Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

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.

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

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.

Do not write outside the box

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 _____

_____

_____

Do not write outside the box

0 1 . 3 Describe a method to determine the mass of dissolved solids in a 100 cm^3 sample of river water.

[4 marks]

0 1 . 4 A sample of river water contains 125 mg per dm^3 of dissolved solids.

Calculate the mass of dissolved solids in grams in 250 cm^3 of this sample of river water.

Give your answer to 2 significant figures.

[4 marks]

Mass of dissolved solids = _____ g

Turn over ►

Do not write outside the box

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

Do not write outside the box

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

Do not write outside the box

0 2 . 2 **Table 1** shows the carbon footprint during the manufacture and use of three cars.

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]

8

Do not write outside the box

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

Do not write outside the box

0 3 . 4 Explain how the student could use chromatography to identify unknown dyes in the food colouring.

[3 marks]

8

Do not write outside the box

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 = 32

Calculate the number of moles of copper that can be produced from 1 dm^3 of this solution.

[3 marks]

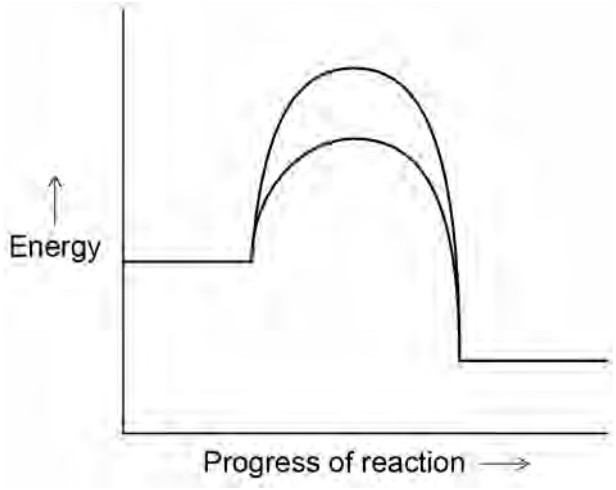
Number of moles of copper = _____ mol

Do not write outside the box

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. ☐

Do not write outside the box

0 4 . 4 Copper is a catalyst in a reaction to produce ethanol from carbon dioxide.

Ethanol (C_2H_5OH) 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

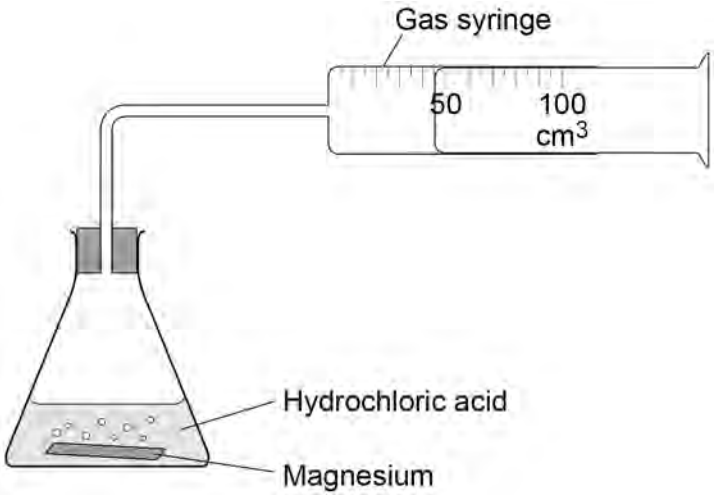
Do not write outside the box

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.

Figure 2



0 5 . 1 Which is the correct ionic equation for the reaction?

[1 mark]

Tick (✓) **one** box.

$Mg + 2H^+ \rightarrow Mg^{2+} + H_2$ ☐

$Mg^{2+} + 2Cl^- \rightarrow MgCl_2$ ☐

$Mg + 2HCl \rightarrow MgCl_2 + H_2$ ☐

$Mg^+ + Cl^- \rightarrow MgCl$ ☐

Do not write outside the 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

Do not write outside the box

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

Table 2

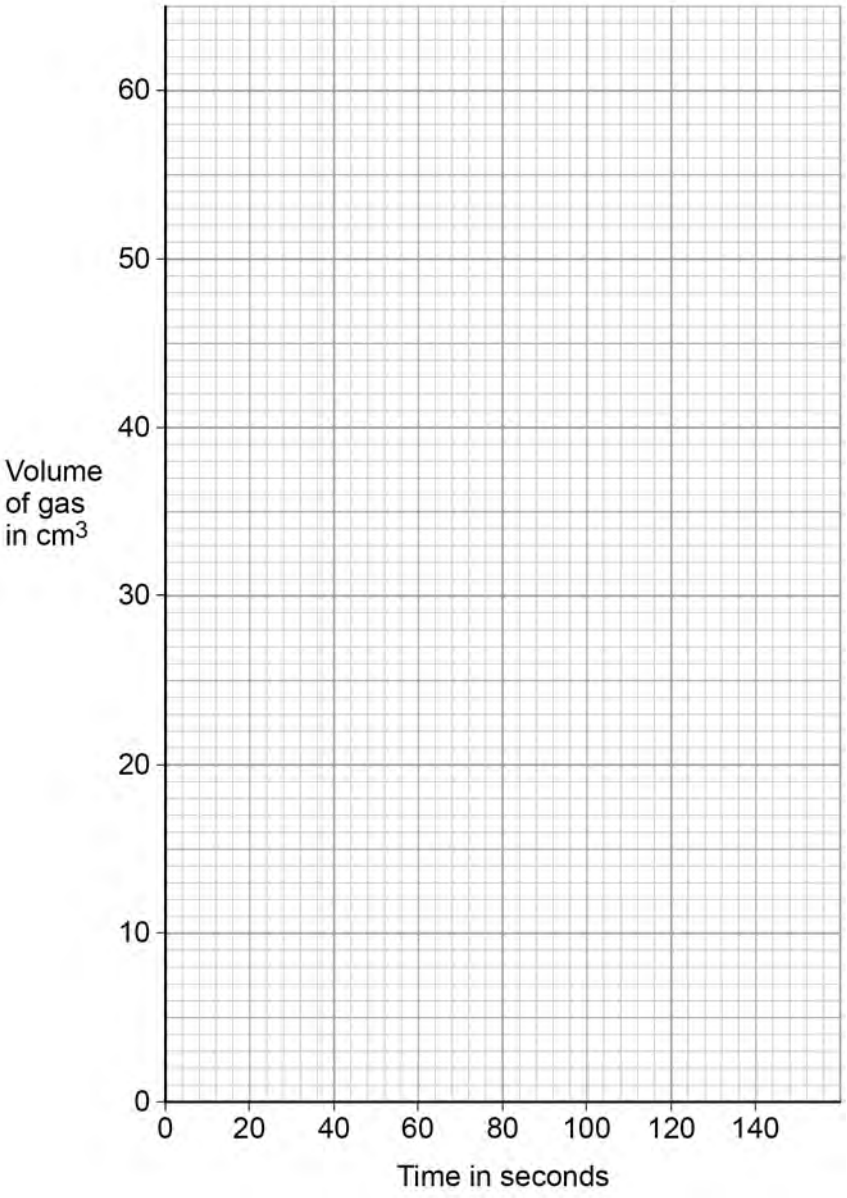
Time in seconds	0	10	35	50	95	120	140
Volume of gas in cm^3	0.0	12.5	36.0	43.5	59.0	60.0	60.0

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

Draw a line of best fit.

[3 marks]

Figure 3



Do not write outside the box

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

Do not write outside the box

0 6 This question is about oxygen (O_2) and sulfur dioxide (SO_2).

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.

$$O_2(g) + 2\,SO_2(g) \rightleftharpoons 2\,SO_3(g)$$

Some of the sulfur trioxide (SO_3) is removed.

Explain what happens to the position of the equilibrium.

[2 marks]

_____

_____

_____

_____

Do not write outside the box

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.

$$CaO + SO_2 \rightarrow CaSO_3$$

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

Do not write outside the box

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:

- $2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$
- $2C_4H_{10} + 5O_2 \rightarrow 8C + 10H_2O$

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]

_____ C_4H_{10} + _____ O_2 → _____ CO + _____ H_2O

Do not write outside the box

0 7 . 4 Carbon dioxide is a greenhouse gas.

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

[4 marks]

10

END OF QUESTIONS

Do not write outside the box

There are no questions printed on this page

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