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	

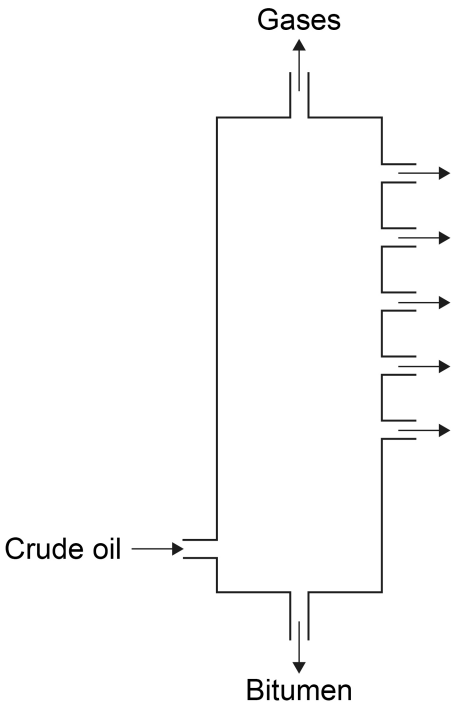
Do not write outside the box

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. ☐

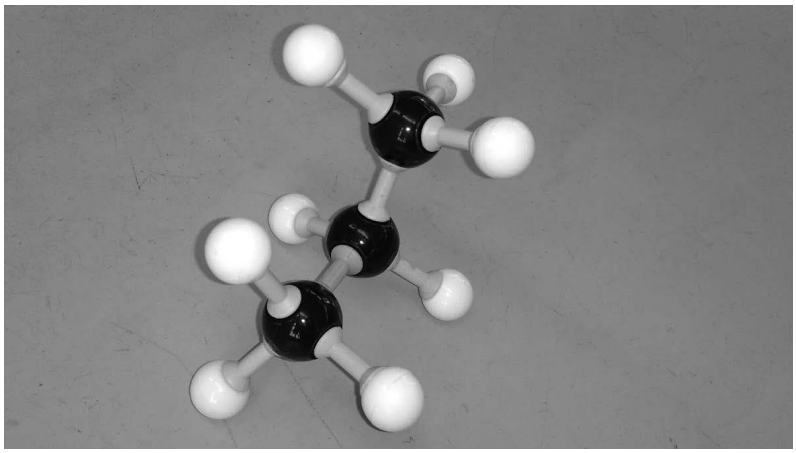
The fractions have different melting points. ☐

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]

12

Turn over for the next question

Do not write outside the box

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

Figure 3 shows the apparatus.

Figure 3

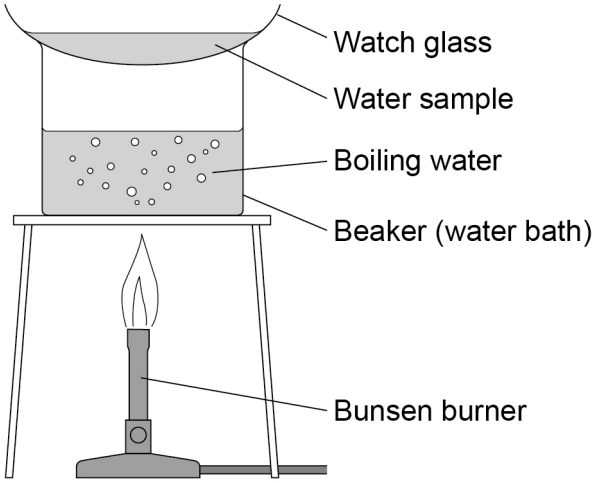


Table 2 shows the student's results.

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

Do not write outside the box

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

Do not write outside the box

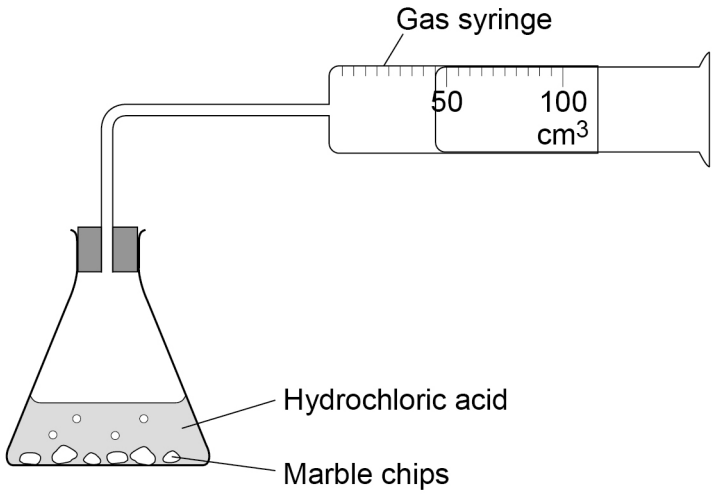
0 5 A student investigated the effect of the size of marble chips on the rate of the reaction between marble chips and hydrochloric acid.

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 → _____

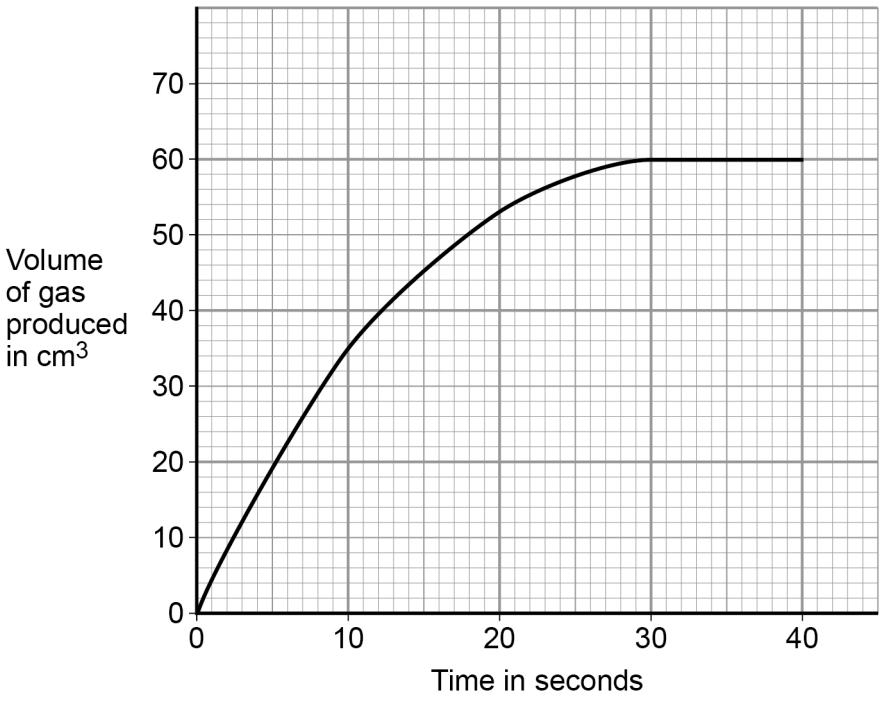
Question 5 continues on the next page

Turn over ►

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]

Do not write outside the box

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]

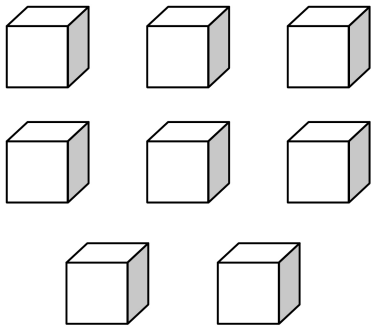
0 5 . 6 Suggest why all three sizes of marble chips produce a maximum volume of 60 cm^3 of gas.

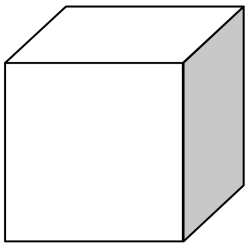
[1 mark]

Do not write outside the box

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'.

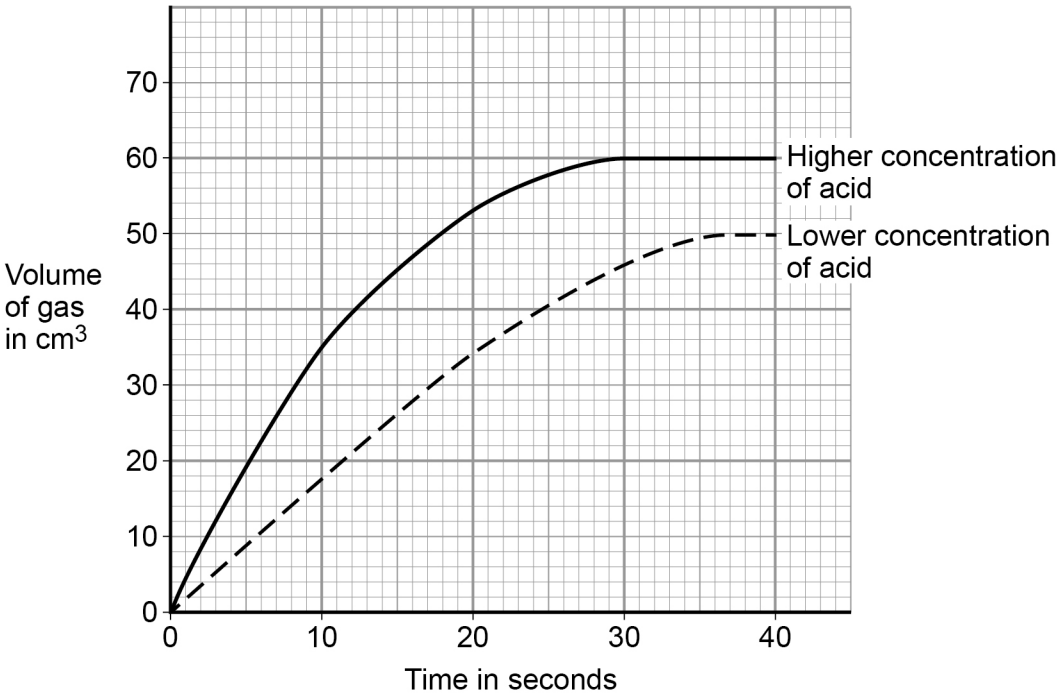
[2 marks]

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.

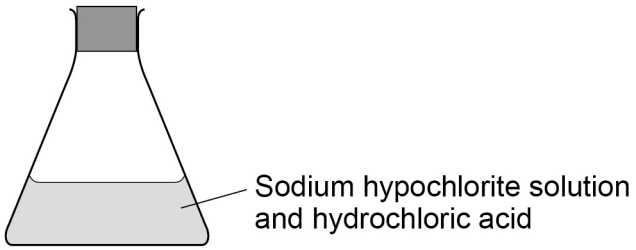
$$NaClO(aq) + 2HCl(aq) \rightleftharpoons NaCl(aq) + H_2O(l) + Cl_2(g)$$

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]

12

END OF QUESTIONS