Please check the examination details below before entering your candidate information

Candidate surname	Other names

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

Centre Number	Candidate Number

Wednesday 12 June 2019

Morning (Time: 1 hour 10 minutes) | Paper Reference **1SC0/2CH**

Combined Science

Paper 5: Chemistry 2

Higher Tier

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- 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**.

Information

- 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.*
- 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 printed on the back cover of this paper.

Advice

- 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.

Turn over ▶

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1/

P 6 0 2 4 7 A 0 1 1 6

Pearson

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)

☒ **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

(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)

kerosene (fuel for) aircraft / jets / lamps / cooking / heaters / fire lighters / rocket fuel (1)

diesel oil (fuel for) cars / trains / trucks / lorries / vehicles / tractors / generators / boats (1)

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

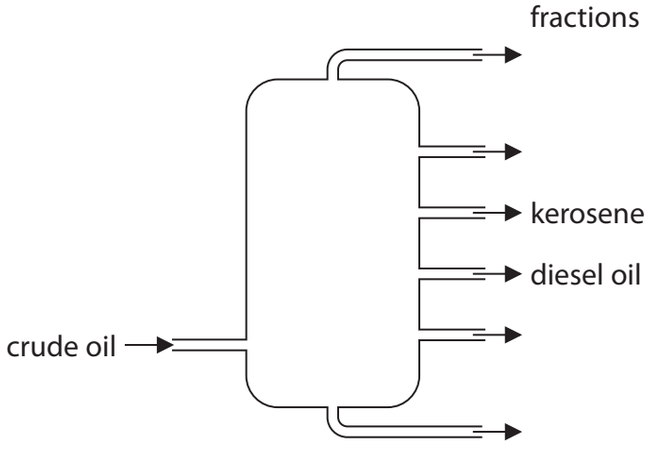


Figure 1

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

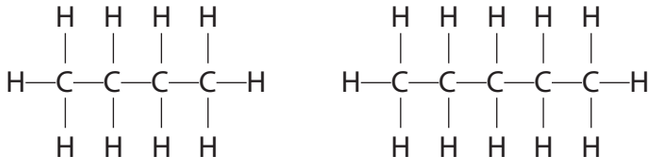
Choose a property.
State how this property for kerosene compares with the property for diesel oil.

(1)

property boiling point:

comparison low(er)

(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

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

(2)

An explanation linking

• they differ by CH2 / differ by one carbon atom / pentane has one more carbon (1)

• they have the same general formula / CnH2n+2 / both alkanes (1)

(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)

$\frac{100}{58}$ (= 1.724…) (1)

$\frac{48 \times 100}{58}$ (1) (= 82.759)

mass of carbon = 82.8 (g) (1) g

(Total for Question 1 = 9 marks)

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)

	protons	neutrons	electrons
☒ **A**	13	14	13
☒ **B**	13	14	10
☒ **C**	14	13	10
☒ **D**	14	13	17

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

$$2Mg + O_2 \rightarrow 2MgO$$

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)

MgO = 24 + 16 = 40 (1)

1 g Mg forms $\frac{40\ (1)}{24}$ = 1.67 (g) MgO

1.35 g Mg forms $\frac{40 \times 1.35\ (1)}{24}$ MgO

= 2.25 (g)

mass of magnesium oxide = ... g

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

Write the balanced equation for this reaction.

(3)

Cl2 + H2 ----> 2HCl (3

(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)

Na^+ 2.8 (1)

Cl^- 2.8.8 (1)

(Total for Question 2 = 9 marks)

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.

(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)

	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

(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)

factor 1 combustion/ burning of fossil fuels (1)

{increases/ gives out} carbon dioxide (1)

factor 2

respiration (1)

increases carbon dioxide (1)

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

It has a low boiling point of –78.5 °C.

Explain why carbon dioxide has a low boiling point.

(2)

An explanation linking
weak {forces between molecules / intermolecular forces} (1)

(intermolecular forces need) little {heat/energy} required (1)

(c) Calculate the number of molecules in 0.11 g of carbon dioxide.

Give your answer to two significant figures.

(relative formula mass : $CO_2 = 44$
Avogadro constant = 6.02×10^{23})

(3)

$\frac{0.11}{44}$ (1) (= 0.0025)

$0.0025 \times 6.02 \times 10^{23}$ (1)

$= 1.5 \times 10^{21}$ (1)

number of molecules = ...

(Total for Question 3 = 10 marks)

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)

	group	period
☒ **A**	2	3
☒ **B**	2	8
☒ **C**	3	2
☒ **D**	3	3

(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)

A description to include from

• effervescence / bubbles / fizz (1)

• disappears / gets smaller (1)

• explodes / flame / ignites / sparks (1)

(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)

an explanation linking
outer {electron /shell} closer to nucleus (1)

so more attraction for {electron/shell} (1)

(therefore) electron is harder to lose (1)

(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)

7.59 x 6 (1) (= 45.54)

92.41 x 7 (1) (= 646.87) (1)

$$\frac{45.54 + 646.87\ (1)\ (= 6.9241)}{100}$$

6.92 (1)

relative atomic mass of lithium = ...

(Total for Question 4 = 10 marks)

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

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

(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.

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

(2)

delivery tube, not in liquid, connected to flask sealed with a bung/cork (1)

gas syringe / measuring cylinder or burette inverted over water (1)

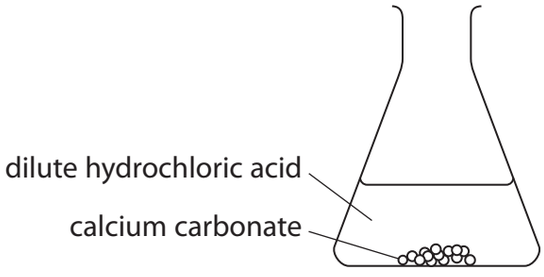

Figure 3

(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)

an explanation linking

breaking bonds {needs energy/ endothermic} (1)

making bonds {releases energy/ exothermic} (1)

more energy is given out than is taken in (1)

*(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.

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

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)

AO1 (3 marks) AO3 (3 marks)

- less gas produced with large lumps in same amount of time
- therefore, reaction slower ORA
- larger lumps have smaller surface area ORA
- fewer particles available for reaction
- fewer collisions in given time
- more gas produced at higher concentration in all experiments
- higher concentration there are more particles in same volume
- more particles available to react
- more frequent collisions
- most gas produced in same time with small lumps and highest concentration ORA
- therefore, fastest reaction is with small lumps and highest concentration ORA

(Total for Question 5 = 11 marks)

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

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

(2)

A description to include

(damp) litmus / indicator paper

bleaches / goes white (1)

(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)

hydrobromic acid (1)

(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)

colour grey/ black (1)

state solid (1)

(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

Explain the observations shown in the table.

(4)

an explanation linking 4 of the following

• {chlorine / bromine} are more reactive than iodine / iodine is the least reactive (1)

• (in the reaction of chlorine with potassium iodide) chlorine displaces iodine / iodine formed / iodide ions oxidised (1)

• (in the reaction of bromine with potassium iodide) bromine displaces iodine / iodine formed / iodide ions oxidised (1)

• brown colour of final mixture is due to iodine (1)

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

Write the balanced equation for this reaction.

(2)

2Fe + 3F2 ----> 2FeF3 (2)

(Total for Question 6 = 11 marks)

TOTAL FOR PAPER = 60 MARKS

The periodic table of the elements

1	2											3	4	5	6	7	0
							1 H hydrogen 1										4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The elements with atomic numbers from 58 to 71 are omitted from this part of the periodic table.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.