Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

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

Tuesday 11 June 2024

Morning (Time: 1 hour 10 minutes)

Paper reference **1SC0/2CH**

Combined Science

PAPER 5

Higher Tier

You must have:
Calculator, ruler, Periodic table (enclosed)

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.

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.

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P 7 4 4 4 5 A 0 1 2 0

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 A student investigates the reaction between marble chips and dilute hydrochloric acid.

The student measures the total volume of carbon dioxide gas produced each minute, for 10 minutes.

(a) Figure 1 shows part of the apparatus used in the experiment.

Complete Figure 1 by drawing and labelling apparatus that could be used to collect and measure the volume of the carbon dioxide gas.

(2)

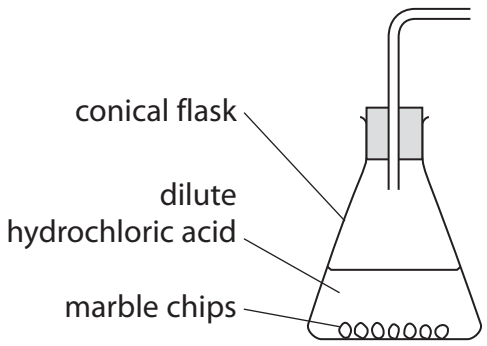

Figure 1

(b) Figure 2 shows a graph of the results of the experiment.

A tangent has been drawn on the curve at a time of 3.5 minutes.

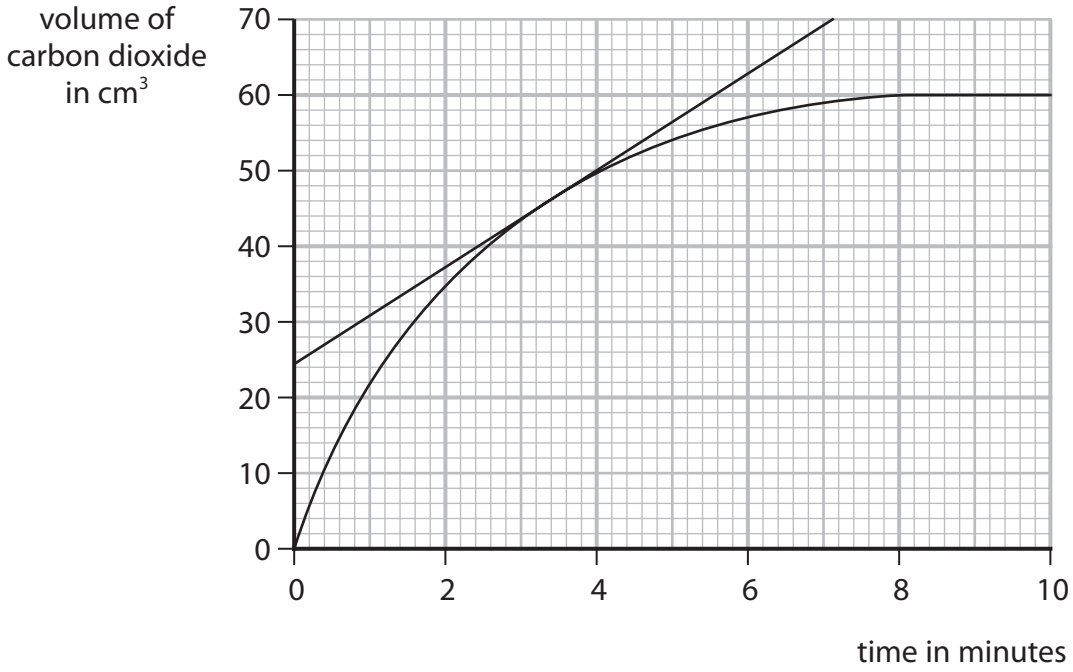

Figure 2

(i) State the total volume of carbon dioxide produced in the first 3.5 minutes.

(1)

volume = ... cm^3

(ii) Using the tangent, calculate the rate of reaction at 3.5 minutes in cm^3 per minute.

$$\text{rate of reaction} = \frac{\text{change in gas volume}}{\text{change in time}}$$

(3)

.....

.....

.....

.....

rate = ... cm^3 per minute

(c) The student repeats the experiment using the same mass of smaller marble chips.

All other conditions remain the same.

Explain the effect on the rate of reaction of using smaller marble chips.

(2)

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(d) Which change would make the rate of reaction slower?

(1)

- ☒ **A** using the same acid at a higher temperature
- ☒ **B** using acid of a lower concentration
- ☒ **C** using a larger flask
- ☒ **D** adding a catalyst

(Total for Question 1 = 9 marks)

2 This question is about the atmosphere.

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

(2)

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.....

.....

(b) Copper reacts with oxygen to form copper oxide.

2.100 g of copper will react completely with 0.529 g of oxygen.

In an experiment, 4.200 g of copper is heated with 50.000 g of oxygen until the reaction is complete.

Calculate the mass of oxygen remaining at the end of the experiment.

(2)

.....

.....

mass of oxygen = ... g

(c) Helium, neon and argon are all inert.

(i) Explain, in terms of electrons, why these gases are inert.

(2)

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(ii) Two pieces of steel can be joined by heating the metal pieces with a very hot flame.

This process is often carried out in an argon atmosphere rather than in air.

Which property makes argon gas suitable for this use?

(1)

☒ **A** argon has a low density

☒ **B** argon has a low melting point

☒ **C** argon is colourless

☒ **D** argon is unreactive

(d) Carbon dioxide is removed from the atmosphere by plants and stored in plants and soil as carbon compounds.

Figure 3 shows the relative amounts of carbon stored in plants and soils in different environments.

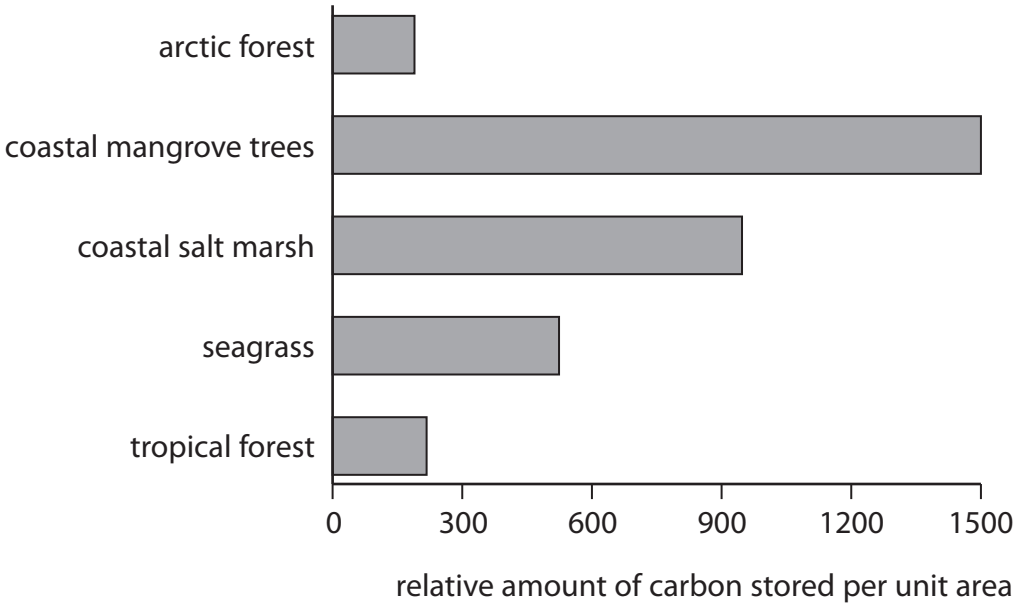

Figure 3

It has been suggested that preserving coastal ecosystems is more effective than reforestation in the mitigation of climate change.

Describe how the data in Figure 3 supports this suggestion.

(2)

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(Total for Question 2 = 9 marks)

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3 (a) (i) Most hydrocarbons found in fossil fuels are members of the alkane homologous series.

State **two** features of an homologous series.

(2)

1 .....

.....

2 .....

.....

(ii) Which molecule is in the same homologous series as CH_4?

(1)

☒ **A** C_5H_{20}

☒ **B** C_6H_{12}

☒ **C** C_8H_{18}

☒ **D** C_9H_{16}

(b) A fossil fuel contains carbon and sulfur.

Explain how the products of the complete combustion of this fossil fuel would affect the environment.

(4)

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(c) Incomplete combustion of fuels may produce carbon monoxide.

Write the balanced equation for the incomplete combustion of heptane, C_7H_{16}, where all of the carbon atoms form carbon monoxide.

(2)

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(Total for Question 3 = 9 marks)

4 (a) Damp iron wool reacts with oxygen in the air.
A student uses the apparatus in Figure 4 to investigate the percentage of oxygen in the atmosphere.

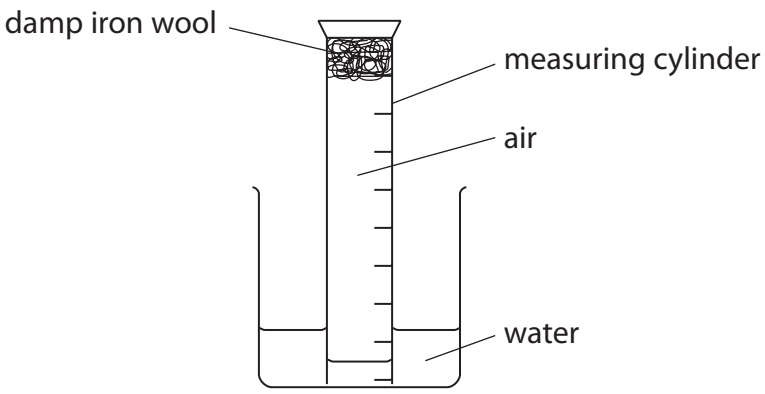

Figure 4

(i) The initial volume of air in the measuring cylinder was 18.0 cm^3.

The student left the apparatus overnight.

The volume of gas in the measuring cylinder the next day was 14.5 cm^3.

To the nearest whole number, what percentage of the air has reacted with the iron wool?

(1)

☒ **A** 19%

☒ **B** 21%

☒ **C** 24%

☒ **D** 81%

(ii) Describe **one** improvement the student could make to this method to ensure that all of the oxygen in the measuring cylinder has reacted.

(2)

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(b) (i) When hydrocarbon fuels are burned, the products are water and carbon dioxide.

Describe what needs to be done to the apparatus in Figure 5 to collect the water and show that carbon dioxide has been produced.

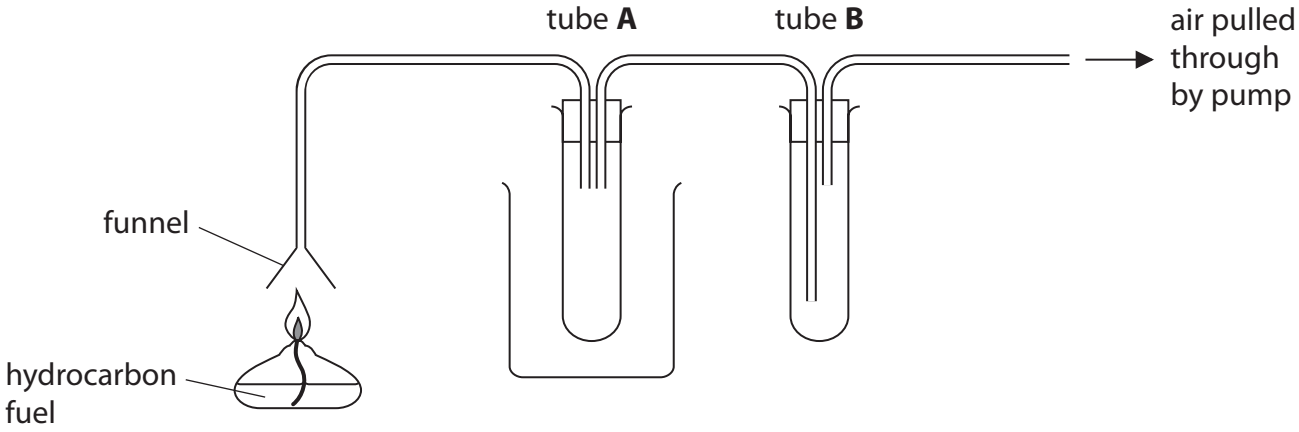

Figure 5

(2)

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(ii) A hydrocarbon, C_xH_y, is burned in excess oxygen, forming 26.4 g of carbon dioxide and 5.4 g of water.

The relative formula mass of C_xH_y is 78.

Calculate the molecular formula of the hydrocarbon C_xH_y.

(relative atomic masses: H = 1.0, C = 12;
relative formula masses: H_2O = 18, CO_2 = 44)

(4)

.....

.....

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.....

.....

molecular formula = ...

(Total for Question 4 = 9 marks)

5 (a) The relative atomic mass of argon is 40 and the relative atomic mass of potassium is 39 but potassium appears after argon in the periodic table.

State why potassium appears after argon in the periodic table.

(1)

.....

.....

(b) Potassium reacts with water to form two products.

(i) Give the formulae of both products.

(1)

..... **and** .....

(ii) The reaction of potassium with water is exothermic.

On Figure 6, draw and label the reaction profile diagram for this reaction, labelling the activation energy.

(2)

Figure 6

(c) Some reactions are endothermic.

Explain, in terms of bond breaking and bond forming, why some reactions are endothermic.

(3)

(d) Ethene reacts with hydrogen chloride.

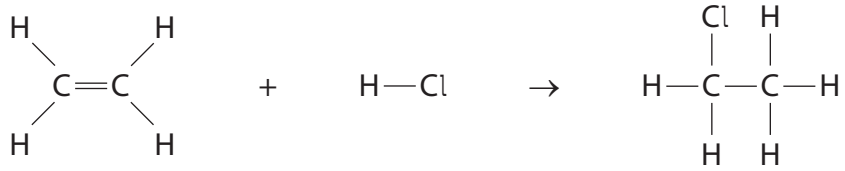

Figure 7 shows the bond energies for the different bonds in the three molecules in the reaction.

bond	bond energy in kJ mol^{-1}
C—H	412
C═C	612
C—C	348
H—Cl	431
C—Cl	338

Figure 7

Calculate the energy change for this reaction.

(4)

energy change = ... kJ mol^{-1}

(Total for Question 5 = 11 marks)

6 The elements in group 7 of the periodic table are the halogens.

(a) Which row shows the colour and physical state of iodine at room temperature?

(1)

		colour	physical state
☒	**A**	dark grey	solid
☒	**B**	red brown	liquid
☒	**C**	green	solid
☒	**D**	purple	gas

(b) Iron wool is heated with bromine vapour as shown in Figure 8.

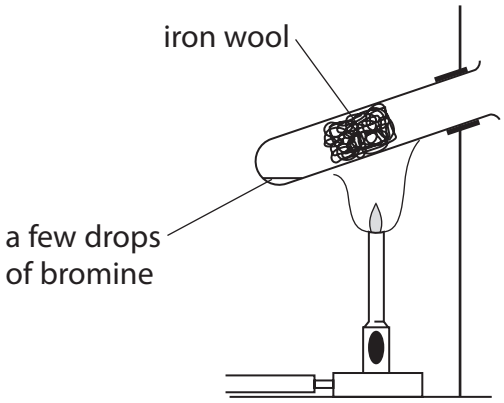

Figure 8

At the end of the reaction, a solid forms at the top of the test tube.

Identify the solid.

(1)

.....

(c) Aluminium reacts with bromine.

Write the balanced equation for the reaction between aluminium and bromine.

(3)

.....

*(d) (i) The order of reactivity of the halogens can be found by displacement reactions.

A student was provided with
- solutions of bromine, chlorine and iodine
- solutions of sodium bromide, sodium chloride and sodium iodide.

Describe experiments the student could carry out using these solutions to find the order of reactivity of bromine, chlorine and iodine, explaining how the results would show the order of reactivity.

You should use equations to support your answer.

(6)

(ii) Explain why the displacement reactions of halogens are redox reactions.

(2)

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(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 60 MARKS

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

Tuesday 11 June 2024

Paper reference **1SC0/2CH**

Combined Science

PAPER 5

Higher Tier

Periodic Table Insert

Do not return this Insert with the question paper.

Turn over ▶

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P 7 4 4 4 5 A

Pearson

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.