

**GCSE (9–1) Combined Science
(Chemistry) A (Gateway Science)
J250/10 Paper 10 (Higher Tier)
Sample Question Paper**

H

Date – Morning/Afternoon

Version 2.2

Time allowed: 1 hour 10 minutes

You must have:

- the Data Sheet

You may use:

- a scientific or graphical calculator
- a ruler



First name

Last name

Centre
number

Candidate
number

INSTRUCTIONS

- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION

- The total mark for this paper is **60**.
- The marks for each question are shown in brackets [].
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **24** pages. Any blank pages are indicated.

SECTION A

Answer **all** the questions.

You should spend a maximum of 20 minutes on this section.

- 1** Fractional distillation is used to separate crude oil into a range of other substances.

The process uses a fractionating column.

Which statement about fractional distillation is / are correct?

- 1** Propane, C_3H_8 , is found in the fraction obtained from the top of the column
- 2** Crude oil is heated before it enters the bottom of the column

- A** 1 only
- B** 2 only
- C** Both 1 and 2
- D** Neither 1 nor 2

Your answer

[1]

- 2** The processes below are used to make water safe to drink.

- chlorination
- filtration
- sedimentation

In what order are these processes done?

- A** Chlorination then filtration then sedimentation
- B** Filtration then chlorination then sedimentation
- C** Filtration then sedimentation then chlorination
- D** Sedimentation then chlorination then filtration

Your answer

[1]

3 Rubidium is found in Group 1 of the Periodic Table.

Bromine is found in Group 7.

Rubidium and bromine react together to form an ionic compound.

Which row shows the electron change for rubidium and the formula of a rubidium ion?

	Electron change	Formula of ion
A	Electron gained	Rb ⁺
B	Electron gained	Rb ⁻
C	Electron lost	Rb ⁺
D	Electron lost	Rb ⁻

Your answer

[1]

4 Aluminium is extracted from its ore by electrolysis.

Which statement explains why aluminium can **only** be extracted by electrolysis?

A Aluminium is lower than carbon in the reactivity series.

B Aluminium is lower than sodium in the reactivity series.

C Aluminium is higher than carbon in the reactivity series.

D Aluminium is higher than iron in the reactivity series.

Your answer

[1]

- 5 Crude oil is separated into fractions which have different boiling points.

Look at the table.

Which letter shows the correct relationship between boiling point, the number of carbon atoms and the size of intermolecular forces?

	Boiling point	Number of carbon atoms in the molecule	Size of intermolecular forces
A	low	less than 20	small
B	low	more than 50	large
C	high	less than 20	large
D	high	more than 50	small

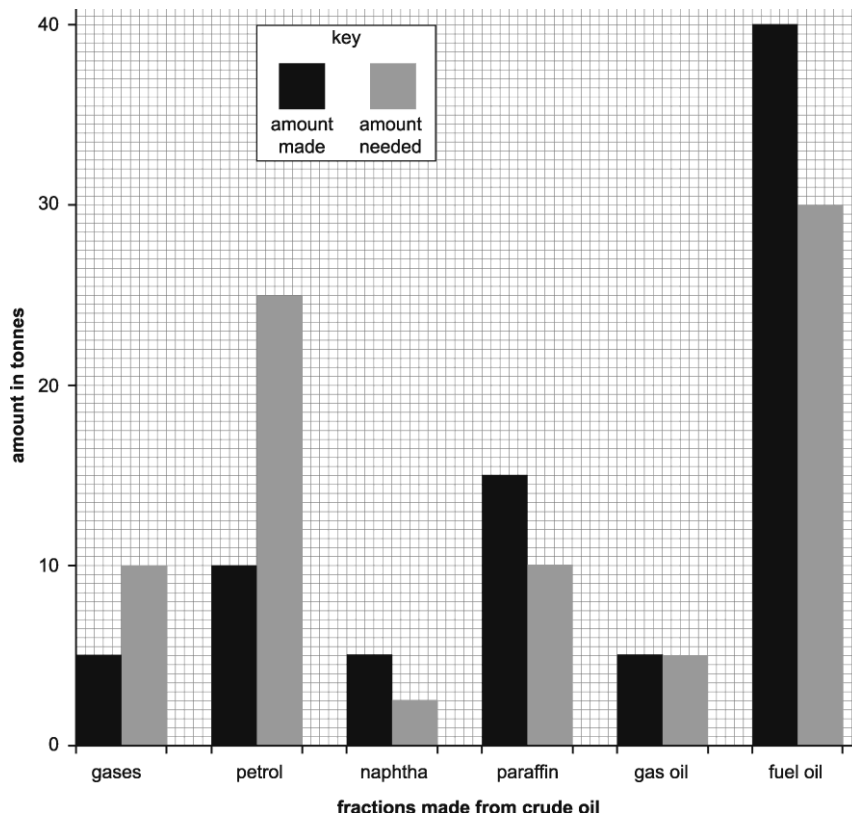
Your answer

[1]

- 6 Fractional distillation separates the substances in crude oil into useful fractions in a refinery.

Look at the bar chart.

- It shows the amount of some of the fractions made from 100 tonnes of crude oil.
- It also shows the amount of each fraction needed for everyday uses.



Cracking converts large molecules into smaller more useful molecules to make supply meet demand.

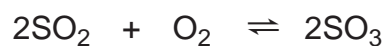
What percentage of petrol is produced by cracking?

- A 25%
- B 40%
- C 50%
- D 60%

Your answer

[1]

- 7 During the manufacture of sulfuric acid, sulfur dioxide, SO_2 , and oxygen, O_2 , react together in a reversible reaction to make sulfur trioxide, SO_3 .



The forward reaction is exothermic.

Which of these sets of conditions give the highest percentage yield of sulfur trioxide at equilibrium?

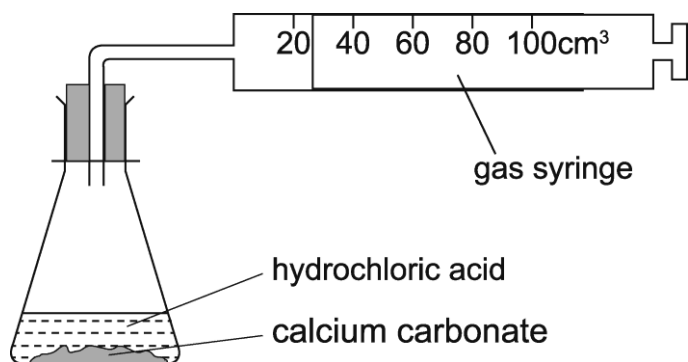
- A 250°C and 1 atm pressure
- B 250°C and 250 atm pressure
- C 450°C and 1 atm pressure
- D 450°C and 250 atm pressure

Your answer

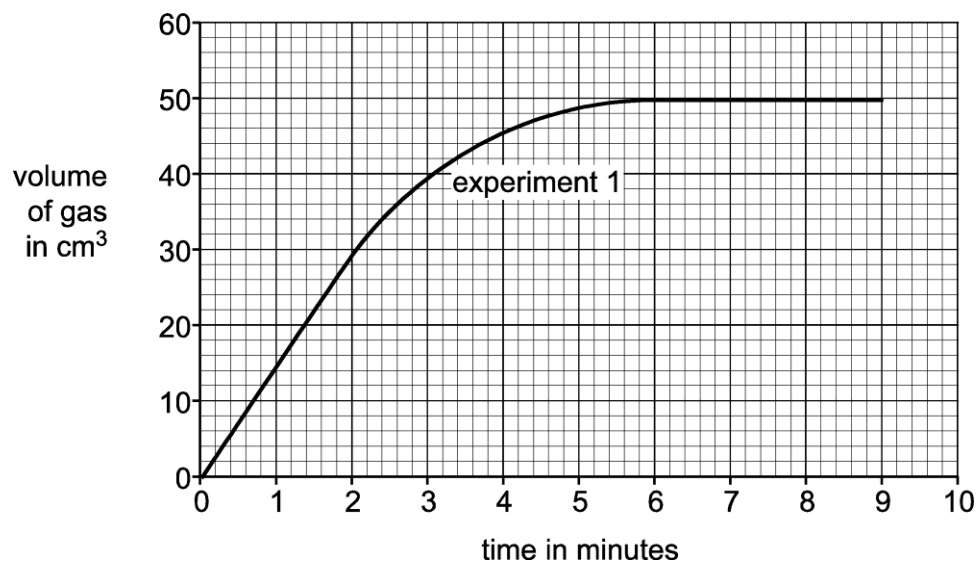
[1]

- 8 A student investigates the reaction between calcium carbonate and hydrochloric acid.

Look at the diagram. It shows the apparatus he uses.



Look at the graph. It shows his results for the experiment.



What is the rate of reaction between 0 and 2 minutes in $\text{cm}^3/\text{minute}$?

- A 7.5
- B 15
- C 30
- D 60

Your answer

[1]

9 Look at the diagrams of the electron structures of four elements.

A	B	C	D

Which element is the most reactive?

Your answer

[1]

10 Which statement is correct for a Group 1 element?

- A It dissolves in water to form a bleach.
- B It is a non-metal.
- C It is an inert gas.
- D It reacts with water to form hydrogen.

Your answer

[1]

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TURN OVER FOR THE NEXT QUESTION

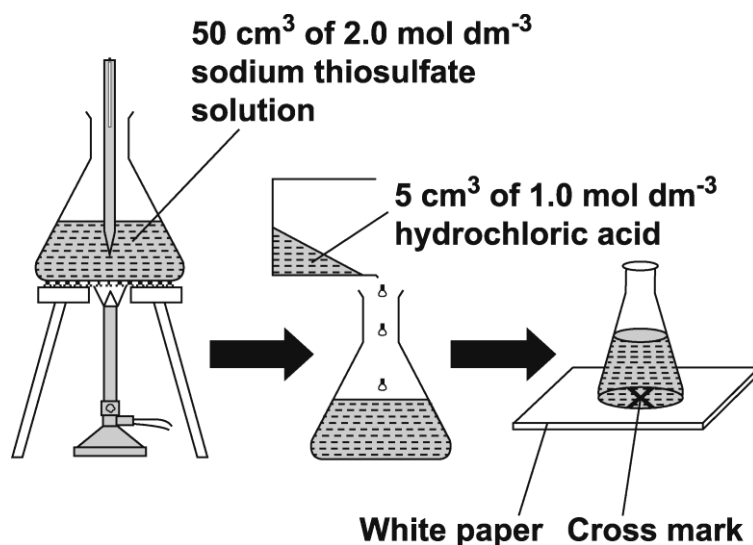
SECTION B

Answer **all** the questions.

11 This question is about rates of reaction.

A student investigates the reaction between sodium thiosulfate solution and hydrochloric acid at different temperatures.

(a) Look at how the student does the experiment.



1. He measures 50 cm³ of sodium thiosulfate solution into the conical flask
He heats the solution to the required temperature.
He records the temperature.
2. He takes the flask off the tripod and gauze and places it on the bench.
3. He adds 5 cm³ of hydrochloric acid and then places the flask on the cross.
4. He measures the time for the cross to disappear.

How should the student improve his method?

Explain your answer.

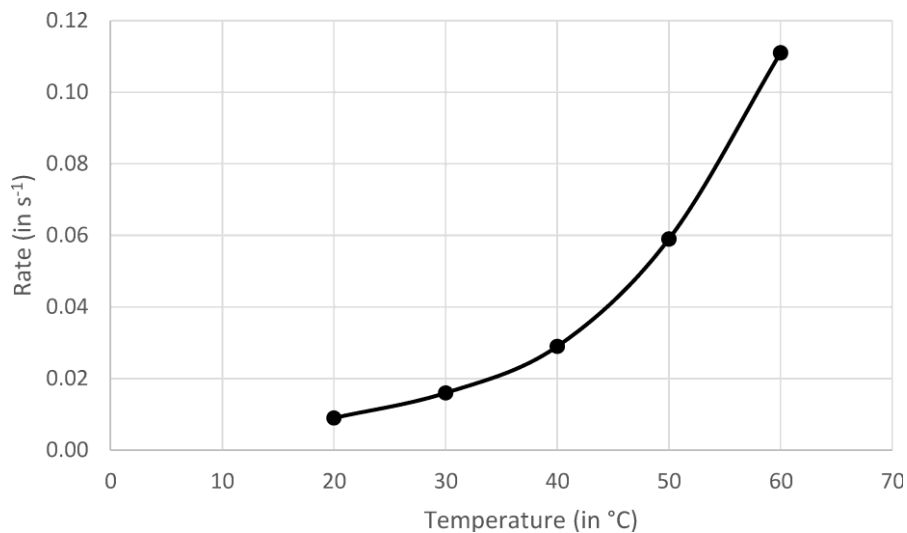
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..... [2]

(b) Look at the graph. It shows the student's results at different temperatures.



When is the reaction fastest?

Use the graph to explain your answer.

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..... [2]

(c) Explain why the rate of reaction of sodium thiosulfate solution and hydrochloric acid is different at different temperatures.

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..... [2]

12 This question is about the reactivity series of metals.

A student heats mixtures of metals and metal oxides.

Look at the table. It shows his results.

	Magnesium, Mg	Lead, Pb	Iron, Fe	Copper, Cu
Magnesium oxide, MgO	no reaction	no reaction	no reaction	no reaction
Copper oxide, CuO	magnesium oxide and copper formed	lead oxide and copper formed	iron oxide and copper form	no reaction
Lead oxide, PbO	magnesium oxide and lead formed	no reaction	iron oxide and lead formed	no reaction
Iron oxide, Fe₂O₃	magnesium oxide and iron formed	no reaction	no reaction	no reaction

(a) Using the results, work out an order of reactivity for the metals.

Explain how you used the results to put the metals in order of reactivity.

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..... [4]

(b) In another experiment, the student reacts copper with silver nitrate, AgNO₃.

Silver and copper nitrate, Cu(NO₃)₂, are formed.

Write a **balanced symbol** equation for the reaction.

..... [2]

13 This question is about life-cycle assessment.

(a) A sports company is developing three new training shoes.



A



B



C

They do a **life-cycle assessment** of each training shoe.

Look at the table.

It gives information from the life-cycle assessment of the training shoes.

	Training shoe A	Training shoe B	Training shoe C
Total energy use (in MJ)	178.77	204.23	156.07
CO₂ emissions (in kg)	13.8	12.0	10.9
Fresh water use (in litres)	4424	3733	3868
Solid waste produced (in kg)	1.04	0.67	0.95
Relative use of solvents	0.101	0.082	0.079

The company decides to manufacture and sell training shoe **C**.

Explain why they make this choice.

Use information from the table to help you.

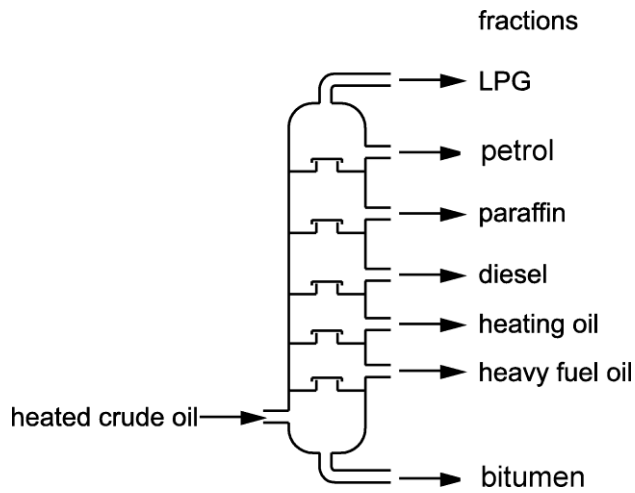
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..... [2]

- (b) The materials used to make trainers are made from crude oil.
Crude oil is separated into many fractions by fractional distillation.
The diagram below shows a fractionating column.



Explain **how** crude oil is separated using a fractionating column.

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[4]

15 A student is making magnesium chloride, MgCl_2 .

(a) Look at the method she uses.

1. Measure 50 cm^3 of dilute hydrochloric acid into a beaker.
2. Add magnesium powder until there is no more effervescence.
3. Heat the mixture until saturated.

Her method does **not** make a pure dry sample of magnesium chloride.

How should she improve her method to get a **pure dry** sample of magnesium chloride?

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..... [1]

(b) Magnesium reacts rapidly with hydrochloric acid.

Barium reacts **more** rapidly with hydrochloric acid.

Explain why this is the case. Use ideas about loss of electrons.

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..... [2]

- (c) Magnesium chloride, MgCl_2 , can also be made by reacting hydrochloric acid, HCl , with magnesium carbonate, MgCO_3 .

Look at the equation for the reaction.



The student uses 2.8 g of magnesium carbonate.

Calculate the mass of magnesium chloride that she should make.

Give your answer to **two significant figures**.

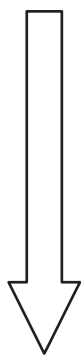
- Relative formula mass of magnesium carbonate = 84.3
- Relative formula mass of magnesium chloride = 95.3

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Answer =g [2]

16 Look at the reactivity series of some metals.

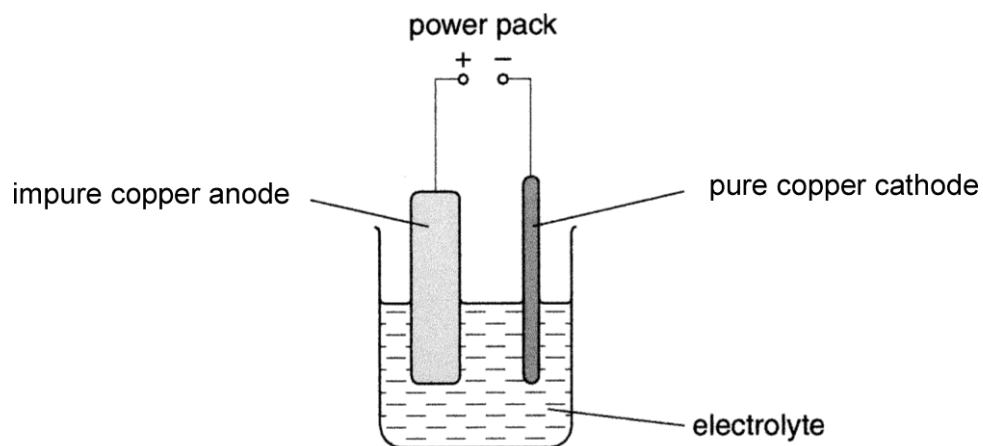
The element carbon is also included in the reactivity series.

sodium	MOST REACTIVE
calcium	
carbon	
tin	
copper	
silver	
gold	

(a) Why is carbon used to extract **copper** from copper oxide?

.....
 [1]

(b) The copper obtained from copper oxide is purified by **electrolysis**.



At the cathode,

- copper ions, Cu^{2+} , gain electrons.
- copper atoms are formed.

Write a **balanced half equation** for the reaction.

Use e^- to represent an electron.

..... [2]

(c) There are other methods of extracting copper.

Look at the information about three other methods of extracting copper.

Method	Key features
Thermal decomposition of copper sulfide, CuS	<ul style="list-style-type: none"> • $\text{CuS} \rightarrow \text{Cu} + \text{SO}_2$ • endothermic reaction • fast reaction
Bioleaching	<ul style="list-style-type: none"> • bacteria use energy of Cu–S bond • uses only 30–50% of energy of thermal decomposition • slow
Phytomining	<ul style="list-style-type: none"> • plants absorb copper compounds when they grow • plants are burned and copper is extracted from the ash

Evaluate bioleaching and phytomining as methods of extracting copper.

Which method would you use? Explain your answer.

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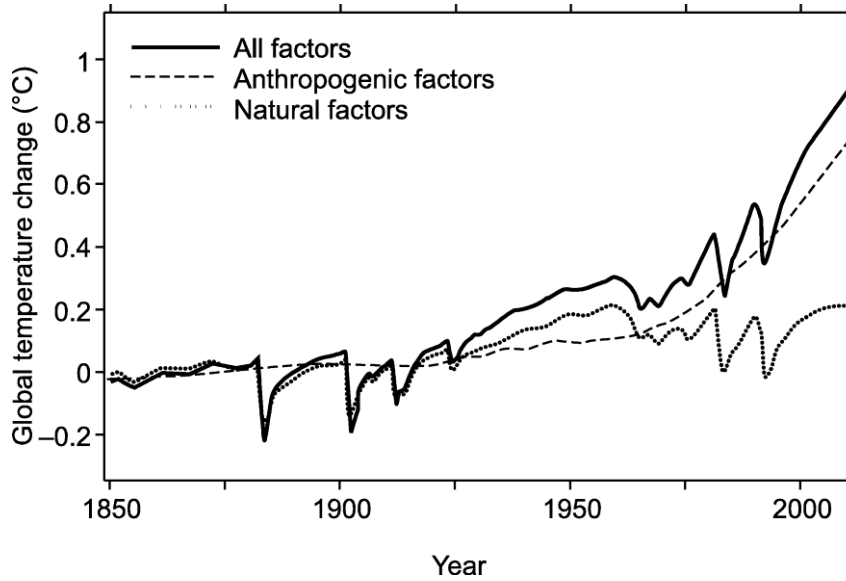
..... [3]

17 Gases such as methane and carbon dioxide absorb infrared radiation that is radiated by the Earth's surface. As a result, the Earth's surface is warmed. This is called the greenhouse effect.

(a) Look at the graph.

It shows how global temperatures have changed as a result of:

- all factors
- anthropogenic factors
- natural factors.



Evaluate the evidence that anthropogenic factors are contributing significantly to global temperature change.

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..... [2]

(b) Global temperature change is one potential effect of increased carbon dioxide levels.

Describe **three** ways in which this effect may be reduced.

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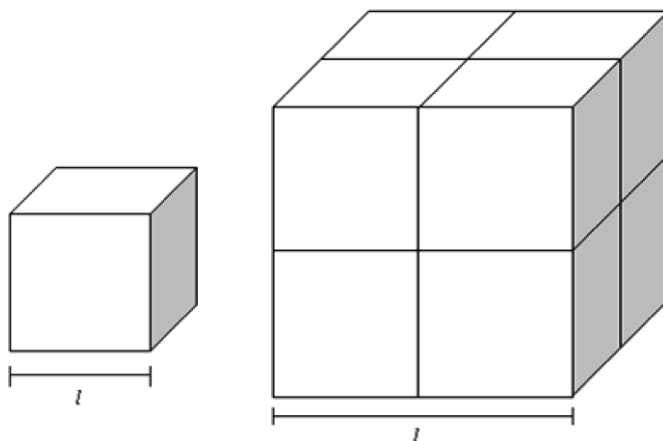
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..... [3]

- 18** A student investigates the reaction between calcium carbonate and hydrochloric acid.

He thinks the reaction will be faster if he uses smaller pieces of calcium carbonate.

He uses different sized cubes of calcium carbonate.



He finds out that the larger the surface area to volume ratio, the faster the reaction.

The surface area to volume ratio for a cube with $l = 1$ cm is 6.0.

- (a)** Calculate the surface area to volume ratio for a cube with $l = 5$ cm.

Answer = [3]

- (b)** Explain why cubes of calcium carbonate with a larger surface area to volume ratio react faster.

.....

 [1]

- (c) The student reacts hydrochloric acid with excess calcium carbonate to produce carbon dioxide gas.

He measures the rate at which the carbon dioxide gas is produced.

He finds that cubes of calcium carbonate with $l = 5$ cm produce gas at a rate of 1.6 cm^3 per second.

The student assumes the surface area to volume ratio is proportional to the rate.

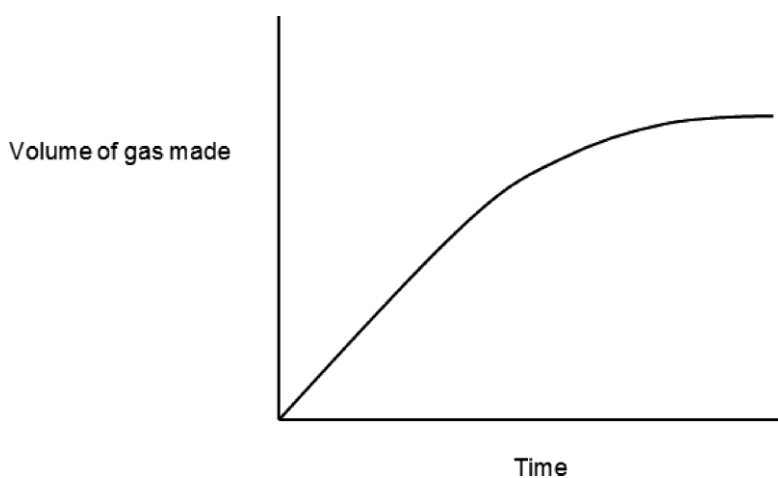
Predict the rate of reaction for cubes of calcium carbonate with $l = 1$ cm.

Use your answer to part (a) to help you answer.

Answer = cm^3 per second [2]

- (d) Other factors affect the rate of a reaction.

The graph below shows the rate of a reaction in which a gas product is made at **60 °C**, without a catalyst.



Add two curves to this graph:

- (i) One for the same reaction which is carried out at **30 °C**, **without** a catalyst. Label the line, **A**. [1]
- (ii) One for the same reaction which is carried out at **60 °C**, **with** a catalyst. Label the line, **B**. [1]

END OF QUESTION PAPER

DO NOT WRITE ON THIS PAGE

Summary of updates

Date	Version	Details
November 2021	2.2	Updated copyright acknowledgements.

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...day June 20XX – Morning/Afternoon

GCSE (9–1) Combined Science (Chemistry) A (Gateway Science)

J250/10 Paper 10 (Higher Tier)

SAMPLE MARK SCHEME

Duration: 1 hour 10 minutes

MAXIMUM MARK 60

This document consists of 20 pages

MARKING INSTRUCTIONS**PREPARATION FOR MARKING****SCORIS**

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal <http://www.rm.com/support/ca>
3. Log-in to scoris and mark the **required number** of practice responses (“scripts”) and the **required number** of standardisation responses.

YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the scoris 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the scoris messaging system.

5. Work crossed out:
 - a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks
 - b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.
6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.
7. There is a NR (No Response) option. Award NR (No Response)
 - if there is nothing written at all in the answer space
 - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
 - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).
8. The scoris **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
If you have any questions or comments for your Team Leader, use the phone, the scoris messaging system, or email.
9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:
Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer. Once the level is located, award the higher or lower mark:

The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.

The lower mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.

In summary:

The skills and science content determines the level.

The communication statement determines the mark within a level.

11. Annotations

Annotation	Meaning
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
()	Words which are not essential to gain credit
–	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

12. Subject-specific Marking Instructions

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9–1) in Combined Science A:

	Assessment Objective
AO1	Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.
AO2.1	Apply knowledge and understanding of scientific ideas.
AO2.2	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
AO3	Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.
AO3.1	Analyse information and ideas to interpret and evaluate.
AO3.1a	Analyse information and ideas to interpret.
AO3.1b	Analyse information and ideas to evaluate.
AO3.2	Analyse information and ideas to make judgements and draw conclusions.
AO3.2a	Analyse information and ideas to make judgements.
AO3.2b	Analyse information and ideas to draw conclusions.
AO3.3	Analyse information and ideas to develop and improve experimental procedures.
AO3.3a	Analyse information and ideas to develop experimental procedures.
AO3.3b	Analyse information and ideas to improve experimental procedures.

SECTION A

Question	Answer	Marks	AO element	Guidance
1	C	1	1.1	
2	C	1	1.2	
3	C	1	2.1	
4	C	1	1.2	
5	A	1	1.2	
6	D	1	2.1	
7	B	1	2.1	
8	B	1	2.2	
9	A	1	2.1	
10	D	1	1.1	

SECTION B

Question		Answer	Marks	AO element	Guidance
1 1	(a)	measure temperature of sodium thiosulfate and acid mixture (1) (because) temperature will be different from sodium thiosulfate solution alone (1) OR place flask on cross before adding acid (1) idea that reaction has started before timing begins / idea that moving flask will increase mixing (1)	2	3.3b	ALLOW measure temperature of sodium thiosulfate solution when it has been removed from tripod (1) (because) temperature will continue to rise after flask is removed from tripod (1)
	(b)	(reaction is fastest) at 60°C (1) (because) gradient of graph is steepest (1)	2	2.2	ALLOW (reaction is fastest) between 50 – 60 °C (1) ALLOW rate of reaction has highest value (1)
	(c)	At higher temperatures ion/molecules of sodium thiosulfate and hydrochloric acid have more energy (1) So more frequent and more successful collisions (1)	2	2.2	

Question		Answer	Marks	AO element	Guidance
12	(a)	<p>Order of reactivity (most to least) magnesium iron lead copper</p> <p>magnesium as most reactive and copper as least (1) iron and lead in correct order (1)</p> <p>Explanation Any two from idea that none of the metals displace magnesium (from magnesium oxide) / magnesium displaces all the other metals from their metal oxides so magnesium is most reactive (1) idea that copper is displaced from copper oxide by all three other metals / copper cannot displace any of the other metals so copper is least reactive (1) idea that lead will displace iron or copper so is more reactive than these metals / lead cannot displace magnesium so is less reactive (1)</p>	4	<p>3.1a 3.1a</p> <p>2.2 x 2</p>	<p>ALLOW correct explanation for iron (1)</p>
	(b)	<p>$\text{Cu} + 2\text{AgNO}_3 \rightarrow 2\text{Ag} + \text{Cu}(\text{NO}_3)_2$</p> <p>formulae (1) balancing (1)</p>	2	2.1	<p>balancing mark is conditional on correct formulae ALLOW any correct multiple e.g. $2\text{Cu} + 4\text{AgNO}_3 \rightarrow 4\text{Ag} + 2\text{Cu}(\text{NO}_3)_2$ ALLOW = or \rightleftharpoons for arrow DO NOT ALLOW 'and' or & for + ALLOW one mark for correct balanced equation with incorrect use of upper and lower case formulae e.g. $\text{CU} + 2\text{AgNO}_3 \rightarrow 2\text{Ag} + \text{Cu}(\text{NO}_3)_2$</p>

Question		Answer	Marks	AO element	Guidance
13	(a)	<p>Any two from lowest total energy use (1) lowest CO₂ emissions (1) least amount of solvents used (1)</p>	2	3.1b	
	(b)	<p>Tall column with condensers coming off at different heights (1)</p> <p>Column heated at the bottom so hot at the bottom and cool at the top (1)</p> <p>Because substances in crude oil have different boiling points (1)</p> <p>Substances with high boiling points condense at the bottom and substances with low boiling points condense at the top (1)</p>	4	1.2 1.2 1.1 1.2	

Question		Answer	Marks	AO element	Guidance
14	(a)	closed system (1) rate of forward reaction equals rate of backwards reaction / AW (1)	2	1.1	
	(b)*	<p><i>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</i></p> <p>Level 3 (5–6 marks)</p> <p>Applies understanding of Le Chatelier’s principle to predict how <u>and</u> explain why the position of equilibrium changes with each condition</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Level 2 (3–4 marks)</p> <p>Applies understanding of Le Chatelier’s principle to predict how the position of equilibrium changes with each condition AND explains why the position of equilibrium changes with one condition</p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p>	6	1.1 x 3 2.1 x 3	<p>AO1.1: Knowledge of Le Chatelier’s principle</p> <ul style="list-style-type: none"> • With increased pressure, equilibrium moves to the right. • With increased temperature, equilibrium moves to the left. • Equilibrium moves to the right with addition of CO₂. <p>AO2.1: Apply knowledge of Le Chatelier’s principle to reaction to predict position of equilibrium</p> <ul style="list-style-type: none"> • Equilibrium moves to the right with increased pressure as less gaseous moles on RHS. • Equilibrium moves to the right with increased pressure as 4 moles of gas on LHS and 2 moles of gas on RHS. • Equilibrium moves to the left with increased temperature favouring the backward endothermic reaction. • Equilibrium moves to the left with increased temperature as forward reaction is exothermic. • Equilibrium moves to the right with addition of CO₂ to reduce that change in concentration.

Question	Answer	Marks	AO element	Guidance
	<p>Level 1(1–2 marks)</p> <p>Applies understanding of Le Chatelier’s principle to predict how the position of equilibrium changes with each condition</p> <p>OR</p> <p>Applies understanding of Le Chatelier’s principle to predict how <u>and</u> explain why the position of equilibrium changes with one condition</p> <p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p>0 marks <i>No response or no response worthy of credit.</i></p>			

Question		Answer	Marks	AO element	Guidance
15	(a)	filter off excess magnesium before heating and evaporate to dryness (1) OR filter off excess magnesium before heating, allow to crystallise, filter and dry (1)	1	3.3b	
	(b)	(in barium) outer shell electrons are further from the nucleus/(in barium) nuclear attraction for outer shell electrons is less (1) so are lost more easily (1)	2	2.2 1.2	ALLOW ora for magnesium IGNORE electrons are lost faster
	(c)	$2.8 \div 84.3 = 0.033$ moles used so 0.033 moles MgCl_2 made (1) $0.033 \times 95.3 = 3.2$ (1) but mass is 3.2 (g) (2)	2	2.1	ALLOW idea that 84.3g of magnesium carbonate makes 95.3g of magnesium chloride for one mark unit not needed ALLOW 3.17 (g) for 1 mark if no other mark awarded DO NOT ALLOW 3.16 (g) Award 2 marks if answer on answer line = 3.2 (g)

Question		Answer	Marks	AO element	Guidance
16	(a)	carbon is more reactive than copper / ora (1)	1	2.2	
	(b)	$\text{Cu}^{2+} + 2\text{e}^{-} \rightarrow \text{Cu}$ formulae (1) balancing (1)	2	2.2	balancing mark is conditional on correct formulae ALLOW any correct multiple e.g. $2\text{Cu}^{2+} + 4\text{e}^{-} \rightarrow 2\text{Cu}$ ALLOW = or \rightleftharpoons for arrow DO NOT ALLOW 'and' or & for + ALLOW one mark for correct balanced equation with incorrect use of upper and lower case formulae e.g. $\text{Cu}^{2+} + 2\text{e}^{-} \rightarrow \text{CU}$
	(c)	(use) bioleaching (1) because bioleaching uses energy of Cu-S bond (1) phytomining releases CO_2 from burning of plants (1)	3	3.1 a 3.2 a x 2	

Question		Answer	Marks	AO element	Guidance
17	(a)	idea that global temperatures have increased significantly (since about 1975) as anthropogenic factors have increased (1) idea that natural factors, and hence global temperatures, have not increased significantly (1)	2	3.1b	
	(b)	Any three from reduce energy consumption/reduce burning of fossil fuels (1) use renewable energy sources (1) switch to hybrid vehicles/hydrogen fuel cell vehicles (1) buy energy efficient appliances (1) switch to energy efficient lighting (1) drive less / walk / use bus (1) choose foods with less air miles (1)	3	1.1	

Question		Answer	Marks	AO element	Guidance
18	(a)	surface area = $(5 \times 5) \times 6 = 150$ (1) volume = $5 \times 5 \times 5 = 125$ (1) surface area: volume = $150: 125 = 1.2:1$ (1)	3	1.2	Allow 6:5
	(b)	idea of increased collision frequency / more collisions per second (1)	1	1.2	IGNORE faster collisions / quicker collisions
	(c)	$6/1.2 =$ rate of reaction (1cm) / 1.6 (1) $6/1.2 \times 1.6 = 8$ (cm ³ per second) (1)	2	2.1	
	(d)	(i) & (ii) <div style="text-align: center;"> <p>The graph plots 'Volume of gas made' on the vertical axis against 'Time' on the horizontal axis. Two curves, A and B, originate from the origin. Curve B has a steeper initial gradient and reaches a higher final plateau volume than curve A. Curve A has a shallower initial gradient and reaches a lower final plateau volume. Both curves eventually level off, indicating that the reaction has reached completion.</p> </div>	2	1.2	Curve A should be drawn completely under the original, it should not quite reach the plateau but approach near to it at the end of the time axis Curve B should be drawn completely above the original, rising more steeply to start with and reaching the plateau before that of the original

Summary of updates

Date	Version	Change
May 2018	2	We've reviewed the look and feel of our papers through text, tone, language, images and formatting. For more information please see our assessment principles in our "Exploring our question papers" brochures on our website
October 2019	2.1	Question 18(a) - Addition to guidance column: Allow answer expressed as common fraction- 6:5

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