Paper Reference(s) **1SC0/2CH**

Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Combined Science
Paper 5: Chemistry 2
Higher Tier

Wednesday 12 June 2019 – Morning

Time: 1 hour 10 minutes plus your additional time allowance

INSTRUCTIONS TO CANDIDATES

Write your centre number, candidate number, surname, other names and your signature in the boxes below. Check that you have the correct question paper.

Centre No.								
Candidate No.								
Surname								
Other names								
Signature								
Paper Reference	1	S	C	0	/	2	C	H

- **Use BLACK ink or ball-point pen.**
- **Answer ALL questions.**
- **Answer the questions in the spaces provided – there may be more space than you need.**
- **Calculators may be used.**
- **Any diagrams may NOT be accurately drawn, unless otherwise indicated.**
- **You must show all your working out with your answer clearly identified at the end of your solution.**

MATERIALS REQUIRED FOR EXAMINATION
Calculator, ruler

ITEMS INCLUDED WITH QUESTION PAPERS
Periodic Table

INFORMATION FOR CANDIDATES

- **The total mark for this paper is 60.**
- **The marks for EACH question are shown in brackets – use this as a guide as to how much time to spend on each question.**

(Instructions continue on next page)

- In questions marked with an ASTERISK (*), marks will be awarded for your ability to structure your answer logically showing how the points that you make are related or follow on from each other where appropriate.
- A periodic table is provided.

ADVICE TO CANDIDATES

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 Most of the fuels used today are obtained from crude oil.

(a) Which statement about crude oil is correct? (1 mark)

☐ **A crude oil is a compound of different hydrocarbons**

☐ **B crude oil is a mixture of hydrocarbons**

☐ **C crude oil contains different hydrocarbons, all with the same molecular formula**

☐ **D crude oil is an unlimited supply of hydrocarbons**

(Question continues on next page)

(b) Crude oil is separated into several fractions by fractional distillation. Two of these fractions are kerosene and diesel oil.

(i) State a use for each of these fractions. (2 marks)

kerosene _____

_____

diesel oil_____

_____

(Question continues on next page)

(ii) Figure 1 shows where the fractions kerosene and diesel oil are produced in the fractionating column.

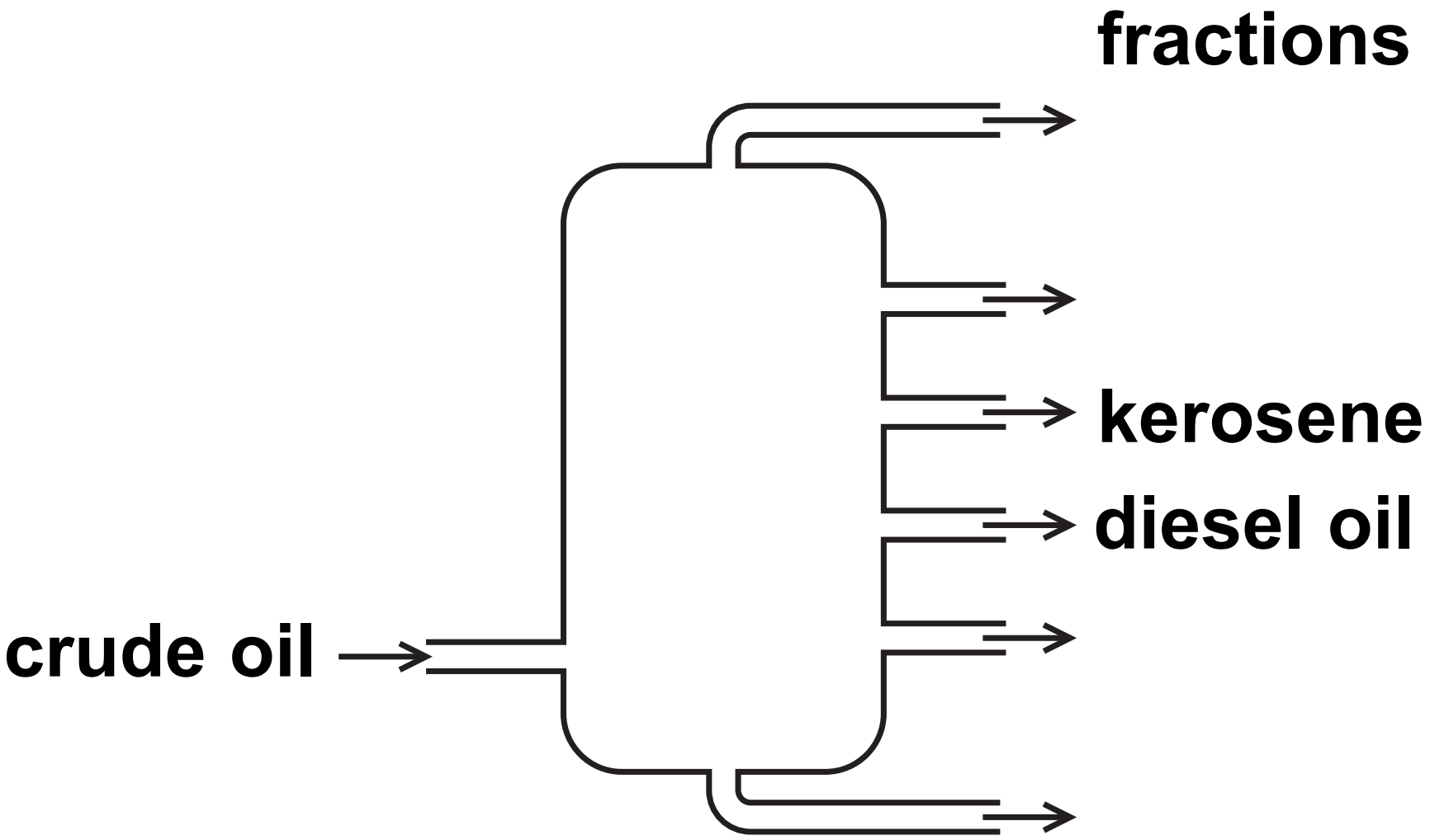

Figure 1

Kerosene is obtained higher up the column than diesel oil.
Kerosene and diesel oil fractions have slightly different properties.

(Question continues on next page)

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Choose a property.
State how this property for kerosene compares with the property for diesel oil. (1 mark)

property _____

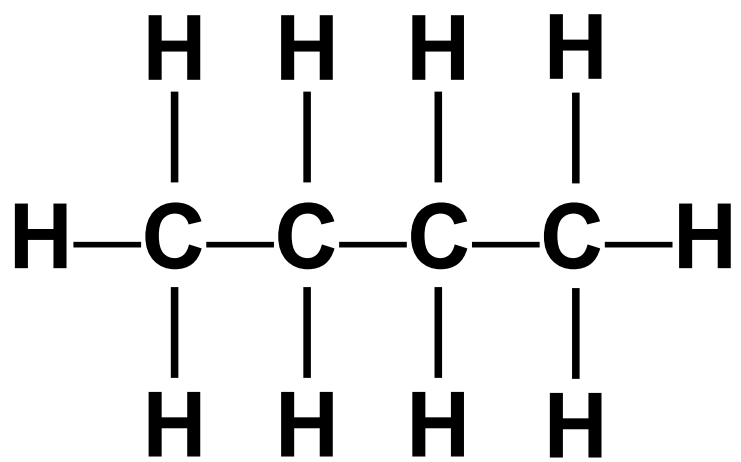
_____

comparison _____

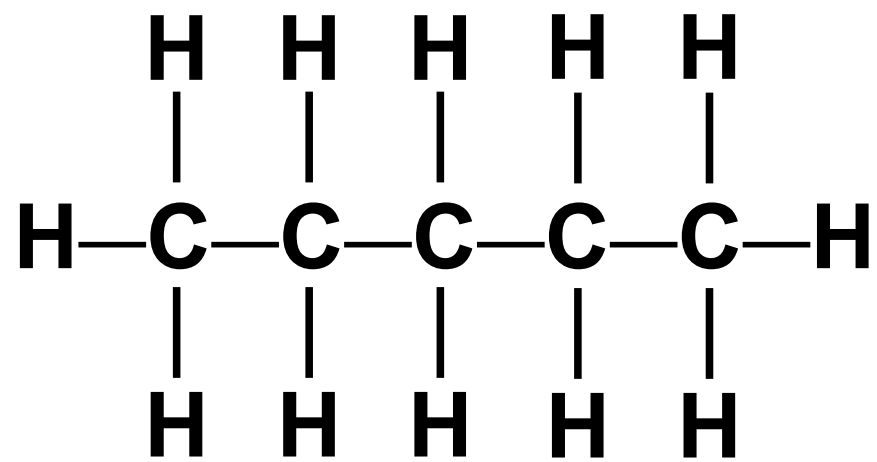
_____

(Question continues on next page)

(c) Figure 2 shows the formulae of a molecule of butane and of a molecule of pentane.
Butane and pentane are neighbouring members of the same homologous series.



butane



pentane

Figure 2

(Question continues on next page)

9

(i) Explain, using these formulae, why butane and pentane are neighbouring members of the same homologous series. (2 marks)

(Question continues on next page)

(Turn over)

(ii) Butane has the formula C_4H_{10}.

Calculate the mass of carbon in 100 g of butane.

Give your answer to three significant figures.

(relative atomic masses: H = 1·00, C = 12·0;
relative formula mass: C_4H_{10} = 58·0)

You must show your working.
(3 marks)

mass of carbon = _____ g

(TOTAL FOR QUESTION 1 = 9 MARKS)

(Questions continue on next page)

2 (a) An aluminium atom has the atomic number 13 and the mass number 27.

Which row shows the numbers of subatomic particles present in an aluminium ion, Al^{3+}? (1 mark)

	protons	neutrons	electrons
☐ A	13	14	13
☐ B	13	14	10
☐ C	14	13	10
☐ D	14	13	17

(Question continues on next page)

(b) Magnesium burns in excess oxygen to form magnesium oxide.
The balanced equation for this reaction is

$$2Mg + O_2 \longrightarrow 2MgO$$

Starting with 1·35 g of magnesium, calculate the maximum mass of magnesium oxide that could be formed in this reaction.
(relative atomic masses: O = 16·0, Mg = 24·0)

You must show your working.
(3 marks)

(Continue your answer on next page)

mass of magnesium oxide = _____ g

(Question continues on next page)

(c) Chlorine reacts with hydrogen to form hydrogen chloride.

Write the balanced equation for this reaction. (3 marks)

(Question continues on next page)

(d) **Sodium reacts with chlorine to form sodium chloride.**

The electronic configuration of the sodium atom is 2.8.1 and the electronic configuration of the chlorine atom is 2.8.7.

Give the electronic configurations of the ions formed. (2 marks)

Na^+ _____

Cl^- _____

(TOTAL FOR QUESTION 2 = 9 MARKS)

(Questions continue on next page)

3 (a) Carbon dioxide is one of the gases in the Earth's atmosphere.
The percentage of carbon dioxide in the Earth's atmosphere has changed over time.

(Question continues on next page)

(Turn over)

(i) **Which row of the table shows the approximate percentage of carbon dioxide thought to be in the Earth's early atmosphere and how this percentage changed to form the Earth's atmosphere today? (1 mark)**

	approximate percentage of carbon dioxide in the Earth's early atmosphere	change in percentage carbon dioxide to form the Earth's atmosphere today.
☐ A	5	increased
☐ B	5	decreased
☐ C	95	increased
☐ D	95	decreased

(Question continues on next page)

(ii) The actual percentage of carbon dioxide in the Earth's atmosphere today varies.

Explain TWO factors that cause the percentage of carbon dioxide in today's atmosphere to vary. (4 marks)

factor 1 _____

factor 2 _____

(Continue your answer on next page)

(Question continues on next page)

(Turn over)

(b) Carbon dioxide is a simple molecular, covalent compound.

It has a low boiling point of –78·5 ^{o}C.

Explain why carbon dioxide has a low boiling point. (2 marks)

(Question continues on next page)

(c) Calculate the number of molecules in 0·11 g of carbon dioxide. (3 marks)

Give your answer to two significant figures.

(relative formula mass : CO_2 = 44
Avogadro constant = $6{\cdot}02 \times 10^{23}$)

number of molecules = _____

(TOTAL FOR QUESTION 3 = 10 MARKS)

(Questions continue on next page)

4 Some of the elements in the periodic table are metals.

(a) The electronic configuration of a metal is 2.8.3

Which row shows the group and period of the periodic table where this metal is found? (1 mark)

	group	period
☐ A	2	3
☐ B	2	8
☐ C	3	2
☐ D	3	3

(Question continues on next page)

(b) Lithium, potassium and rubidium are alkali metals.

(i) Describe what you would see when a small piece of rubidium is dropped on to water. (2 marks)

(Question continues on next page)

(ii) The electronic configuration of lithium is 2.1
The electronic configuration of potassium is 2.8.8.1
Lithium is less reactive than potassium.

Explain, in terms of their electronic configurations, why lithium is less reactive than potassium. (3 marks)

(Continue your answer on next page)

(Question continues on next page)

(c) Lithium has two naturally occurring isotopes, lithium-6 and lithium-7.

A sample of lithium contains
7·59% of lithium-6
92·41% of lithium-7.

Calculate the relative atomic mass of lithium in this sample.

Give your answer to two decimal places.
You must show your working.
(4 marks)

(Continue your answer on next page)

relative atomic
mass of lithium = _____

(TOTAL FOR QUESTION 4 = 10 MARKS)

(Questions continue on next page)

5 Calcium carbonate reacts with dilute hydrochloric acid to produce calcium chloride, water and carbon dioxide.

$$CaCO_3 + 2HCl \longrightarrow CaCl_2 + H_2O + CO_2$$

(a) A student wanted to measure the amount of gas produced in two minutes.

The student suggested that this could be done by counting the number of bubbles formed. However, the bubbles are produced too quickly to count them.

Figure 3 shows a conical flask in which the calcium carbonate and dilute hydrochloric acid are reacting.

(Question continues on next page)

Complete Figure 3 to show the apparatus that could be used to measure accurately the volume of gas given off in two minutes. (2 marks)

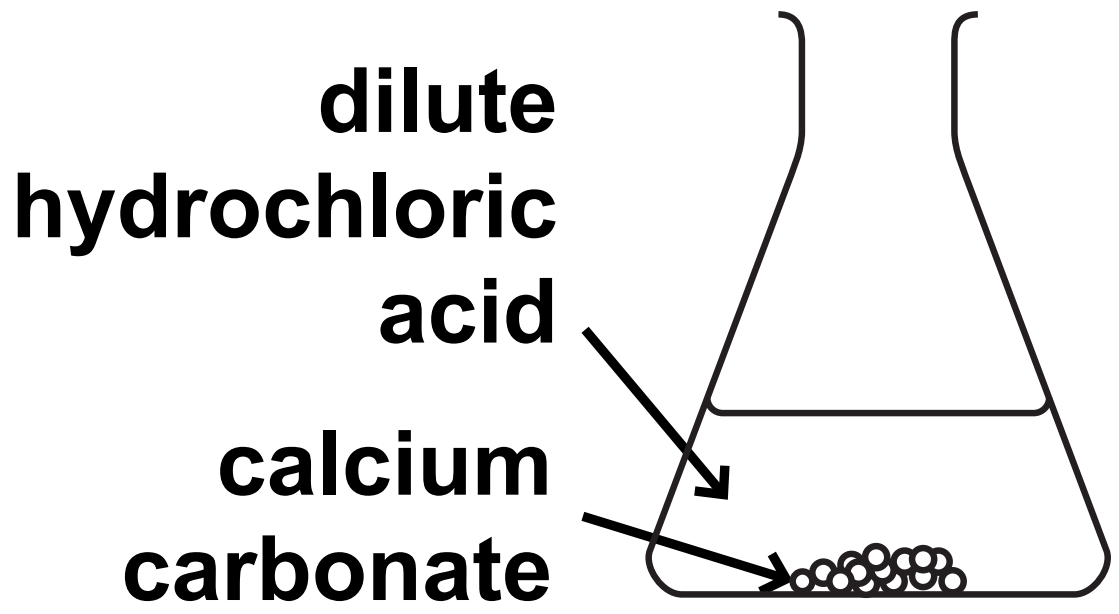


Figure 3

(Question continues on next page)

(Turn over)

(b) The reaction between calcium carbonate and dilute hydrochloric acid is exothermic.

Explain, in terms of bond breaking and bond making, why some reactions are exothermic. (3 marks)

(Question continues on next page)

*(c) An investigation was carried out into the rate of reaction of calcium carbonate with dilute hydrochloric acid.

5·0 g of small lumps of calcium carbonate were reacted with 50 cm^3 of 0·50 mol dm^{-3} hydrochloric acid.
Another 5·0 g of the same sized lumps of calcium carbonate were reacted with 50 cm^3 of 1·0 mol dm^{-3} hydrochloric acid.
The volume of gas collected in two minutes was recorded for each experiment.

The two experiments were then repeated, each using 5·0 g of large lumps of calcium carbonate.

(Question continues on next page)

Figure 4 shows the results.

concentration of hydrochloric acid in mol dm^{-3}	volume of gas collected in cm^3	
	small lumps of calcium carbonate	large lumps of calcium carbonate
0·50	17·2	3·1
1·0	35·1	5·6

Figure 4

(Question continues on next page)

Explain, in terms of collision of particles, how these results show the effect of the size of the lumps of calcium carbonate and the effect of the concentration of the acid on the rate of this reaction. (6 marks)

(Continue your answer on next page)

(Continue your answer on next page)

(Continue your answer on next page)

(Continue your answer on next page)

(TOTAL FOR QUESTION 5 = 11 MARKS)

(Questions continue on next page)

6 Fluorine, chlorine, bromine, iodine and astatine are elements in group 7.

(a) Describe the test to show that a gas is chlorine. (2 marks)

(Question continues on next page)

(b) Bromine reacts with hydrogen to form hydrogen bromide.
Hydrogen bromide dissolves in water to form a solution.

State the name of the solution formed. (1 mark)

(Question continues on next page)

(c) There is a trend in the colour and the state of the halogens at room temperature.

Predict the colour and state of astatine at room temperature. (2 marks)

colour _____

state _____

(Question continues on next page)

(d) Bromine, chlorine and iodine are dissolved in water to make aqueous solutions.
Potassium iodide solution is added to each of these solutions.

Figure 5 shows the observations.

halogen	initial colour of aqueous solution	final colour of mixture
bromine	orange	brown
chlorine	pale green	brown
iodine	brown	brown

Figure 5

(Question continues on next page)

Explain the observations shown in the table. (4 marks)

(Continue your answer on next page)

(e) Fluorine reacts vigorously with iron to produce iron(III) fluoride, FeF_3.

Write the balanced equation for this reaction. (2 marks)

(TOTAL FOR QUESTION 6 = 11 MARKS)

TOTAL FOR PAPER = 60 MARKS

END