AQA

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 13 June 2018 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	
TOTAL	

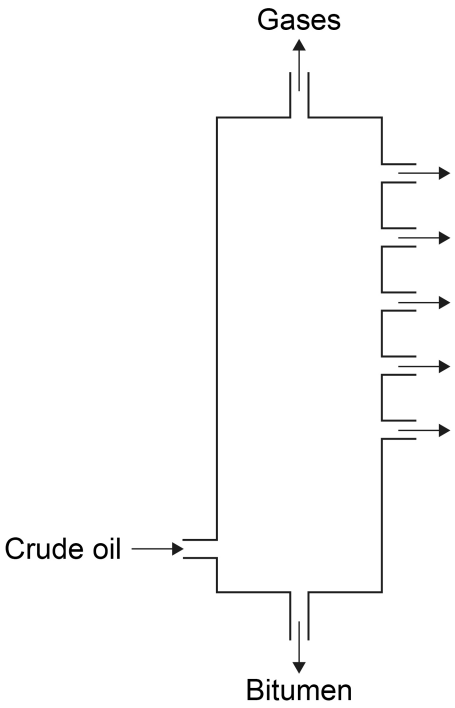
Do not write outside the box

0 1 Crude oil is a mixture of hydrocarbons.

0 1 . 1 The hydrocarbons in crude oil are separated into fractions by fractional distillation.

Figure 1 shows a fractional distillation column.

Figure 1



Crude oil vapour passes up the column.

Complete the sentence.

Choose the answer from the box.

[1 mark]

condenses	**dissolves**	**freezes**	**melts**

Each fraction _____ at a different level.

Do not write outside the box

0 1 . 2 Why do the fractions separate?

[1 mark]

Tick **one** box.

The fractions have different boiling points. ☐

The fractions have different flammability. ☐

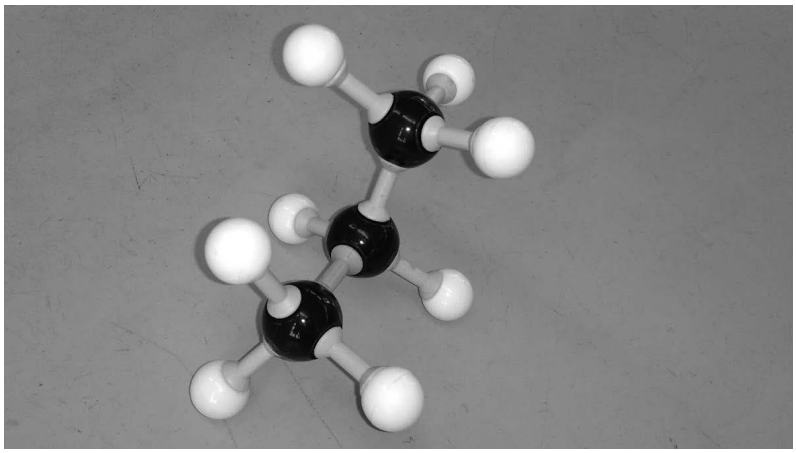
The fractions have different melting points. ☐

The fractions have different viscosity. ☐

Most of the hydrocarbons in crude oil are alkanes.

0 1 . 3 **Figure 2** represents an alkane molecule.

Figure 2



Name the alkane.

[1 mark]

_____

Question 1 continues on the next page

Do not write outside the box

0 1 . 4 Methane (CH_4) is an alkane.

What is the general formula for alkanes?

[1 mark]

Tick **one** box.

C_nH_n ☐

C_nH_{2n} ☐

C_nH_{2n-2} ☐

C_nH_{2n+2} ☐

0 1 . 5 Alkanes burn in oxygen.

Balance the equation for methane burning.

[1 mark]

$$\_\_\_\_ CH_4 + \_\_\_\_ O_2 \rightarrow \_\_\_\_ CO_2 + \_\_\_\_ H_2O$$

0 1 . 6 Ethene is an alkene.

Which reagent is used to test for alkenes?

[1 mark]

Tick **one** box.

Anhydrous copper sulfate ☐

Bromine water ☐

Damp litmus paper ☐

Limewater ☐

Do not write outside the box

Table 1 shows data from a life cycle assessment (LCA) for the disposal of 10 000 biodegradable plastic bags.

Table 1

	Burning and using the energy to generate electricity	Landfill
Mass of carbon dioxide produced in kg	25	15
Mass of solid residue in kg	0.050	0.070
Mass of sulfur dioxide produced in kg	0.20	0.30

0 1 . 7 Why are life cycle assessments (LCA) done?

[1 mark]

0 1 . 8 Compare the **two** methods for the disposal of biodegradable plastic bags.

Use information from **Table 1**

[4 marks]

11

Do not write outside the box

0 2 This question is about the Earth's atmosphere.

0 2 . 1 Carbon dioxide is a greenhouse gas.

What is another greenhouse gas?

[1 mark]

Tick **one** box.

Argon ☐

Methane ☐

Nitrogen ☐

Oxygen ☐

0 2 . 2 Greenhouse gases cause global climate change.

Give **two** effects of global climate change.

[2 marks]

1 _____

_____

2 _____

_____

0 2 . 3 4.1 kg of a plastic, used to make plastic bottles, has a carbon footprint of 6.0 kg of carbon dioxide.

Calculate the carbon footprint of one plastic bottle of mass 23.5 g

[2 marks]

_____

_____

_____

_____

Carbon footprint = _____ kg of carbon dioxide

Do not write outside the box

0 2 . 4 Give **one** way that carbon dioxide emissions can be reduced when a plastic bottle is manufactured.

[1 mark]

0 2 . 5 Explain how the percentages of nitrogen, oxygen and carbon dioxide in the Earth's atmosphere today have changed from the Earth's early atmosphere.

[6 marks]

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Turn over for the next question

0 3 A student investigated the mass of dissolved solids in 5 cm^3 samples of water.

Figure 3 shows the apparatus.

Figure 3

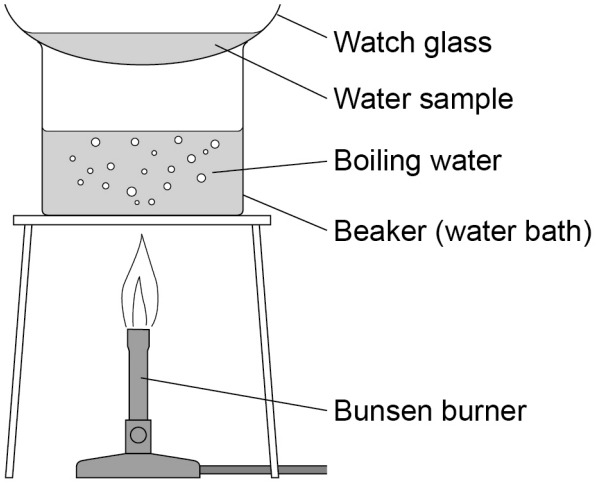


Table 2 shows the student's results.

Table 2

Type of water	Mass in g			
	Watch glass	Watch glass and dissolved solids	Dissolved solids in 5 cm^3 of water	Dissolved solids in 1000 cm^3 of water
Sea water	9.34	9.48	0.14	28.00
River water	9.15	9.23	0.08	**X**
Rainwater	8.93	8.93	0.00	0.00

0 3 . 1 Calculate mass **X** in **Table 2**

[1 mark]

Mass **X** = _____ g

Do not write outside the box

0 3 . 2 5 cm^3 is a small volume of water for each experiment.

Give **one** advantage and **one** disadvantage of using a larger volume.

[2 marks]

Advantage _____

_____

Disadvantage _____

_____

0 3 . 3 Potable water is **not** pure water.

Describe the difference between potable water and pure water.

[1 mark]

_____

_____

_____

0 3 . 4 Potable water is obtained from both groundwater **and** from sea water.

Describe how groundwater and sea water are treated to produce potable water.

[3 marks]

_____

_____

_____

_____

_____

_____

Question 3 continues on the next page

0 3 . 5 The percentage by mass of dissolved solids in a 6.50 g sample is 2.2%

Calculate the mass of the dissolved solids.

[2 marks]

Mass of dissolved solids = _____ g

9

Do not write outside the box

0 4 Fertilisers are formulations.

0 4 . 1 What is a formulation?

[1 mark]

0 4 . 2 A bag of fertiliser contains 14.52 kg of ammonium nitrate (NH_4NO_3).

Relative formula mass (M_r): NH_4NO_3 = 80

Calculate the number of moles of ammonium nitrate in the bag of fertiliser.

Give your answer in standard form to 2 significant figures.

[4 marks]

Moles of ammonium nitrate = _____ mol

Question 4 continues on the next page

Do not write outside the box

0 4 . 3 The fertiliser also contains potassium chloride.

Explain why potassium chloride has a high melting point.

[4 marks]

9

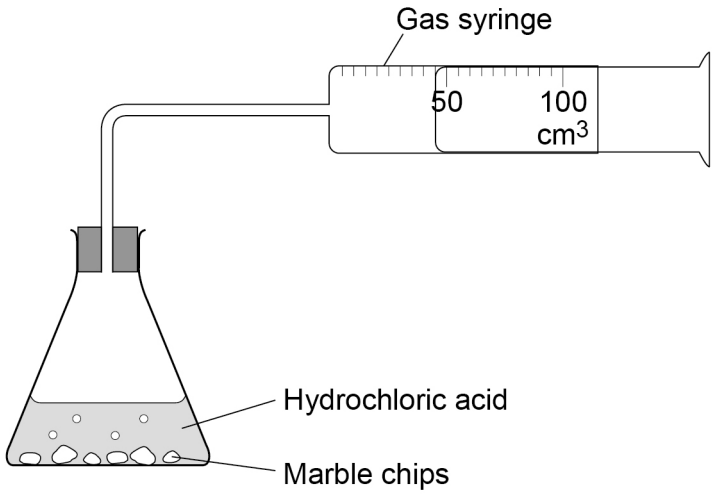
0 5 A student investigated the effect of the size of marble chips on the rate of the reaction between marble chips and hydrochloric acid.

This is the method used.

1. Add 10 g of marble chips into the flask.
2. Add 50 cm^3 of hydrochloric acid, connect the gas syringe and start a timer.
3. Record the volume of gas produced every 10 seconds.

Figure 4 shows the apparatus.

Figure 4



0 5 . 1 Complete the equation for the reaction.

[2 marks]

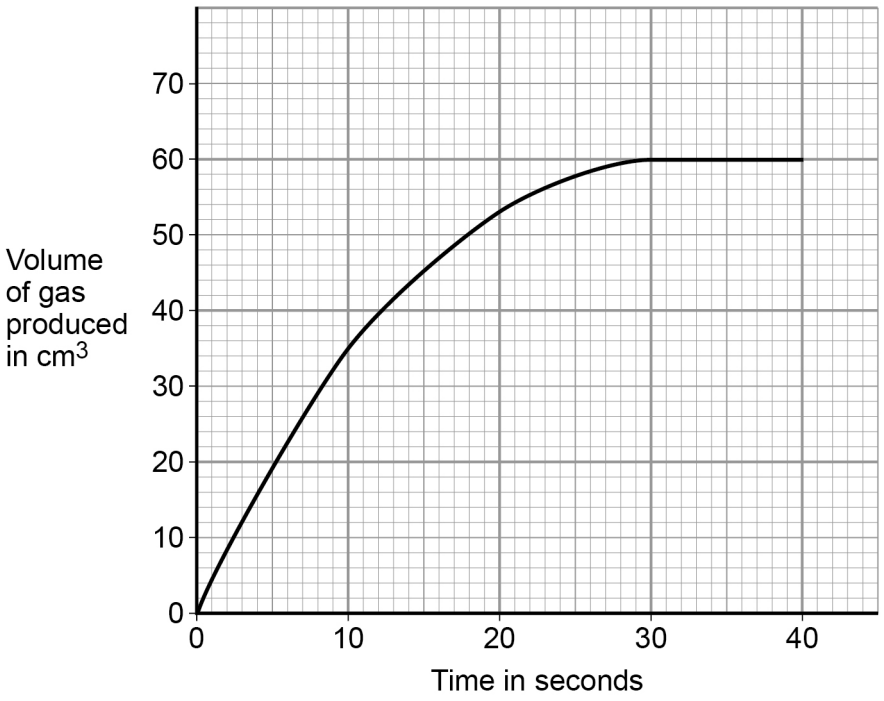
$CaCO_3$ + ____ HCl → _____

Question 5 continues on the next page

Do not write outside the box

Figure 5 shows the student's results.

Figure 5



0 5 . 2 Describe the trend shown in **Figure 5**

Use values in your answer.

[3 marks]

0 5 . 3 Describe how you would use **Figure 5** to find the rate of the reaction at 15 seconds.

You do **not** need to do a calculation.

[2 marks]

0 5 . 4 Give the units for the rate of this reaction.

[1 mark]

Table 3 shows the results of the investigation.

Table 3

Relative size of marble chips	Volume of gas produced in cm^3 after given time in seconds					
	10 s	**20 s**	**30 s**	**40 s**	**50 s**	**60 s**
Small	35	53	60	60	60	60
Medium	21	39	51	58	60	60
Large	14	29	39	48	58	60

0 5 . 5 Give **one** conclusion about how the size of the marble chips affects the rate of the reaction.

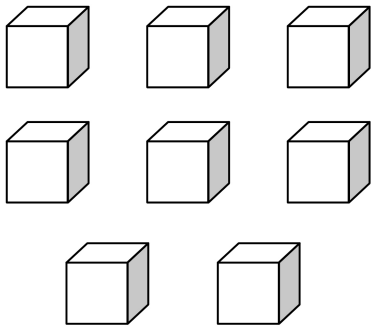
[1 mark]

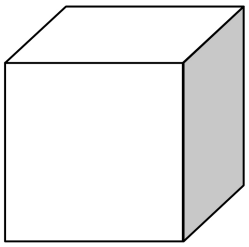
0 5 . 6 Suggest why all three sizes of marble chips produce a maximum volume of 60 cm^3 of gas.

[1 mark]

0 5 . 7 **Figure 6** shows eight small cubes, each 1 cm x 1 cm x 1 cm, and one large cube, 2 cm x 2 cm x 2 cm

Figure 6





Total volume of small cubes = 8 cm^3

Volume of large cube = 8 cm^3

Total surface area of small cubes = 48 cm^2

Calculate the surface area of the large cube.

[2 marks]

Surface area of the large cube = _____ cm^2

0 5 . 8 Explain why the size of the marble chips affects the rate of the reaction.

Give your answer in terms of 'collision theory'.

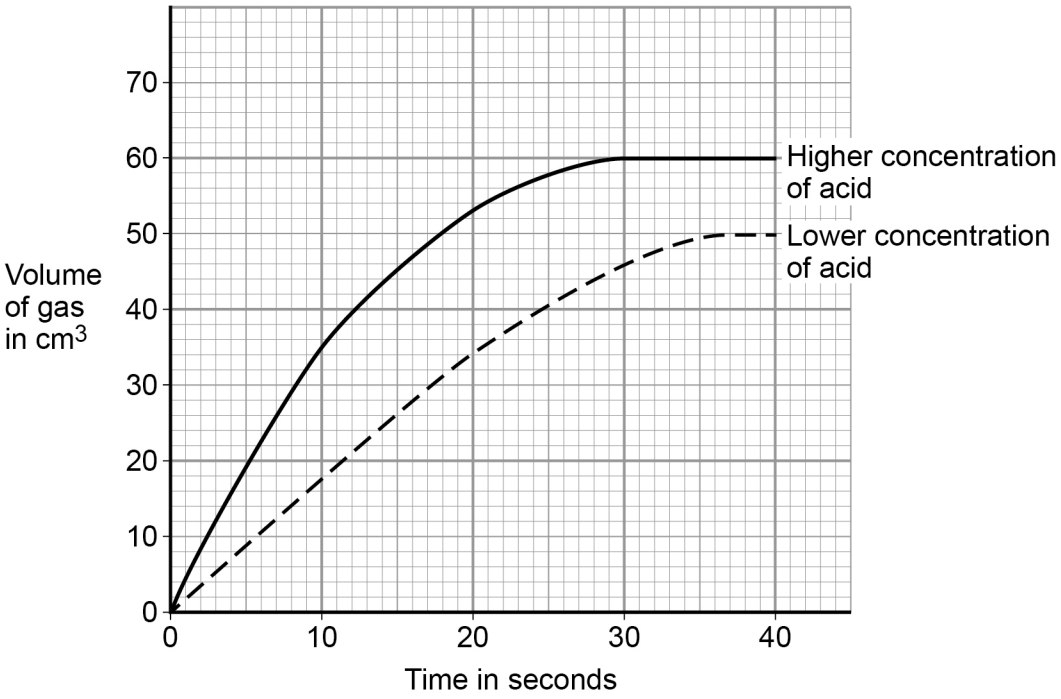
[2 marks]

Do not write outside the box

0 5 . 9 The student repeated the investigation with small marble chips using hydrochloric acid with a lower concentration.

Figure 7 shows the volume of gas produced during the first 40 seconds.

Figure 7



Explain why the results for the lower concentration of acid are different from the results for the higher concentration of acid.

[3 marks]

17

Turn over for the next question

Do not write outside the box

0 6 Bleach is a solution of sodium hypochlorite (NaClO).

Chlorine gas is produced when bleach reacts with hydrochloric acid.

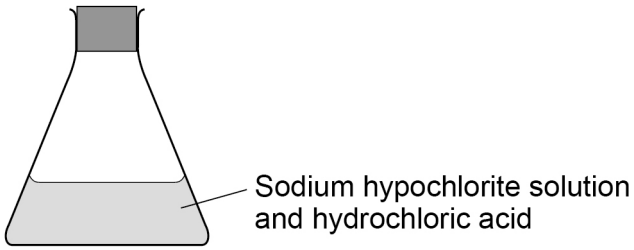
$$NaClO(aq) + 2HCl(aq) \rightleftharpoons NaCl(aq) + H_2O(l) + Cl_2(g)$$

0 6 . 1 Give the test and result for chlorine gas.

[2 marks]

Figure 8 shows a sealed flask of sodium hypochlorite and hydrochloric acid at equilibrium.

Figure 8



0 6 . 2 Explain why equilibrium is reached in this reaction.

[2 marks]

Do not write outside the box

0 6 . 3 The stopper in **Figure 8** is removed and hydrochloric acid is added.

The stopper is replaced.

Explain what happens to the equilibrium.

[4 marks]

Question 6 continues on the next page

Do not write outside the box

Chlorine gas is also produced when hydrogen chloride decomposes.

$$2HCl(g) \rightleftharpoons H_2(g) + Cl_2(g)$$

The forward reaction is endothermic.

0 6 . 4 Predict the effect of increasing the temperature on the amount of chlorine gas produced at equilibrium.

Explain your answer using Le Chatelier's Principle.

[2 marks]

0 6 . 5 Explain the effect of increasing the pressure on this equilibrium.

[2 marks]

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END OF QUESTIONS