

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

GCSE COMBINED SCIENCE: TRILOGY

H

Higher Tier
Chemistry Paper 2H

Wednesday 12 June 2019

Morning

Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:

- a ruler
- a scientific calculator
- the periodic table (enclosed).

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information

- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	



J U N 1 9 8 4 6 4 C 2 H 0 1

IB/M/Jun19/E12

8464/C/2H

0 1

Water that is safe to drink contains dissolved substances.

0 1 . 1

What do we call water that is safe to drink?

[1 mark]Tick (✓) **one** box.

Desalinated

☐

Filtered

☐

Fresh

☐

Potable

☐**0 1 . 2**

Describe a test for pure water.

Give the result of the test if the water is pure.

[2 marks]

Test

Result



0	1	.	3
---	---	---	---

Describe a method to determine the mass of dissolved solids in a 100 cm³ sample of river water.

[4 marks]

0	1	.	4
---	---	---	---

A sample of river water contains 125 mg per dm³ of dissolved solids.

Calculate the mass of dissolved solids in grams in 250 cm³ of this sample of river water.

Give your answer to 2 significant figures.

[4 marks]

Mass of dissolved solids = _____ g

Turn over ►



0	1	.	5
---	---	---	---

A water company allows a maximum of 500 mg per dm^3 of sulfate ions in drinking water.

A sample of drinking water contains 44 mg per dm^3 of sulfate ions.

Calculate the percentage (%) of the maximum allowed mass of sulfate ions in the sample of drinking water.

[2 marks]

Percentage (%) of the maximum allowed mass = _____ %

13



0	2
---	---

This question is about atmospheric pollutants from fuels.

0	2	.	1
---	---	---	---

Fuel burns in a car engine.

Describe how oxides of nitrogen are produced in a car engine.

[2 marks]

Question 2 continues on the next page

Turn over ►



0	2	.	2
---	---	---	---

Table 1

Car	Mass of CO ₂ produced during manufacture in kg	Mass of CO ₂ produced when driving in kg per km	Total mass of CO ₂ produced from manufacture and 40 000 km driving in kg	Total mass of CO ₂ produced from manufacture and 100 000 km driving in kg
Car A	14 000	0.123	18 920	26 300
Car B	20 000	0.085	23 400	28 500
Car C	23 000	0.044	24 760	27 400

Evaluate the carbon footprint of the cars.

Use information from **Table 1**.

[6 marks]

[illegible]

0 3

This question is about chromatography of food colouring.

0 3 . 1

Food colouring is a formulation.

What is a formulation?

[1 mark]

0 3 . 2

Explain how paper chromatography separates the dyes in a food colouring.

Do **not** give details of how to do the experiment.

[2 marks]

0 3 . 3

Explain how the student could tell from the chromatogram that the food colouring contained more than one dye.

[2 marks]

Question 3 continues on the next page

Turn over ►

0	3	.	4
---	---	---	---

Explain how the student could use chromatography to identify unknown dyes in the food colouring.

[3 marks]

8



0 4

This question is about copper and fuels.

0 4 . 1

Copper is extracted from low-grade ores by phytomining.

Describe how copper metal is produced by phytomining.

[4 marks]

0 4 . 2

Another method of extracting copper from low-grade ores is bioleaching.

A solution of copper sulfate (CuSO_4) produced by bioleaching has a concentration of 0.319 g/dm^3 Relative atomic masses (A_r): Cu = 63.5 O = 16 S = 32Calculate the number of moles of copper that can be produced from 1 dm^3 of this solution.**[3 marks]**

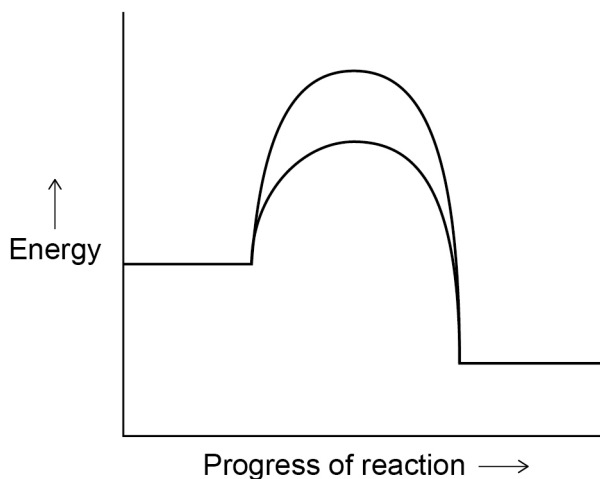
Number of moles of copper = _____ mol

Turn over ►

Copper is used as a catalyst.

Figure 1 shows reaction profiles for a reaction with and without a catalyst.

Figure 1



0 4 . 3

How do the reaction profiles show that using a catalyst does **not** affect the overall energy change for the reaction?

[1 mark]

Tick (✓) **one** box.

Both reaction profiles show exothermic reactions.

☐

Both reaction profiles start at the same energy level and end at the same energy level.

☐

Both reaction profiles show the activation energy.

☐

The activation energy for the uncatalysed reaction is much lower than for the catalysed reaction.

☐


0	4	.	4
---	---	---	---

Copper is a catalyst in a reaction to produce ethanol from carbon dioxide.

Ethanol ($\text{C}_2\text{H}_5\text{OH}$) is used as a fuel.

Suggest why producing ethanol from carbon dioxide is sustainable.

[2 marks]

0	4	.	5
---	---	---	---

Chemistry plays an important role in sustainable development.

What is sustainable development?

[2 marks]

12

Turn over for the next question

Turn over ►

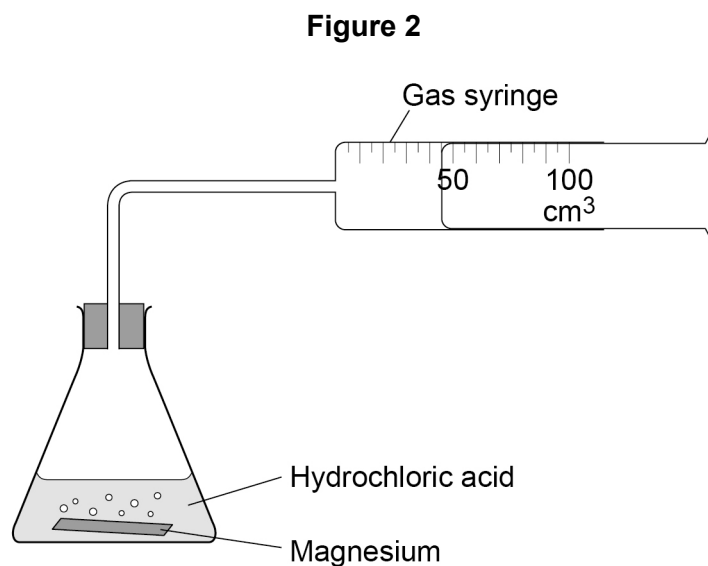


0 5

This question is about magnesium.

A student investigated the rate of the reaction between magnesium and hydrochloric acid.

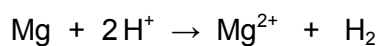
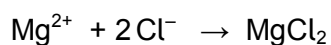
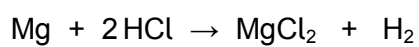
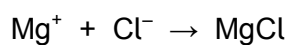
Figure 2 shows the apparatus.

**0 5****1**

Which is the correct ionic equation for the reaction?

[1 mark]

Tick (✓) **one** box.

☐☐☐☐

0 5 . 2

What happens in the reaction between magnesium and hydrochloric acid?

[1 mark]

Tick (✓) **one** box.

Electron sharing

☐

Electron transfer

☐

Proton transfer

☐

Question 5 continues on the next page

Turn over ►



0 5 . 3 Table 2 shows the student's results.

Table 2

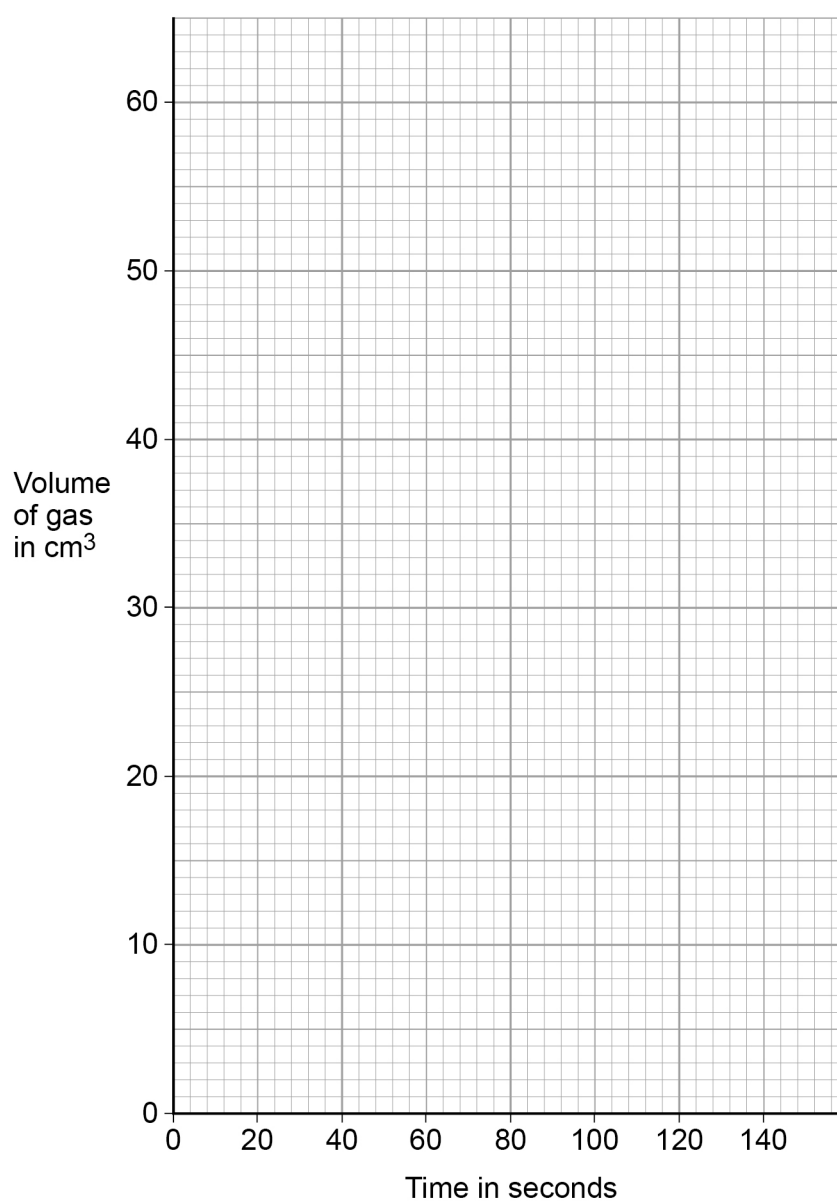
Time in seconds	0	10	35	50	95	120	140
Volume of gas in cm ³	0.0	12.5	36.0	43.5	59.0	60.0	60.0

Plot the data from **Table 2** on **Figure 3**.

Draw a line of best fit.

[3 marks]

Figure 3



0 5 . 4 Describe the changes in the rate of this reaction.

[3 marks]

0 5 . 5 Explain why the rate of this reaction changes.

Give your answer in terms of collision theory.

[3 marks]

11

Turn over for the next question

Turn over ►



0 6This question is about oxygen (O₂) and sulfur dioxide (SO₂).**0 6 . 1**

Give the test and result for oxygen gas.

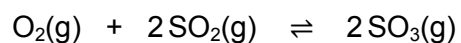
[2 marks]

Test _____

Result _____

0 6 . 2

The reaction between oxygen and sulfur dioxide is at equilibrium.

Some of the sulfur trioxide (SO₃) is removed.

Explain what happens to the position of the equilibrium.

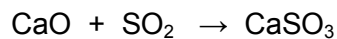
[2 marks]



0	6	.	3
---	---	---	---

Sulfur dioxide is an atmospheric pollutant.

Sulfur dioxide pollution is reduced by reacting calcium oxide with sulfur dioxide to produce calcium sulfite.



7.00 g of calcium oxide reacts with an excess of sulfur dioxide.

Relative atomic masses (A_r): O = 16 S = 32 Ca = 40

Calculate the mass of calcium sulfite produced.

[4 marks]

Mass of calcium sulfite produced = _____ g

8

Turn over for the next question

Turn over ►



0 7

This question is about hydrocarbons and crude oil.

0 7 . 1

Hydrocarbon fuels are produced from crude oil.

Describe how crude oil is separated into fractions.

[4 marks]

Butane is a hydrocarbon.

0 7 . 2

Two equations for the combustion of butane are:

- $2\text{C}_4\text{H}_{10} + 13\text{O}_2 \rightarrow 8\text{CO}_2 + 10\text{H}_2\text{O}$
- $2\text{C}_4\text{H}_{10} + 5\text{O}_2 \rightarrow 8\text{C} + 10\text{H}_2\text{O}$

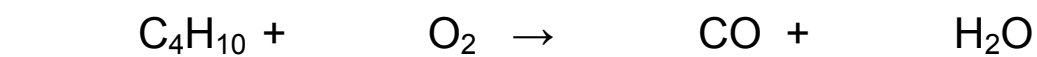
Why are different products formed?

[1 mark]

0 7 . 3

One other product of the combustion of butane is carbon monoxide.

Balance the equation.

[1 mark]

Describe the greenhouse effect in terms of the interaction of short and long wavelength radiation with matter.

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END OF QUESTIONS



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*Do not write
outside the
box*

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

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