the acid was in excess.

Question 17(b)

Exemplar 1

(b) Look at the equation for the reaction.

\[ \text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2 \]

The student knows the reaction is complete when there is no magnesium left.

Use the equation to explain one other way the student could tell that the reaction was complete.

She could measure the mass of what is left after the reaction to see if there is a decrease.

Examiner commentary

Incorrect answer. While this is a very reasonable response, it is not tied in to the equation clearly enough to be given credit. Examiners were looking for a statement about the cessation of hydrogen production.
Question 17(c)

Exemplar 1

(c) The student predicts she should make 9.5g of magnesium chloride, MgCl₂.

She actually makes 7.9g.

Calculate the percentage yield.

Give your answer to 3 significant figures.

\[
\frac{7.9 \times 100}{9.5} = 83.978 \ldots
\]

Answer = 84.2 \% [3]

Examiner commentary

The candidate appears to have made an unfortunate slip when transposing the numbers from the calculation. However, the fact that the working has been shown means that two of the marks can still be credited.

Question 17(d)

Exemplar 1

(d) Write down one reason, other than a mistake, why the student may have obtained a percentage yield of less than 100%.

Mass of the products may contain molecules from

a different gas. [1]

Examiner commentary

Incorrect answer. Examiners were looking for practical reasons why the yield might be less than 100%. However, many candidates gave this type of answer instead, which does not gain credit. Other candidates often missed the instruction 'other than a mistake' and discussed mistakes that could have been made, often in calculation.
Question 18(a)

Exemplar 1

2 marks

18 Antacid tablets are used to treat indigestion.

A student investigates two different antacid tablets, X and Y. Both tablets, X and Y, contain calcium carbonate, CaCO₃.

Calcium carbonate reacts with hydrochloric acid, Calcium chloride, CaCl₂, water and carbon dioxide are made.

(a) Write a balanced symbol equation for this reaction.

```
CaCO₃ + 2HCl → CaCl₂ + H₂O + CO₂
```

Examiner commentary

Correct answer. This question assesses the ability to write and balance equations at a slightly higher level than in question 16ci, and here the candidate has both correctly provided the missing formulae and balanced the equation.
Question 18(b)(i)

(b) The diagram shows the apparatus the student uses.

Tablet X

Gas syringe

Hydrochloric acid

The student reacts tablet X with 100 cm$^3$ of hydrochloric acid. The hydrochloric acid is in excess.

He measures the volume of gas made every minute during the first five minutes.

He does a second experiment using tablet Y and a fresh 100 cm$^3$ sample of the same hydrochloric acid.

The table shows his results.

<table>
<thead>
<tr>
<th>Time (minutes)</th>
<th>Volume of gas (cm$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tablet X</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>38</td>
</tr>
<tr>
<td>2</td>
<td>48</td>
</tr>
<tr>
<td>3</td>
<td>48</td>
</tr>
<tr>
<td>4</td>
<td>48</td>
</tr>
<tr>
<td>5</td>
<td>48</td>
</tr>
</tbody>
</table>

(i) The graph shows the results for tablet X.

What is the volume of gas made by the end of the experiment?

Answer = ......................... cm$^3$ [1]
Exemplar 1  

1 mark

(i) The graph shows the results for tablet X.

What is the volume of gas made by the end of the experiment?

Answer = $48 \text{ cm}^3$ [1]

Examiner commentary

Correct answer. Most candidates were able to use the graph to identify the volume of gas.
Question 18(b)(ii)

Examiner commentary

A mark has been credited for plotting the points, but the candidate has assumed that the line of best fit must be a straight line, and does not get the second mark. This was a common mistake, and possibly reflects a difference in interpretation of the term 'line of best fit'.

Exemplar 1

1 mark
Examiner commentary

Again, the mark is for plotting the points only.
**Question 18(b)(iii)**

**Exemplar 1**

1 mark

(iii) Tablet X contains less calcium carbonate than tablet Y.

How do the results show this?

Tablet Y produced more gas

[1]

**Examiner commentary**

Correct answer. Many candidates realised that they needed to look at the total amount of gas produced. The most common mistake was to discuss the time taken as the important factor.

**Question 18(c)**

**Exemplar 1**

4 marks

(c) The rate of reaction between calcium carbonate and hydrochloric acid can be increased by:

* Using a more concentrated solution of hydrochloric acid
* Increasing the temperature of the acid.

Explain how each of these methods increase the rate of the reaction.

Use ideas about collisions between particles.

Increasing the temperature of the acid allows particles to move more. This means that the number of successful collisions increases. This increases the rate of the reaction. Using more concentrated acid means that there are more particles in the same volume, which means that there are more collisions between particles that result in the reaction occurring. [4]

**Examiner commentary**

Correct answer. The candidate has referred to the number of ‘successful’ collisions, which is especially relevant to the temperature answer, and also to ‘more particles in the same volume’ as part of the concentration answer. Both of these points indicate that the candidate is working at a very high level. Many other candidates merely referred to ‘more particles’ without mentioning volume, and so did not gain credit. Similarly, ‘more collisions’ was a common response. This wording was allowed once, but not twice. ‘Particles move more’ is a weak alternative to ‘move faster’, but in this case examiners decided to allow it.
Question 19(a)

Exemplar 1

19 Ammonia is made from nitrogen and hydrogen.

(a) The reaction between nitrogen and hydrogen is reversible.

Examiner commentary

Correct answer. The concept of a reversible reaction was well understood, with many candidates scoring the mark, as here.
**Question 19(b)(i)**

Exemplar 1 1 mark

(b) The graph shows the percentage of ammonia made at different temperatures and pressures.

(i) Describe how the percentage of ammonia changes as the pressure increases at 450°C.

...The percentage of ammonia made increases... [1]

**Examiner commentary**

Correct answer. The candidate has correctly stated that the percentage of ammonia increases. However, many other candidates thought the question was asking about the trend on going from one line to the next, and so tried to describe the relationship between temperature and percentage of ammonia.

**Question 19(b)(ii)**

Exemplar 1 1 mark

(ii) Write down a temperature and pressure which make 20% of ammonia.

Temperature = ... °C  Pressure = ... atmospheres [1]

**Examiner commentary**

Correct answer. There are three possible answers here, by far the most common correct response being 350°C and 50 atmospheres. A common incorrect response was to give a value for 550°C, despite there being no information on the graph to support this.
Exemplar 1

Examiner commentary

Correct answer. Candidates gained their marks from their diagram, or their written answer, or a mixture of the two. In this case the 3 marks could be gained from either route.
Exemplar 1

Level 3, 5 marks

(a)* The student thinks that solid X contains only lithium ions, $\text{Li}^+$, and sulfate ions, $\text{SO}_4^{2-}$.

Use her results to explain if she is correct.

The student is not correct on test 1. Please note there is no sulfur. Test 1 shows lithium ions or are in solid x as a crimson (red) flame is produced. This shows that lithium ions are present. Test 3 shows that chlorine is present as when chlorine1 of silver nitrate is added to a solution of x it changes from a colourless to a white precipitate. The student was wrong with sulfur ions as if they are present or when HCl and barium chloride solution is added it would have turned into a white precipitate, not... [6]

Examiner commentary

This is an excellent answer. Lithium and chloride ions are shown to be present, and sulfate ions absent, in each case with clear reasoning. However, there is no reference to significance of test 2, and there are references to chlorine instead of chloride and sulfur instead of sulfate. This answer is considerably better than the Level 2 descriptor though not enough for a full Level 3, and is worth 5 marks.
Exemplar 2

Level 2, 4 marks

(b)* The student thinks that solid X contains only lithium ions, Li\(^+\), and sulfate ions, SO\(_4\)\(^{2-}\).

Use her results to explain if she is correct.

Her result from the flame test shows that solid X gives a red flame. This leads...suggest that solid X contains lithium. This is because lithium produces a crimson red flame and calcium produces a bright red flame. It is not...stated what type of red the student sees in particular. The second test, in which she adds dilute sodium hydroxide, suggests that solid X contains zinc ions as...the white precipitate it produces redissolves.

Examiner commentary

The answer links the flame colour to Lithium, and goes further by discussing the limitation of this observation. That the second test identifies the presence of zinc ions is also clearly stated. This is a strong Level 2 answer which gets 4 marks.
Exemplar Candidate Work

**Question 21(a)**

21 A student does a titration with an acid and an alkali.

He uses dilute sulfuric acid, sodium hydroxide solution and an indicator solution.

The student’s method is:

- Use a measuring cylinder to pour 25.0 cm³ of sodium hydroxide solution into a conical flask
- Add a few drops of an indicator to the sodium hydroxide solution
- Use a burette to add dilute sulfuric acid to the sodium hydroxide solution until the indicator changes colour.

Exemplar 1 3 marks

(a) The student wants to get a more accurate value for how much acid reacts with 25.0 cm³ of sodium hydroxide solution.

Describe and explain how the student could improve his experiment to get a more accurate value.

Repeat the experiment... three times and then use an average reading.

This will standardise results and reduce the chance of error.

Keep swirling the solution in conical flask as the student adds drops.

[4]

**Examiner commentary**

This answer shows that the candidate is familiar with titration procedure, and was given marks for stirring and for adding acid dropwise. ‘Repeat the experiment’ was also given credit, and is the point that most candidates made. Marks were also available for explaining why swirling the contents of the flask might improve accuracy, and for the importance of carrying out a trial run.

Examiners saw many incorrect suggestions which, while not worthy of credit, did at least show thoughtful interaction with the information given in the question stem, and so were commendable. These included ‘count out the number of drops of indicator’.

Low ability candidates often suggested replacing the burette with a measuring cylinder.
Question 21(b)  

Exemplar 1  

2 marks

(b) Another student does a titration. She also uses dilute sulfuric acid, sodium hydroxide solution and an indicator solution.

The table shows her results.

<table>
<thead>
<tr>
<th>Titration number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume of acid (cm³)</td>
<td>26.4</td>
<td>25.2</td>
<td>25.6</td>
<td>25.4</td>
</tr>
</tbody>
</table>

The student decides that the best value for the mean (average) volume of acid is 25.4 cm³.

Show how she calculated this value.

\[
\frac{26.4 + 25.2 + 25.6 + 25.4}{4} = 25.4
\]

Examiner commentary

Correct answer. The candidate’s has identified the outlier and correctly calculated the mean, so gains full marks.
Question 21(c)

Exemplar 1

3 marks

(c) The equation for this reaction is

\[ \text{H}_2\text{SO}_4 + 2\text{NaOH} \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O} \]

| Relative formula mass, \( M_w \) | 
|-----------------|-----------------|
| \text{H}_2\text{SO}_4 | 88 |
| \text{NaOH} | 40 |
| \text{Na}_2\text{SO}_4 | 142 |
| \text{H}_2\text{O} | 18 |

Water is a waste product in this reaction.

Calculate the atom economy for the reaction.

Give your answer to 1 decimal place.

\[
\begin{align*}
98 + 40 + 40 &= 178 \\
178 : 100 &= 1.78 \\
36 : 1.78 &= 20.2 \\
100 - 20.2 &= 79.8 \\
\end{align*}
\]

Answer = 79.8% [3]

Examiner commentary

Correct answer. The candidate has correctly calculated the atom economy. This proved to be a very difficult task for even the high ability candidates, and many candidates did not even attempt it. Here the final figure has been rounded answer to one decimal place as required, so the answer gains all 3 marks.
Question 22(a)

Exemplar 1

1 mark

(a) Complete the following paragraph about the greenhouse effect.

Use words from the list.

- CFCS
- cool
- Earth's
- hydrogen
- infrared
- methane
- microwave
- Sun's
- ultraviolet
- warm

Greenhouse gases such as \( \text{carbon dioxide} \) and \( \text{hydrogen} \) absorb \emph{infrared} radiation radiated by the \emph{Sun's} surface, then emit it in all directions. This greenhouse effect keeps the Earth and its atmosphere \emph{warm} enough for living things to exist. [2]

Examiner commentary

The candidate has substituted two of the four words correctly, so gets 1 mark.

Question 22(b)

Exemplar 1

1 mark

(b) Write about two possible ways that greenhouse gas emissions can be reduced.

Reducing the combustion of fossil fuels is an excellent answer, and gets the first mark. 'Using ways of transport that do not produce pollution' lacks sufficient detail to be given credit.
Question 23(a)

Exemplar 1

23 This question is about metals and alloys:
(a) The table gives information about some alloys.

<table>
<thead>
<tr>
<th>Alloy</th>
<th>Main metal or metals</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brass</td>
<td>Copper and zinc</td>
<td>Musical instruments and coins</td>
</tr>
<tr>
<td>Bronze</td>
<td>Aluminium and copper</td>
<td>Statues</td>
</tr>
<tr>
<td>Duralumin</td>
<td>Aluminium and iron</td>
<td>Aircraft parts</td>
</tr>
<tr>
<td>Solder</td>
<td>Lead and tin</td>
<td>Joining metals</td>
</tr>
<tr>
<td>Steel</td>
<td>Iron</td>
<td>Bridges, cars</td>
</tr>
</tbody>
</table>

Complete the table.

Choose your answers from the list.

Aluminium and copper
Aluminium and iron
Copper and tin
Copper and zinc
Copper and lead
Lead and zinc

Examiner commentary

This answer is slightly unusual in that the candidate has scored their 1 mark for realising that brass is made of copper and zinc. Most candidates put copper and tin for this option.

While the choice of aluminium and iron for Duralumin was common to the majority of papers, those candidates who did get any credit for this question tended to get it here.
Question 23(b)

Exemplar 1

The table gives some information about solder, copper and tin.

<table>
<thead>
<tr>
<th>Metal</th>
<th>Melting point (°C)</th>
<th>Density (g/cm³)</th>
<th>Relative hardness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>1085</td>
<td>8.96</td>
<td>Soft</td>
</tr>
<tr>
<td>Tin</td>
<td>232</td>
<td>7.31</td>
<td>Soft</td>
</tr>
<tr>
<td>Solder</td>
<td>130</td>
<td>10.3</td>
<td>Quite hard</td>
</tr>
</tbody>
</table>

Solder is better than copper or tin for joining metals together.

Suggest why. Use the information in the table.

It has the lowest melting point and it is quite hard therefore it's easy to melt and less hard to break.

Examiner commentary
Correct answer. The candidate has given a clear, concise answer and has even explained the reasoning behind it.

Question 23(c)

Exemplar 1

(c) Steel is an alloy containing iron.

Complete the word equation for the corrosion of iron.

Iron + ...oxygen... + ...water... → ...hydrated iron oxide...

Examiner commentary
Correct answer. This is an excellent answer, while high ability candidates often got the first mark for successfully identifying the reagents, few stated that the product was hydrated iron oxide.
Question 23(d)(i)

Exemplar 1

1 mark

(d) (i) Iron can be plated with a layer of zinc to prevent it corroding.

This is called galvanising.

Explain how galvanising prevents iron from corroding.

It blocks prevents oxygen and water from getting to iron... [2]

Examiner commentary

Examiners wanted more than a statement about zinc acting as a barrier, they were looking for knowledge of what the barrier was against as shown here. The second mark was for a statement about reactivity, or zinc acting as a sacrificial metal. A very small minority of candidates were able to gain this second mark.

Question 23(d)(ii)

Exemplar 1

0 marks

(ii) Iron can also be plated with a layer of tin to prevent it corroding.

Describe a disadvantage of tin plating for preventing corrosion.

It is soft therefore it can be easily bent... [1]

Examiner commentary

The answer given here was a very common response. The problems of tin plating were not well understood.
Question 24(a)

This question is about life-cycle assessment.

(a) A car company is developing three new cars:
- A petrol car
- A diesel car
- An electric car.

They do a life-cycle assessment of each car.

Look at the information about the life-cycle assessment of each car.

Exemplar 1  3 marks

The company decides to manufacture and sell the electric car.

Explain why they make this choice.

Use the information from the life-cycle assessment to help you.

Because it requires the least energy to make and the

relatively amount of global warming is the lowest. And the least ozone

is made.

[3]
Examiner commentary

Correct answer. The question assessed the ability to extract information from the diagram, and differentiated well. High ability candidates identified three advantages of electric cars, as here, whereas others could only see one or two. A common mistake was to give the amount of water pollution as an advantage, missing the fact that it is not as good as for petrol cars. Consequently statements such as ‘electric cars perform better in every respect except for acid rain’ are incorrect and did not gain any credit.

The question instructs candidates to use the information from the life-cycle assessment so the answer should include information from the life-cycle assessment to gain the marks.
Exemplar 1

2 marks

(b) The fuels for the petrol and diesel cars are made from crude oil.

Crude oil is separated into different parts by fractional distillation.

The diagram shows a fractionating column.

Explain why crude oil vapour can be separated by fractional distillation.

All fractions have different boiling points, therefore the vapour is separated. The higher up the vapour is the lower temperature. This causes some of the vapour to condense and the rest is rising up. [3]

Examiner commentary

Most candidates were familiar with a fractionating column, though they found it hard to express their explanations coherently enough to gain credit. Unfortunately, some candidates discussed melting points, and others discussed cracking.

Here, the candidate knows that different fractions within crude oil have different boiling points and also that there is a temperature gradient within the column, so gets 2 of the 3 marks. Candidates who went on to explain their answer in terms of intermolecular forces or molecule sizes could access a further mark.
Exemplar 1

2 marks

The table shows the boiling points of molecules present in different crude oil fractions.

<table>
<thead>
<tr>
<th>Molecule</th>
<th>Boiling point (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>-2</td>
</tr>
<tr>
<td>B</td>
<td>125</td>
</tr>
<tr>
<td>C</td>
<td>216</td>
</tr>
<tr>
<td>D</td>
<td>502</td>
</tr>
</tbody>
</table>

Which molecule, A, B, C or D, is in the LPG fraction?

Explain your decision.

[2] It has the lowest boiling point.

Examiner commentary

Correct answer. The candidate has identified which fraction is the LPG, and given the reason, so scores both marks. This task is not as obvious as it looks, and a significant number of candidates scored 1 mark only. Fraction D was the most common incorrect answer.
Exemplar 1

34

Examiner commentary

Correct answer. This question required candidates to identify both advantages and a disadvantage and to state which was which. Interestingly, the question was answered slightly better than Question 24a. In this example the candidate has appreciated the significance of the emboldened text and has started the answer by giving an advantage and a disadvantage. That the candidate has then given a second advantage shows that they have read the question carefully enough to realise that one of each might not be enough, and so has scored all 3 marks.
Question 25(a)

A student is using the internet to find out about alcohols. The student finds the following information.

<table>
<thead>
<tr>
<th>Name</th>
<th>Number of carbon atoms</th>
<th>Boiling point (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methanol</td>
<td>1</td>
<td>65</td>
</tr>
<tr>
<td>Ethanol</td>
<td>2</td>
<td>79</td>
</tr>
<tr>
<td>Propanol</td>
<td>3</td>
<td>97</td>
</tr>
<tr>
<td>Pentanol</td>
<td>5</td>
<td>138</td>
</tr>
<tr>
<td>Hexanol</td>
<td>6</td>
<td>156</td>
</tr>
</tbody>
</table>

Exemplar 1

3 marks
Examiner commentary
Correct answer. The graph has been drawn well and scores all 3 marks. Many candidates scored well on this task. The main error was to draw the line through the origin.

Question 25(b)(i)

Exemplar 1 1 mark

(b) (i) The student could not find a value for the boiling point of butanol, C₄H₉OH.

Use the graph to estimate the boiling point of butanol.

Answer = [120] °C [1]

Examiner commentary
Correct answer. The candidate has used the graph to correctly identify the boiling point. Low ability candidates either missed the instruction to use the graph or were not certain how to do this. However, many candidates scored well on this task.
Question 25(b)(ii)

Exemplar 1

1 mark

(ii) Draw the displayed formula of butanol, C₄H₉OH.

Examiner commentary
Correct answer. The candidate has made the correction to the diagram clearly and unambiguously, so gains the mark.

Exemplar 2

1 mark

(ii) Draw the displayed formula of butanol, C₄H₉OH.

Examiner commentary
Correct answer. As in Exemplar 1, the answer is unambiguous, and gets the mark. Both these exemplars show the '-OH' group on the right hand side of the molecule. Candidates who draw it on the left hand side of the molecule MUST remember to change it to 'HO-' if they are to get credit.
Question 25(c)

Exemplar 1 0 marks

(c) The alcohols all react in a similar way because they all contain the same functional group.

What is the functional group in an alcohol molecule?

[1]

Examiner commentary

Incorrect answer. A very strong response but, unfortunately, not quite enough. Examiners were looking for ‘hydroxyl’ or ‘hydroxy’ as the possible answers. The candidate would have gained the mark by writing –OH and not trying to name the functional group.

Question 25(d)

Exemplar 1 0 marks

(d) Ethanol, C₂H₅OH, can be oxidised to ethanoic acid using potassium manganate(VII).

What is the formula of ethanoic acid?

[1]

Examiner commentary

The answer is incorrect, but at least the candidate has given a formula. Many candidates gave some form of word or formula equation.
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