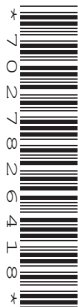# OCR
Oxford Cambridge and RSA

H

GCSE (9–1) Combined Science (Chemistry) A (Gateway Science)
J250/10 Paper 10, C4–C6 and CS7 (PAGs C1–C5) (Higher Tier)

Wednesday 13 June 2018 – Morning
Time allowed: 1 hour 10 minutes

You must have:
• a ruler (cm/mm)
• the Data Sheet (for Chemistry A (inserted))

You may use:
• a scientific or graphical calculator
• an HB pencil

First name	
Last name	

Centre number						Candidate number				

INSTRUCTIONS
• The Data Sheet will be found inside this document.
• 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. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
• Do **not** write in the barcodes.

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 **20** pages.

Turn over

SECTION A

Answer **all** the questions.

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

1   Iron can be extracted from its ore by heating it with carbon.

Which statement is the correct explanation for this?

A   Iron is above carbon in the reactivity series.

B   Iron is above copper in the reactivity series.

C   Iron is below carbon in the reactivity series.

D   Iron is below sodium in the reactivity series.

Your answer ⬜   [1]

2   Look at the table.

	Nitrogen	Oxygen	Carbon dioxide	Argon
A	21%	78%	0.04%	0.1%
B	80%	15%	4.5%	0.5%
C	70%	20%	9%	1.0%
D	78%	21%	0.04%	0.9%

Which row in the table shows the percentages of gases in the present day atmosphere?

Your answer ⬜   [1]

3   Look at the equation for the reaction between sulfur dioxide and oxygen to make sulfur trioxide.

$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$
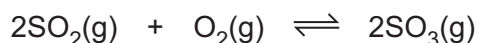
The reaction forms a **dynamic equilibrium**.

Which of the following describes dynamic equilibrium?

A   All the reactants and products are gases.

B   The rate of the backward reaction is greater than the rate of the forward reaction.

C   The rate of the forward and backward reactions are equal.

D   The rate of the forward reaction is greater than the rate of the backward reaction.

Your answer ⬜   [1]

4 Fluorine is the most reactive element in Group 7 (Group 17).

Why?

A Fluorine atoms gain an electron more readily than the other Group 7 elements.

B Fluorine is a gas.

C Fluorine exists as diatomic molecules.

D Fluorine atoms lose electrons more readily than the other Group 7 elements.

Your answer [ ] **[1]**

5 Which statement about the fractional distillation of crude oil is correct?

A Diesel leaves the fractionating column at the bottom.

B Petrol leaves the fractionating column at the top.

C The fractionating column is hottest at the top.

D The hydrocarbons in crude oil can be separated because they have different boiling temperatures.

Your answer [ ] **[1]**

6 Magnesium is a more reactive metal than copper.

Why?

A Copper forms positive ions more readily than magnesium.

B Copper is higher in the reactivity series than magnesium.

C Magnesium gains electrons more readily than copper.

D Magnesium loses its outer electrons more easily than copper.

Your answer [ ] **[1]**

7   Which of these solutions will react with each other?

   A   Sodium bromide and iodine

   B   Sodium chloride and bromine

   C   Sodium chloride and iodine

   D   Sodium iodide and bromine

   Your answer [ ]   **[1]**

8   Which statement about the halogens (Group 7 elements) is correct?

   A   Astatine is the most reactive halogen.

   B   Chlorine has the electronic structure 2.8.7.

   C   Fluorine is the element with the darkest colour.

   D   The halogens have the molecular formula X_3.

   Your answer [ ]   **[1]**

9   Why does a catalyst speed up a chemical reaction?

   A   It causes the reactants to collide less frequently.

   B   It decreases the overall energy change of the reaction.

   C   It lowers the activation energy of the reaction.

   D   It makes more product.

   Your answer [ ]   **[1]**

10 Which statement about extracting copper by phytoextraction is correct?

   A   Bacteria in the soil absorb the copper ions.

   B   Plant ash is equivalent to a high grade ore.

   C   Plant roots absorb copper metal from the soil.

   D   The plants are crushed to extract the copper ions.

   Your answer [ ]   **[1]**

SECTION B

Answer **all** questions.

11 A company wants to make a glass to hold a cold drink. They are considering materials **A** and **B**.

Look at the life cycle assessments for a glass made out of materials **A** and **B**.

Process	Material A		Material B	
	Energy used (MJ)	Greenhouse gases made (g of CO_2)	Energy used (MJ)	Greenhouse gases made (g of CO_2)
Extracting the raw materials	5.0	2.2	3.8	1.4
Manufacturing of the glass from the raw materials	0.4	0.3	0.4	0.1
Transporting the glasses to the shops	1.5	1.0	3.1	2.2
Process **W**	2.0	0.6	5.0	1.7
Total	....	....	....	....

(a) Complete the table to show the totals for each column. **[2]**

(b) Write down the name of process **W**.

.... **[1]**

(c) It costs more to transport glasses made from material **B**.

Suggest a reason why.

.... **[1]**

(d) Which material should the company choose?

Justify your answer.

....

....

....

.... **[2]**

12 A student investigates the rate of reaction between magnesium and hydrochloric acid. The reaction gives off hydrogen gas.

Magnesium ribbon
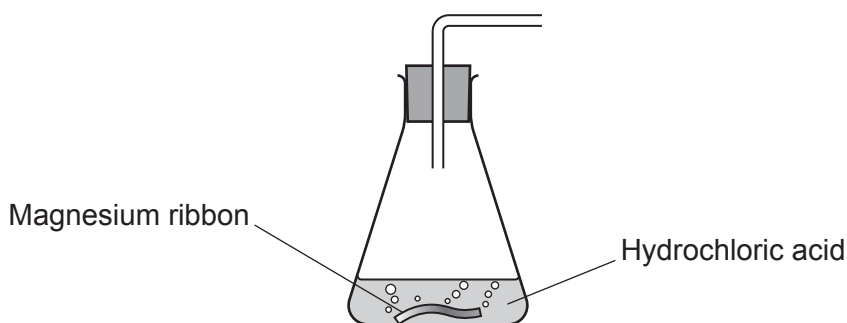
Hydrochloric acid

The student wants to investigate how changing the **concentration** of the hydrochloric acid affects the rate of reaction.

Look at her plan.

First experiment

I will put 0.5 g of magnesium ribbon into the flask.

I will add 50 cm^3 of hydrochloric acid.

I will measure how fast the gas is given off.

Second experiment

I will put another 0.5 g of magnesium ribbon into the flask.

I will add 100 cm^3 of the same hydrochloric acid.

I will measure how fast the gas is given off.

Another student thinks that the plan will not work and he does not understand exactly what he has to do.

Suggest how the plan for this investigation can be improved.

....

....

....

....

.... **[4]**

13 The table shows some hydrocarbons from crude oil.

Name	Formula
Methane	CH_4
Propane	C_3H_8
Butane	C_4H_{10}

(a) Nonane is another hydrocarbon from crude oil.

It contains 9 carbon atoms.

Predict the formula of nonane.

.... **[1]**

(b) Write down the name of this homologous series of hydrocarbons.

.... **[1]**

14 A student investigates the rate of reaction between marble chips and hydrochloric acid.

He measures the total mass of carbon dioxide given off for different sizes of marble chips.

Look at a graph of his results.
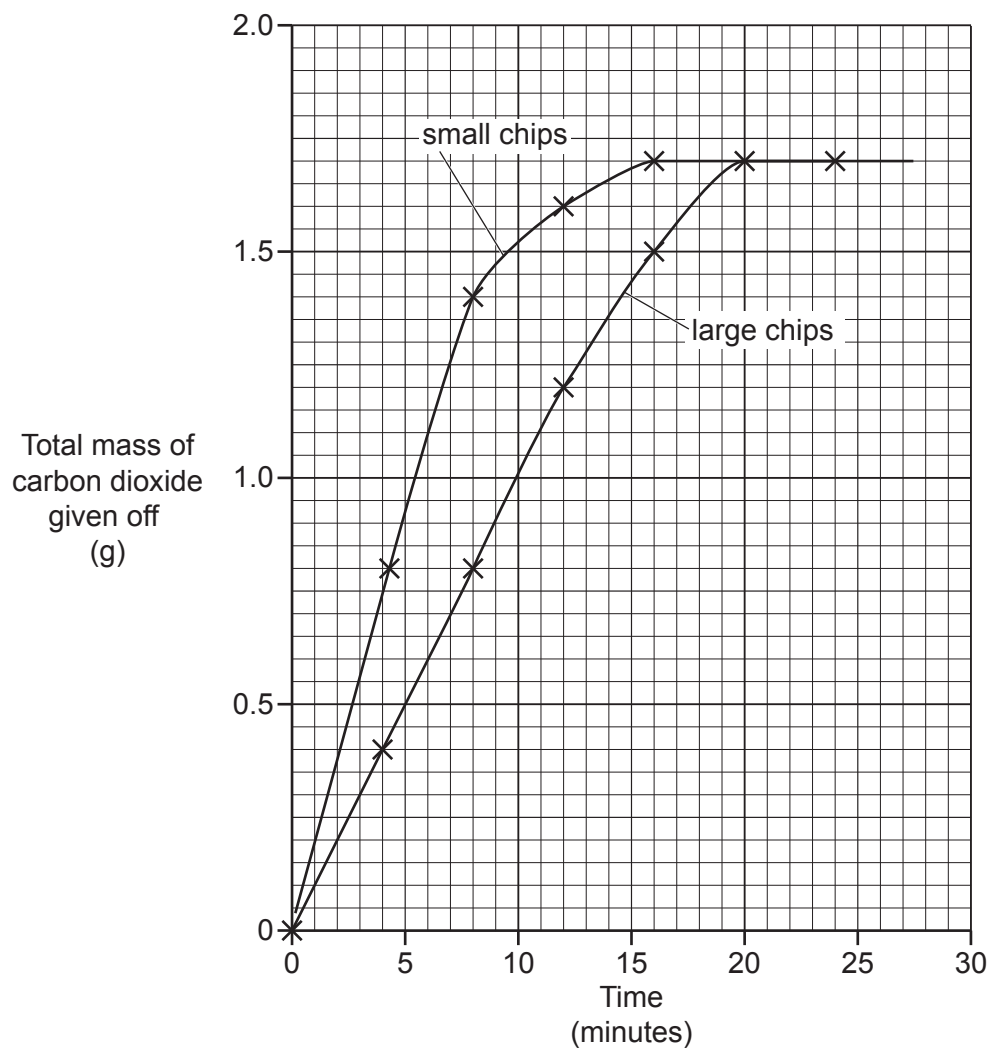
(a) (i) Calculate the rate of reaction **during the first 8 minutes** for the small marble chips **and** the large marble chips.

Include the units.

Give your answers to **2** decimal places.

Small marble chips	Large marble chips
Answer = ... Unit = ...	Answer = ... Unit = ...

[3]

(ii) Which reaction is faster?

Explain how you can tell using data from the graph.

....

....

.... **[2]**

(b) Explain why changing the size of the marble chips changes the rate of the reaction.

....

....

....

....

.... **[3]**

Turn over

10

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

15 Look at the diagram.

It shows four processes (1 – 4) which happen in the Earth's atmosphere and on its surface.
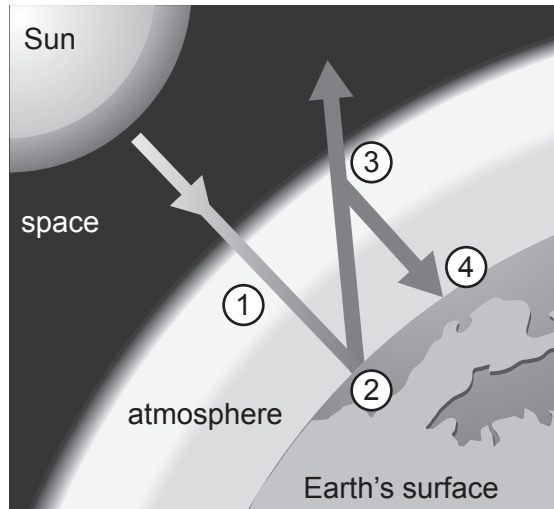
(a) Describe the four processes and how the greenhouse effect occurs.

....

....

....

....

....

.... **[4]**

Turn over

(b) Look at the graphs.

Graph 1 shows how the Earth's temperature has changed between 1880 and 2010.
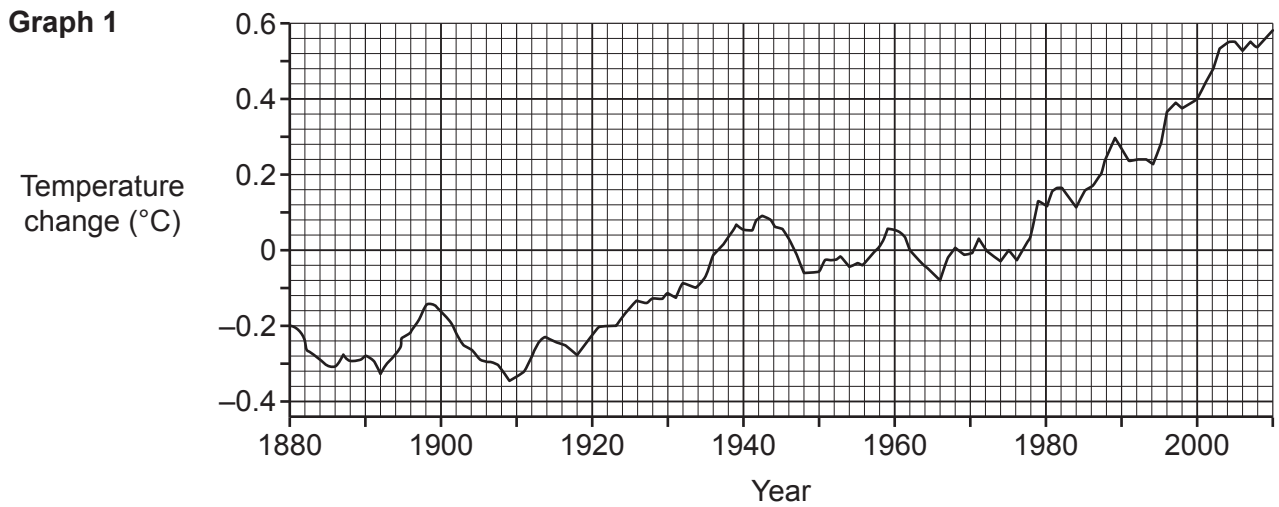
Graph 1

Graph 2 shows how the amount of carbon dioxide in the air has changed between 1750 and 2010.
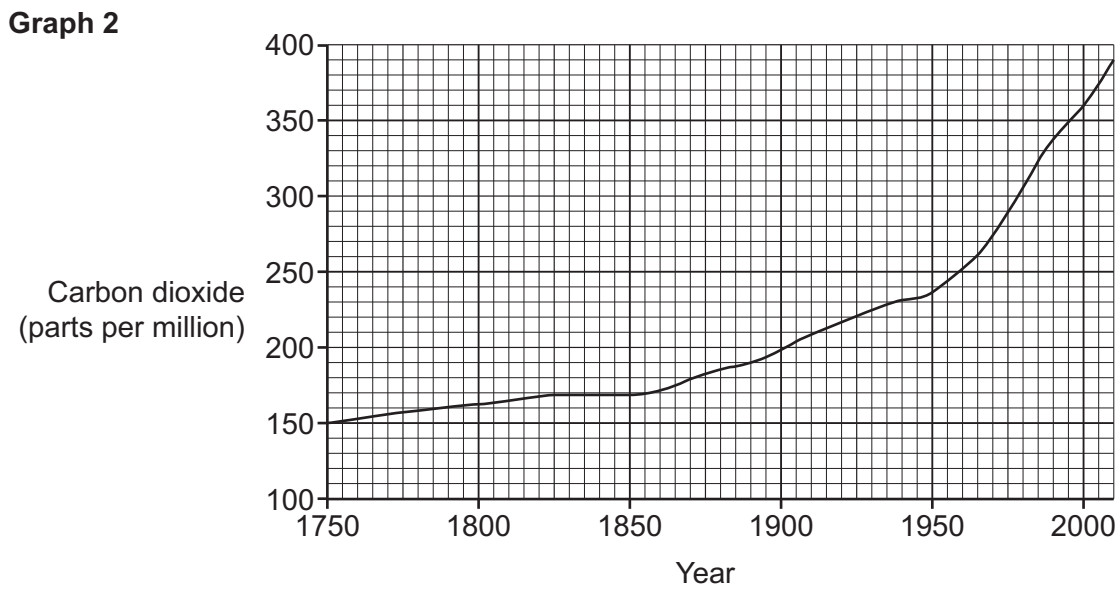
Graph 2

Some scientists believe that **graph 1** and **graph 2** show that increased levels of carbon dioxide have increased the Earth's temperature.

Other scientists believe that it is just a natural cycle of change.

Quote data from the graph which supports **both** of these arguments.

Evidence to support increased temperature of Earth ....

....

....

....

Evidence to support a natural cycle ....

....

....

.... **[2]**

16 Look at the information about three elements **X**, **Y** and **Z** in the Periodic Table.

Element	X	Y	Z
Atomic number	Less than 11	11	More than 11
Melting point (°C)	181	98	63
Density (g/cm^3)	0.53	0.97	0.86
Reaction with water	Reacts quickly making hydrogen	Reacts vigorously making hydrogen	Reacts explosively making hydrogen
Energy needed to remove 1 electron from an atom (kJ/mol)	520	496	419
Atomic radius (nm)	0.134	0.154	0.196
Formula of chloride	XCl	YCl	ZCl
Action of heat on carbonates	Breaks down and makes carbon dioxide	No reaction	No reaction

(a)* Student A thinks that elements **X**, **Y** and **Z** are in the same Group of the Periodic Table.

Student B thinks they are in different Groups of the Periodic Table.

Analyse and explain the information in the table that supports **both** Student A's and Student B's conclusions.

Who do you think is correct?

....

....

....

....

....

....

....

....

....

....

.... **[6]**
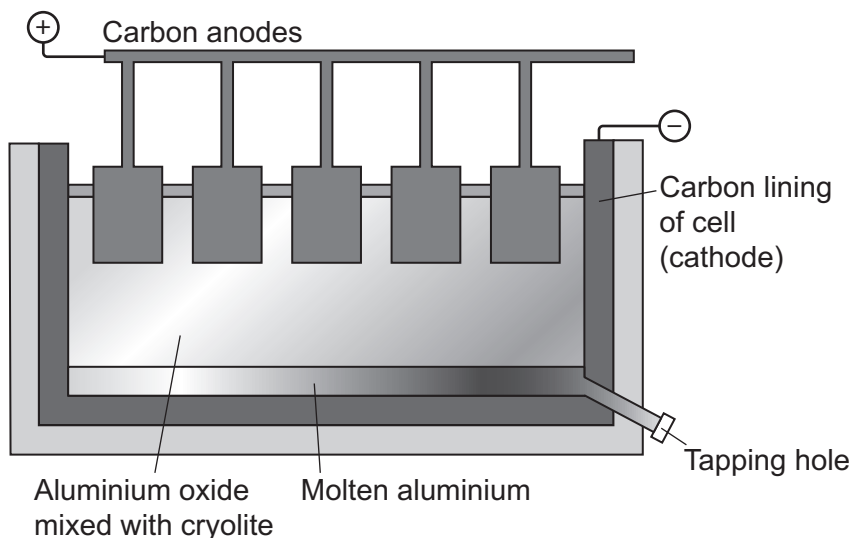
(b) Write a **balanced symbol equation** for the reaction of element **Y** with water.

Use '**Y**' to represent element **Y**.

.... **[2]**

Turn over

17 Aluminium is extracted from its ore by electrolysis.

This is an electrolysis cell.

- (a) Aluminium **cannot** be extracted by heating aluminium oxide with carbon.

    Explain why.

    .... [1]

- (b) Aluminium oxide is mixed with cryolite in the electrolysis cell.

    Explain why cryolite is used.

    .... [1]

- (c) Aluminium is made at the negative electrode (cathode) from aluminium ions, Al^{3+}.

    Write a **half equation** for this reaction. Use e⁻ to represent an electron.

    .... [1]

- (d) Oxygen, O_2, is made at the positive electrode (anode).

    The anodes in the cell have to be replaced every few weeks.

    Suggest why.

    ....

    .... [2]

- (e) Write the overall **balanced symbol** equation for the electrolytic breakdown of aluminium oxide, Al_2O_3.

    .... [2]

18 Look at the equation for the equilibrium reaction between sulfur dioxide, SO_2, oxygen and sulfur trioxide, SO_3, in a closed system.

$$2SO_2(g) \ + \ O_2(g) \ \rightleftharpoons \ 2SO_3(g) \qquad \Delta H = -196 \, kJ/mol$$

(a) Predict the effect of adding **more oxygen** to the equilibrium mixture.

Explain your answer.

....

....

.... **[2]**

(b) Predict the effect of increasing the **total pressure** in the equilibrium mixture.

Explain your answer.

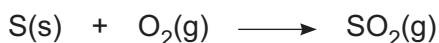..

....

.... **[2]**

(c) Predict the effect of increasing the **temperature** of the equilibrium mixture.

Explain your answer.

....

....

.... **[2]**

(d) Sulfur dioxide for this reaction is made by burning sulfur.

$$S(s) \ + \ O_2(g) \ \longrightarrow \ SO_2(g)$$

Calculate the mass of sulfur needed to make 48 tonnes of sulfur dioxide.

Give your answer to **2** significant figures.

The relative atomic mass, Ar, of S is 32.1 and of O is 16.0.

Answer = ... tonnes **[3]**

18

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

OCR
Oxford Cambridge and RSA