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Examiners' report

GCSE

COMBINED SCIENCE A (GATEWAY SCIENCE)

OCR Level 1/Level 2 GCSE (9-1) in Combined Science A (Gateway Science)

J250

For first teaching in 2016

J250/10 Summer 2025 series

Version 1

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Contents

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. A selection of candidate responses is also provided. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.

A full copy of the question paper and the mark scheme can be downloaded from Teach Cambridge.

Paper 10 series overview

J250/10 is the second of two Higher tier papers for the Chemistry content of Gateway Science, Combined Science A. It is designed to assess content from Topics C4 to C6 with assumed knowledge of Topics C1 to C3 and Topic CS7 (PAGs C1-C5) and is worth 60 marks. Questions 1, 2 and 11 overlap with the Foundation tier paper.

There was no evidence to suggest that candidates were short of time in answering this paper. Most candidates attempted every question.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• could explain how catalysts work using ideas about the rate of reaction and activation energy (**Question 11 (c) (ii)**) • understood that increasing the rate of the reaction does not affect the amount of product obtained (**Question 11 (c) (iii)**) • showed their working clearly in calculations (**Question 11 (d) (i) and 15 (a)**) • could suggest an improvement to an experiment to avoid the danger of inhalation of chlorine gas (**Question 13 (c) (ii)**) • were able to recall the pattern of reactivity of the halogens (**Question 13 (d) (i)**) • could recall Le Chatelier's Principle and apply it to explain how a higher yield of a product could be obtained (**Question 14**).	• were unable to calculate the rate of reaction from a tangent shown on a graph (**Question 2**) • could not balance an equation (**Question 11 (a)**) • were unable to calculate the surface area of a cube (**Question 11(d) (i)**) • could not recall the pattern of reactivity of the halogens (**Question 13 (d) (i)**) • confused Le Chatelier's Principle with the definition for dynamic equilibrium and attempted to explain changes in equilibrium position in terms of rates of reaction (**Question 14**) • misinterpreted what one or more questions were asking, e.g. wrote about the pros and cons of recycling rather than evaluating the use of the recycling bins (**Question 15 (b) (i)**).

Section A overview

Section A contains 10 Multiple Choice Questions, which focus on Assessment Objectives 1 and 2 (AO1 and AO2). Questions 1 and 2 overlap with the Foundation tier paper.

It was good to see that candidates attempted every question.

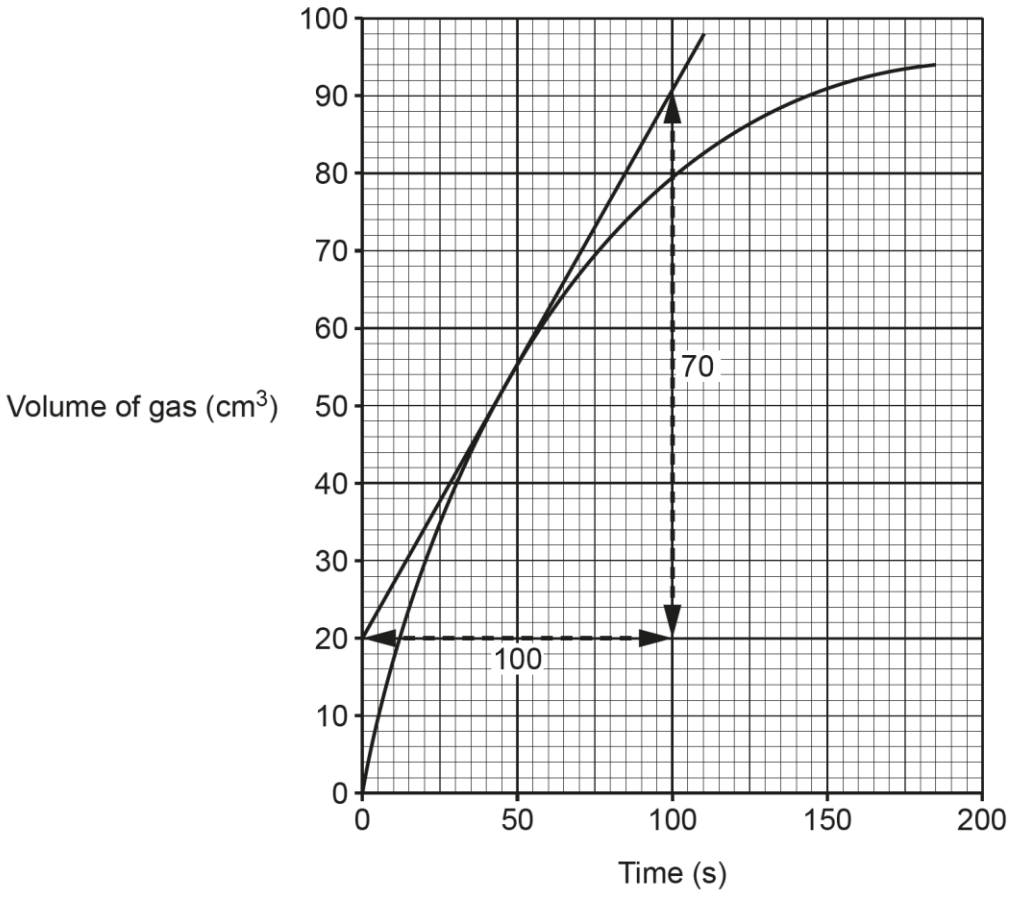
The majority of candidates answered Question 1 (dynamic equilibrium) correctly. The following questions were mostly correct: Question 4 (collision theory) and Question 7 (phytoextraction). Questions 2, 5 and 8 discriminated well between candidates across the range. Question 10 was the most challenging question in this section.

Candidates may find it helpful to underline key words in the question and to show any calculations next to the relevant question. They can write on the paper as they attempt to eliminate the distractors and remove those that they decide are incorrect.

Question 2

2 The graph shows the volume of gas produced during a reaction.

A tangent has been drawn at 50 seconds. The gradient of the tangent gives the rate of reaction.



What is the rate of reaction, in cm^3/s, at 50 seconds?

A 0.56

B 0.70

C 1.1

D 1.4

Your answer ☐ **[1]**

This question proved to be a good discriminator. More than half of candidates were able to correctly calculate the rate of reaction using the tangent. The most common incorrect response was C which is the average rate over the first 50 seconds.

Question 3

3 What are the optimum reaction conditions for the cracking of hydrocarbons?

	Temperature (°C)	Catalyst
A	25	not used
B	25	alumina
C	650	alumina
D	650	not used

Your answer ☐ **[1]**

The majority of candidates correctly selected C. Most knew that a high temperature was required so C and D were popular choices, followed by B with just a catalyst.

Question 5

5 The diagram shows information about a fraction produced in the fractional distillation of crude oil.

What is a correct statement about the fraction produced at the bottom of the fractional distillation column?

A It has a high boiling point.

B It is a gas.

C Its intermolecular forces are weak.

D Its molecules are small.

Your answer ☐ **[1]**

Most candidates knew the link between temperature and the position of the fractions in the column. C was a common incorrect answer.

Question 6

6 These are the first four members of the alkane homologous series.

Methane	CH_4
Ethane	CH_3CH_3
Propane	$CH_3CH_2CH_3$
Butane	$CH_3CH_2CH_2CH_3$

Which statement describes the alkanes in the homologous series?

A The formula of successive alkanes differs by CH_3.

B They have different chemical properties.

C They have the same boiling points.

D They have the same general formula.

Your answer ☐ **[1]**

Only a quarter of candidates missed out on this mark. B was the most common incorrect answer.

Question 8

8 The Earth's early atmosphere may have been mainly carbon dioxide.

Which statement about the carbon dioxide is **incorrect**?

A It dissolved in the oceans.

B It reacted with nitrogen.

C It was absorbed by plants during photosynthesis.

D It was released by volcanoes.

Your answer ☐ **[1]**

Although over half of all candidates correctly chose B, a significant number did not realise that carbon dioxide does dissolve in the oceans so selected A.

Question 9

9 Which equation shows a reaction where copper is extracted using electrolysis?

A $CuCO_3(s) \rightarrow CuO(s) + CO_2(g)$

B $CuCl_2(aq) \rightarrow Cu(s) + Cl_2(g)$

C $2CuO(s) + C(s) \rightarrow 2Cu(s) + CO_2(g)$

D $Cu_2S(s) + O_2(g) \rightarrow 2Cu(s) + SO_2(g)$

Your answer ☐ **[1]**

Around half of candidates selected B correctly. All other responses were seen, with D being the most common.

Question 10

10 Which statement explains why zinc, Zn, is **more** reactive than iron, Fe?

A Fe atoms form negative ions more easily than Zn atoms.

B Fe atoms lose electrons more easily than Zn atoms.

C Zn atoms form positive ions more easily than Fe atoms.

D Zn atoms gain electrons more easily than Fe atoms.

Your answer ☐ **[1]**

This question proved challenging for many candidates with D being the most common incorrect response. Most understood that zinc formed ions more readily than iron, but many thought that electrons were being gained instead of lost.

Misconception

? Many candidates think that electrons are gained, rather than lost, when metals form ions.

Section B overview

Section B, worth 50 marks, consists of short answer questions and an extended six-mark Level of Response question. These questions are designed to test Assessment Objectives 1, 2 and 3 (AO1, AO2 and AO3). Question 11 overlapped with the Foundation tier paper.

It was pleasing to see almost all candidates attempting the Level of Response question (Question 14).

Candidates found the following questions most challenging:

Incomplete combustion (Question 12 (b) (ii)), experimental procedure (Question 13 (c) (ii)), water purification (Question 13 (e) (i)) and the greenhouse effect (Question 16 (a)).

It is important that candidates read the question very carefully to understand exactly what is required - marks cannot be given for good science if it does not answer the question being asked.

Candidates should be reminded to show their working in calculations, in a logical order, rather than just writing the final answer from their calculator. They may be able to access some marks for their working even if their final answer is not correct.

Question 11 (a)

11 Hydrogen peroxide solution, $H_2O_2(aq)$, decomposes to make water and oxygen gas.

(a) Complete the **balanced symbol** equation for the reaction.

$$2H_2O_2(aq) \rightarrow .....H_2O(l) + ...(g)$$

[2]

Almost all candidates knew that 2 water molecules were formed. Fewer remembered that oxygen was diatomic and wrote O_2 to gain the 2nd mark. Common incorrect responses were O and 2O.

Question 11 (b)

(b) Describe a test and its result which shows that the gas produced in the reaction is oxygen.

Test .....

.....

Result .....

.....

[2]

Around half of the candidates scored both marks, with most knowing that a splint was re-lit. Fewer were able to correctly describe a glowing splint; incorrect responses included lit/lighted/burnt out/ extinguished/blown out splint. A small number described other gas tests, most commonly that for hydrogen.

A few misunderstood the question and attempted to describe an experiment to produce oxygen gas, e.g. pondweed photosynthesising, a reaction between 2 chemicals, heating water to break it down to form oxygen.

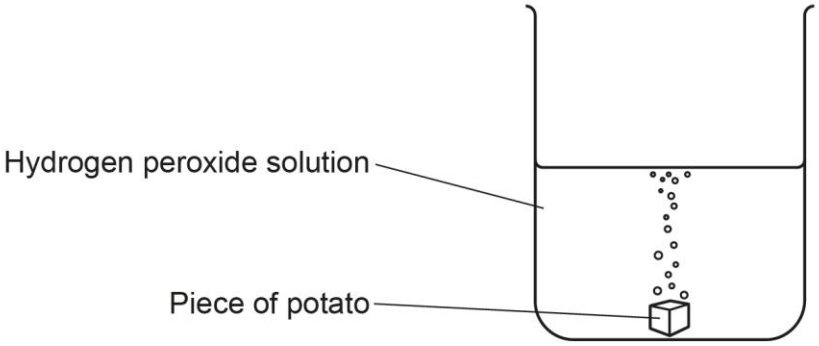
OCR support

A number of the GCSE Examiner Reports this year have raised the concern that candidates' practical skills and knowledge is in decline. OCR has produced a wealth of practical resources to support teachers as part of our Purposeful Practicals materials, including integrated instructions and disciplinary and procedural knowledge assessment opportunities. Find them on Teach Cambridge now.

Question 11 (c) (i)

(c) A hydrogen peroxide solution produces oxygen gas slowly.

A student adds a piece of potato to the hydrogen peroxide solution.
The potato contains a biological catalyst.



(i) What name is given to biological catalysts?

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

While the majority of candidates could name enzymes, some may have been confused by a 'biology' question appearing on a chemistry paper. A wide range of incorrect suggestions were seen with the most common being starch. A small number did not attempt to answer this question.

Question 11 (c) (ii)

(ii) Describe and explain the effect of adding the piece of potato to the hydrogen peroxide solution.

Include ideas about rate of reaction and activation energy.

.....

.....

.....

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

This question was a good discriminator with higher achieving candidates gaining both marks. The majority knew that catalysts speed up the rate of reaction, but fewer mentioned that the activation energy decreased. Some candidates thought that both the rate and activation energy increased. Others thought that the catalyst gave the reaction activation energy, or that because the reaction was faster it reached its activation energy quicker.

A number appeared unclear what the question was asking, so just explained that catalysts speed up reactions without being used up, or they focused on collisions.

Question 11 (c) (iii)

(iii) The student measures the total volume of oxygen produced in the reaction with and without the piece of potato.

With the potato, the total volume is: increased, decreased, stays the same.

Tick (✓) **one** box.

It is decreased. ☐

It is increased. ☐

It stays the same. ☐

[1]

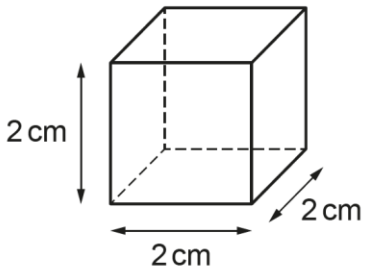
The most common response was 'it is increased' with many candidates incorrectly believing that a faster reaction would produce more gas overall.

Misconception

A common misconception is that increasing the rate of a reaction increases the yield.

Question 11 (d) (i)

(d) The piece of potato added to the hydrogen peroxide solution is a six-sided cube.



(i) Calculate the surface area of the piece of potato in cm^2.

Surface area of the piece of potato = ... cm^2 **[2]**

The majority of candidates understood how to calculate surface area and scored both marks. The most common error was $2^3 = 8$ i.e. a volume calculation.

Very few candidates scored 1 mark for multiplying an incorrect area by 6. However, those who just gave a final incorrect answer with no working were unable to access an 'error carried forward' mark.

Question 11 (d) (ii)

(ii) A student thinks that cutting the potato into smaller pieces will make the catalyst more effective.

Explain why the student is **correct**.

Tick (✓) **one** box.

The smaller pieces have a larger mass. ☐

The smaller pieces have a larger surface area. ☐

The smaller pieces have a larger volume. ☐

[1]

Most candidates knew the correct reason. The common incorrect response was the smaller pieces have a larger volume.

Question 11 (e)

(e) The student measures the rate of reaction when the piece of potato is added to the hydrogen peroxide.

The rate of reaction is 1.5 cm^3/s.

They then measure the rate of reaction again with an increased concentration of hydrogen peroxide.

What would the rate of reaction be now?

Tick (✓) **one** box.

Rate of reaction = 1.5 cm^3/s ☐

Rate of reaction > 1.5 cm^3/s ☐

Rate of reaction < 1.5 cm^3/s ☐

[1]

The majority of students understood the meaning of the symbol '>' and gained the mark. The 3rd choice was the most common incorrect response.

Question 12 (a) (i)

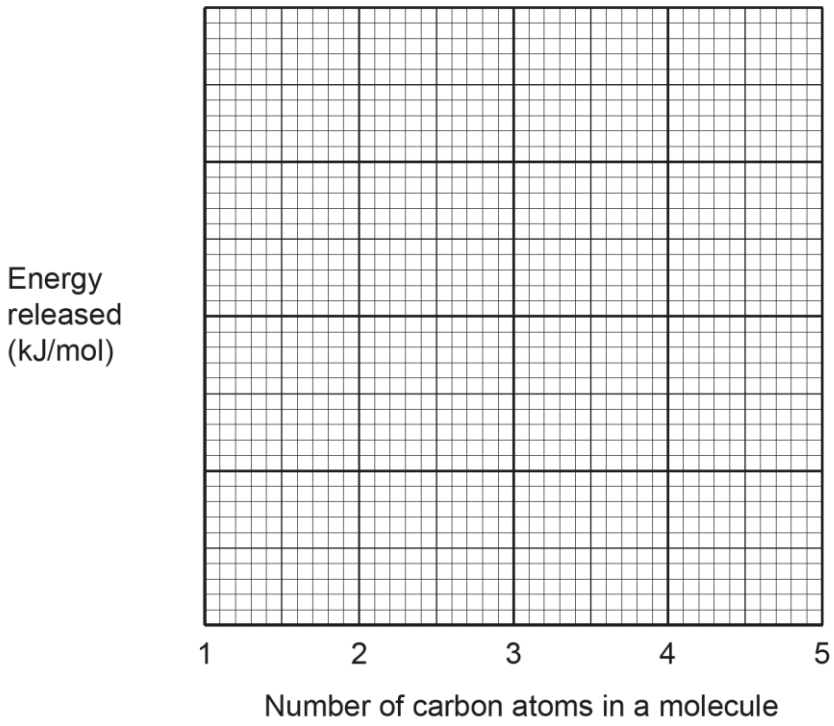
12 Alkanes are an important group of hydrocarbons. They are used as fuels as they release large amounts of energy as they burn.

(a) The table shows how the energy released for different alkanes changes with the number of carbon atoms in a molecule.

Alkane	Number of carbon atoms in a molecule	Energy released (kJ/mol)
Methane	1	900
Ethane	2	1600
Propane	3	
Butane	4	2900
Pentane	5	3500

(i) Plot the data from the table on the graph.

Include a scale for the *y* axis. **[3]**



Most candidates were competent in choosing a good scale and plotting the points. However, a significant number chose a scale of 0, 900, 1800, 2700 etc where one small square = 90; this made it difficult for them to plot their points accurately. Those who did not gain marks had generally chosen a non-linear scale.

For some, the use of a blunt pencil resulted in such large plotted points that it was difficult to confirm their accuracy.

Question 12 (a) (ii)

(ii) Draw a line of best fit. **[1]**

Most candidates drew an acceptable straight line. Others lost the mark as they did not fully erase an incorrect line, linked the points dot-to-dot, or drew a wobbly line freehand. Candidates should be reminded of the importance of using a sharp pencil and a ruler to draw their line of best fit.

Question 12 (a) (iii)

(iii) Use your graph to estimate the energy released when propane burns.

Energy released when propane burns = ... kJ / mol **[1]**

Most candidates were able to read a correct value, within ±½ square, from their graph. However, this proved more challenging for those who had used an unusual scale on their y axis.

Question 12 (b) (i)

(b) When methane, CH_4, burns it can produce carbon monoxide, CO, or carbon dioxide, CO_2.

(i) State **two** problems caused by the products of burning methane.

1 .....

.....

2 .....

.....

[2]

The majority of candidates scored at least one mark, mostly for the idea of global warming or climate change, although they did not always name the gas that was causing this. Higher achieving candidates gained both marks by linking carbon dioxide to global warming or its effects, and for the idea that carbon monoxide was toxic. Some correctly linked carbon monoxide to its action on haemoglobin/red blood cells and the effect it has on oxygen uptake in the blood.

A significant number gave vague responses that could not be credited, e.g. carbon monoxide being harmful/dangerous or causing breathing difficulties, or carbon dioxide being bad for the environment. Others thought that both gases caused global warming. A few misinterpreted the question and referred to problems caused by methane, instead of its combustion products.

Question 12 (b) (ii)

(ii) Suggest why methane sometimes produces carbon monoxide, CO, instead of carbon dioxide, CO_2.

.....

.....

.....

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

This question was a good discriminator with the majority of students still attempting a response. The idea of less oxygen was the most common answer for those scoring one mark, with few mentioning incomplete combustion.

Many mentioned the number of oxygen atoms bonded to the carbon and a few thought it was to do with the amount of energy involved or temperature of the reaction. A variety of other incorrect suggestions were seen. A small number of candidates did not attempt an answer.

Question 13 (a)

13 Chlorine is an element found in Group 7 of the Periodic Table.

(a) What are the elements in Group 7 called?

Tick (✓) **one** box.

The alkali metals ☐

The halogens ☐

The noble gases ☐

[1]

Almost all candidates knew Group 7 were called the halogens; the noble gases were the most common incorrect answer.

Question 13 (b)

(b) Why is chlorine found in Group 7 of the Periodic Table?

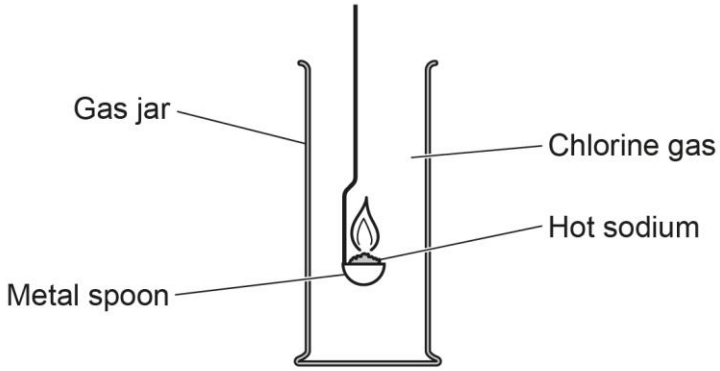
Use ideas about electron arrangement.

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

Most candidates knew that there were 7 electrons in the outer shell. A few gave a correct electron arrangement, but those that referred to chlorine needing one electron to fill its outer shell did not gain credit.

Question 13 (c) (i)

(c) The diagram shows the reaction between a small piece of hot sodium and chlorine gas.



The sodium burns with a bright yellow flame and a white solid is produced.

(i) What is the **name** of the white solid made in the reaction?

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

Many candidates could name sodium chloride, and it was good to see that most gave the name rather than the formula. The most common incorrect response was salt.

Less successful candidates gave a range of responses such as sodium oxide, limestone, precipitate and elements which were neither sodium nor chlorine, e.g. hydrogen, magnesium.

Question 13 (c) (ii)

(ii) A student thinks that the experiment is unsafe.

How could the experiment be improved to make it safe?

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

This question was not well answered. Most candidates mentioned the use of safety goggles/(gas) masks/gloves/tie hair back/safety screens/ventilated area/heat proof mat/insulated spoon rather than giving a way of avoiding the dangers of inhaling toxic chlorine gas.

A few realised that a lid was needed on the gas jar. Not many suggested doing the experiment in a fume cupboard, with some being unable to recall its name and suggesting a gas chamber or similar instead.

Question 13 (c) (iii)

(iii) The metal spoon is made from an alloy of copper.

Suggest a property of this alloy which makes it suitable to use in the experiment.

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

Many candidates scored this mark for the idea of a high melting point with fewer referring to a lack of reactivity. Incorrect responses included good heat conductor, high boiling point, durable/strong metal, or less reactive (instead of unreactive).

Question 13 (d) (i)

(d) The Group 7 elements can be placed into an order of reactivity by using displacement reactions.

The table shows the results of mixing three Group 7 elements, **X**, **Y** and **Z**, and solutions of their salts.

Key	✓ = reaction	✗ = no reaction

	Salt (aq)		
Element	**KCl(aq)**	**KBr(aq)**	**KI(aq)**
X	✗	✗	✓
Y	✗	✗	✗
Z	✗	✓	✓

(i) Describe how the reactivity of the Group 7 elements changes going down the group.

Use the Periodic Table.

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

This question discriminated well with higher achieving candidates able to recall the pattern of reactivity. Others thought that reactivity increased down the group.

Question 13 (d) (ii)

(ii) Which of the elements **X**, **Y** or **Z** is chlorine?

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

Many candidates correctly identified element Z, with Y being the most common incorrect response.

Question 13 (d) (iii)

(iii) Which statements about the reactivity of the Group 7 elements are **true**, and which are **false**?

Tick (✓) **one** box in each row.

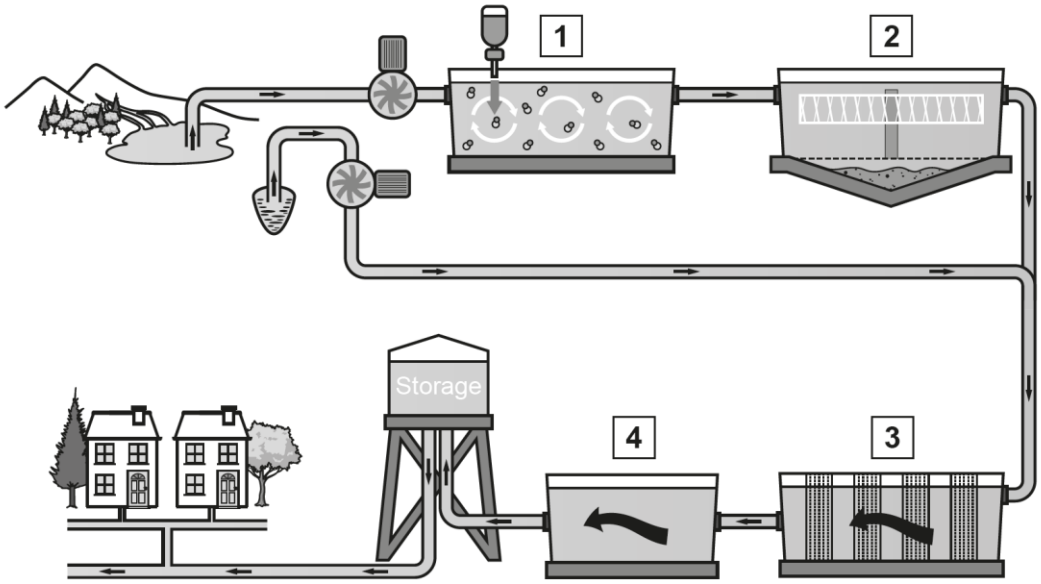
The reactivity of the Group 7 elements increases as...	True	False
...their atoms have more electron shells.		
...their atoms gain electrons more easily.		
...the number of protons in the nucleus increases.		

[2]

The majority of candidates scored at least one mark, with many gaining both. The most common error was to select True for the first row.

Question 13 (e) (i)

(e) This diagram shows how water is treated so it is safe to drink.



(i) At which stage, **1–4**, is chlorine added to water?

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

This process does not appear to be well known; few candidates knew that chlorine is added at stage 4. The most common incorrect answers were stage 1 (possibly because the diagram shows something being added here) and stage 3.

Question 13 (e) (ii)

(ii) Why is chlorine added to water?

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

Many candidates knew that chlorine was added to kill bacteria but bacteria just being 'removed' was not credited. Other common incorrect responses referred to making water potable, cleaning, purifying, removing toxins, getting rid of diseases or just making it safe to drink.

Question 14*

14* Hydrogen is an important chemical used in industry.

Hydrogen is produced when methane and steam are left to reach a dynamic equilibrium.

$CH_4(g) + H_2O(g) \rightleftharpoons CO(g) + 3H_2(g)$

The forward reaction is endothermic.

Describe and explain how changing **one** reaction condition can produce as much hydrogen as possible.

State and use Le Chatelier's principle.

.....

.....

.....

.....

.....

..... **[6]**

This question was attempted by almost all candidates and proved to be a good discriminator. Many were aware of Le Chatelier's Principle but were unable to both recall it accurately and demonstrate a clear enough understanding in order to attain Level 3.

Some candidates could explain that a change in conditions resulted in the reaction counteracting it, but did not relate this to an equilibrium or reversible reaction. Others confused Le Chatelier's Principle with dynamic equilibrium and just stated that the rate of the forward reaction equals the rate of the backward reaction.

Candidates were asked to describe and explain one reaction condition, but many attempted to describe more than one of temperature/concentration/pressure. This led to some confusion when they only got one of them correct. Unfortunately, most were unable to explain clearly how the change in the reaction condition they chose affected the equilibrium.

Temperature, followed by pressure were the most common factors described. Many suggested increasing the temperature and some were able to explain that the forward endothermic reaction would be favoured. A lot of others focused on collision theory and thought that more hydrogen would be produced because the rate increased. Very few mentioned that moving in the endothermic direction would cool the reaction down.

Some who chose pressure thought that an increase in pressure would increase the amount of hydrogen. Others correctly explained how both an increase and a decrease in pressure would affect the equilibrium in terms of the relative number of moles of reactant and products. However, they did not always go on to say whether an increase or decrease of pressure would produce more hydrogen.

The few who suggested increasing concentration were generally less successful. They often did not make it clear what they would increase the concentration of or attempt to give an explanation.

Less successful candidates often just repeated the stem of the question and said they would 'change one reaction condition to make as much hydrogen as possible' but did not attempt to say what factor they would change or give a suitable explanation.

Some candidates are comparing elemental hydrogen in the products (H_2) with hydrogen within compounds in the reactants (CH_4 and H_2O). They believe that the equilibrium must shift to favour the reactants to produce the maximum amount of hydrogen.

In summary, most candidates found this question very challenging and a lot of confused answers were seen.

Misconception

A number of candidates think that an equilibrium consists of two separate systems that can have their conditions changed independently, e.g. that we can increase the temperature of just the reactants but not the products.

Many believe that more products are formed in an equilibrium reaction when temperature is increased due to particles having more energy, more frequent collisions and therefore a faster rate of reaction.

Exemplar 1

Le Chatelier's principle states that the position of equilibrium will shift forwards or backwards to oppose any change in the reaction condition. ~~So if the position of~~ ~~So if the reactants~~ So if the temperature increased for example the position of equilibrium will shift towards the backwards reaction / right hand side to oppose this change in condition because the reactants will have more energy and the rate of reaction will increase. this means that more hydrogen will be produced. **[6]**

This response was awarded Level 2, 3 marks. This example is typical of responses where candidates attempt to explain in terms of rates of reaction.

The candidate has given a satisfactory statement of Le Chatelier's Principle. They have described a change in a reaction condition that produces as much hydrogen as possible i.e. increase the temperature. However, they are confused as to which direction the equilibrium will move as they think the backwards reaction is a move to the right. They have the science correct for Level 2, but their communication is muddled, so only the lower mark within Level 2 is awarded.

They have attempted to explain the change but their science is incorrect so they cannot access Level 3. If they had explained that the reaction moves in the endothermic direction in order to cool it down, they could have been awarded Level 3, 5 marks. In this instance their confusion with backwards reaction/right hand side could have been treated as poor communication and limited them to the lower mark within Level 3.

Question 15 (a)

15 Aluminium cans are made from aluminium extracted from aluminium ore or from recycled aluminium.

(a) It takes 300 MJ of energy to produce 1.0 kg of aluminium from aluminium ore.

It needs 96% less energy to produce aluminium cans from recycled aluminium.

One aluminium can has a mass of 15 g.

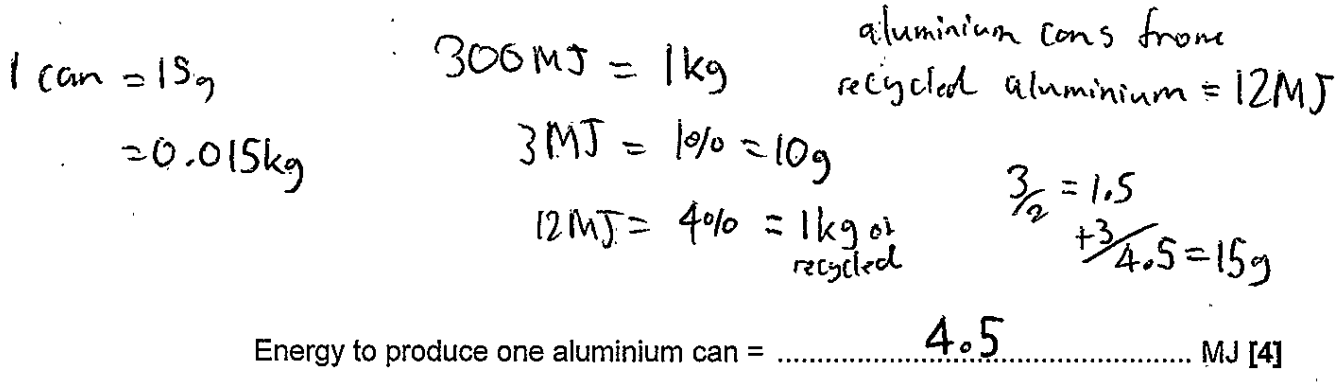
Calculate how much energy, in MJ, it takes to produce **one** aluminium can from recycled aluminium.

Energy to produce one aluminium can = ... MJ **[4]**

Candidates found this question very challenging, but almost everyone attempted it, with most scoring marks. Higher achieving candidates commonly gained all 4 marks. Several different routes through this calculation were seen, but it was frequently difficult to follow the working. It was most common to award 2 marks for 4% of 300 = 12(MJ), which candidates could achieve in more than one way.

The most common error was to omit the conversion of 15g to 0.015kg, or to convert it incorrectly. Some used 96% rather than 4% so scored only 3 marks. Evidence from the calculation methods used by some candidates suggests that they did not have a calculator with them.

Exemplar 2



Many candidates presented muddled working, or no working at all, making it difficult to award marks if the final answer was incorrect.

This calculation is laid out clearly so that although the final answer is incorrect, marks can be given for the working. This candidate scored 3 marks, as follows: conversion of 15g to 0.015kg (1), use of 4% (1), 4% of 300 = 12 MJ (1). However, the working suggests that they may not have had a calculator available.

Candidates often achieved 12MJ by taking 96% of 300 = 288. Then they subtracted this from 300MJ to give 12MJ.

Question 15 (b) (i)

(b) The picture shows recycling bins in a school.

(i) Evaluate the role of these recycling bins in supporting the recycling of materials such as aluminium cans.

Include both a positive and a negative factor in your answer.

Positive factor .....

.....

Negative factor .....

.....

[2]

The majority of candidates scored at least one mark, mostly for a positive factor. The most common responses included the idea of encouraging recycling or being easier to sort and recycle. The idea of less waste going to landfill was not often seen.

The most common negative factor was the idea that people put their waste into the wrong bin. Some candidates realised that more bins need to be emptied/transported but few referred to the fact that products made of mixed materials could not be recycled in any of these bins. The idea that cans may still need to be sorted because they are not all made of aluminium was rarely seen.

A common error was to address the importance/value of recycling and then considering the cost of recycling as a negative factor, rather than realising that the question was about evaluating the use of the bins.

Question 15 (b) (ii)

(ii) The aluminium cans which are collected are transported to a recycling plant.

Outline how these aluminium cans are processed ready to be made into new products.

.....

.....

.....

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

Most candidates scored one mark for melting or crushing, with higher achievers scoring both. Many responses gave more than one answer from the same marking point, e.g. cleaning and crushing, melting and remoulding so could not score both marks.

A few thought that aluminium had to be extracted/purified from a mixture of metals. A small number confused recycling with extraction of aluminium and wrote about electrolysis and/or adding a chemical (occasionally attempting to name cryolite) to reduce the melting point.

Question 16 (a)

16 Greenhouse gases, such as methane, keep the Earth and its atmosphere warm. This is called the greenhouse effect.

(a) **Fig. 16.1** shows the greenhouse effect.

Fig. 16.1

- Solar radiation from the Sun reaches the Earth's surface.
- Most of the radiation is absorbed by the Earth's surface.
- The remainder is emitted by the Earth's surface as infrared radiation.

Describe how greenhouse gases help keep the Earth and its atmosphere warm.

.....

.....

.....

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

The majority of candidates had a poor understanding of how greenhouse gases cause global warming, with less than half scoring any marks. Many did not read the question carefully and focused on the radiation from the sun reaching the greenhouse gases before it reached the Earth, demonstrating a lack of understanding of the diagram. Common errors included: greenhouse gases getting trapped, absorbing sunlight/sun's rays, forming a blanket, blocking radiation. A few thought that greenhouse gases are involved with or cause the ozone layer.

The most popular correct answer was for the idea that greenhouse gases trap heat in the atmosphere; very few candidates mentioned the idea of IR radiation being re-emitted back to Earth.

Some candidates explained how named greenhouse gases were formed, e.g. vehicle fumes, but this was not required.

Misconception

Common misconceptions relating to greenhouse gases include:

- they are absorbed into/trapped in the atmosphere
- they are absorbed into/trapped in the ozone layer
- they form a blanket in the atmosphere
- they absorb sunlight /sun's rays
- they reflect the radiation/rays back to Earth.

Question 16 (b)

(b) **Fig. 16.2** shows how the Earth's temperature has changed since 1880 (compared to the average temperature from 1951–1980).

Fig. 16.2

Image removed to due to third party copyright restrictions

The level of methane in the air has been steadily increasing since 1880.

Describe how **Fig. 16.2** supports the idea that increased levels of methane contribute to global warming.

Include an argument that opposes this idea.

.....

.....

.....

.....

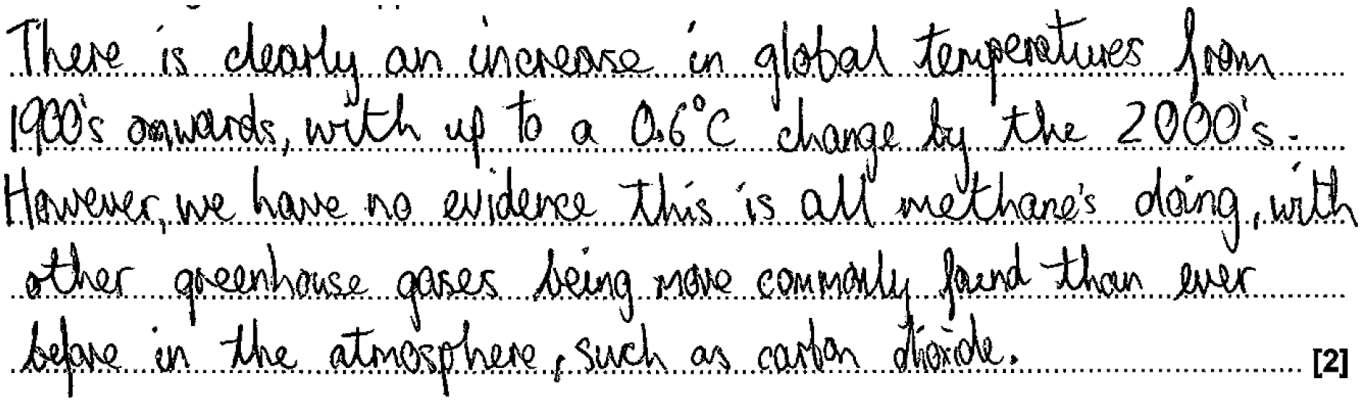
..... **[2]**

Many candidates scored at least 1 mark, with higher achievers scoring both marks. Most appreciated that the graph showed a general increase in temperature but often did not link this to the increased levels of methane so could not gain credit. A few commented that the graph did not show the methane levels.

However, many were able to recall that other factors (other greenhouse gases and carbon dioxide in particular) were responsible for global warming. Some also mentioned the fact that other factors were involved but did not name them, so gained no credit. A small number commented on the fact that the temperature fluctuates even though methane is increasing. The idea that 'Earth's atmosphere is complex so it is hard to draw accurate conclusions' was rarely seen. It was good to see correct additional answers that were not in the mark scheme, e.g. Milankovitch cycles.

Some candidates misinterpreted the question and focused on explaining that methane levels were rising, and where the methane was coming from. There were some mentions of methane increasing due the industrial revolution and increasing numbers of vehicles.

Exemplar 3


There is clearly an increase in global temperatures from 1900's onwards, with up to a 0.6°C change by the 2000's. However, we have no evidence this is all methane's doing, with other greenhouse gases being more commonly found than ever before in the atmosphere, such as carbon dioxide. [2]

This is a typical response and was given 1 mark. Although the candidate has used evidence from the graph that global temperatures are rising and given some data to support this, they have not linked it to the fact that methane levels are increasing (which was stated in the stem of the question). The first mark cannot be given. The second mark is awarded for naming another factor, carbon dioxide, that could be causing the temperature increase.

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