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

Time 1 hour 10 minutes

Paper reference **1SC0/2CH**

Combined Science

PAPER 5

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.
- There is a periodic table on the back cover of the 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.
- Good luck with your examination.

Turn over ▶

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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) The concentration of a solution can be calculated using the equation

$$\text{concentration of solution} = \frac{\text{mass of solid}}{\text{volume of solution}}$$

A student dissolved 9.25 g of ammonium chloride in water and made up the solution to a volume of 200 cm^3.

Use the equation to calculate the concentration of this solution in g dm^{-3}.

(2)

concentration = ... g dm^{-3}

(b) Dissolving ammonium chloride in water is an endothermic process.
Figure 1 shows part of the reaction profile for this process.

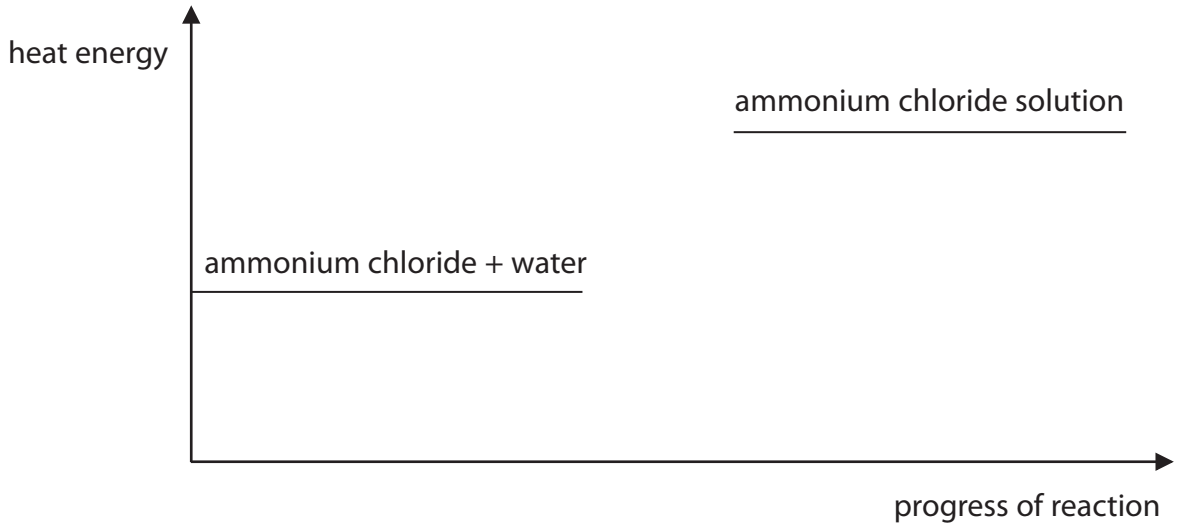

Figure 1

(i) Explain how Figure 1 shows that dissolving ammonium chloride in water is an endothermic process.

(2)

(ii) Complete the reaction profile in Figure 1 and label the activation energy.

(2)

(c) A student used the equipment in Figure 2 to investigate whether electricity can pass through solid ammonium chloride and through ammonium chloride solution.

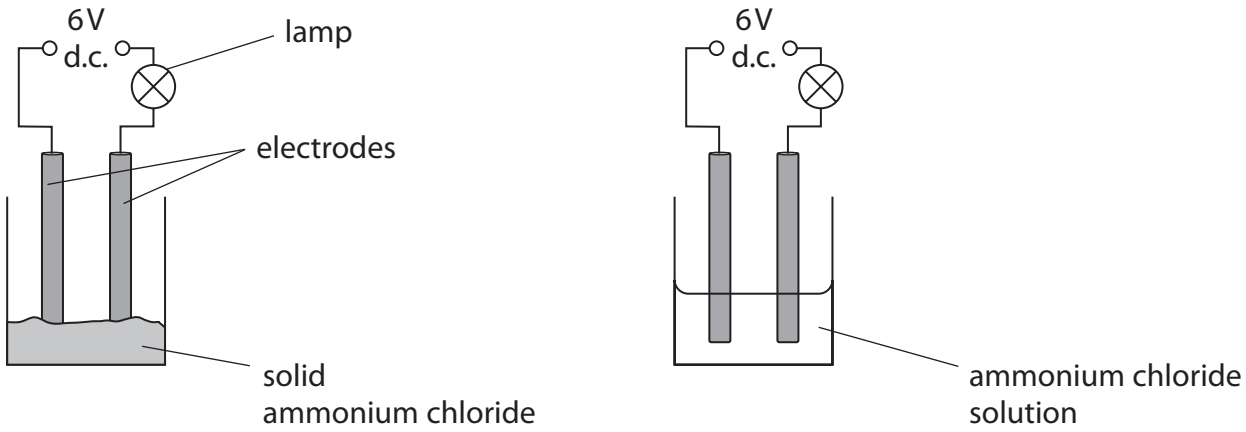

Figure 2

If an electrical current flows in the circuit, the lamp will light up.

Figure 3 shows the results of the investigation.

substance	lamp
solid ammonium chloride	did not light up
ammonium chloride solution	lit up brightly

Figure 3

Explain the results of the investigation.

(3)

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(Total for Question 1 = 9 marks)

2 Diesel oil is a mixture of hydrocarbons that can be obtained from crude oil.

(a) State the name of the process used to separate diesel oil from crude oil.

(1)

.....

(b) Diesel oil contains alkanes.
These alkanes are part of an homologous series.

Which statement about compounds in this homologous series is true?

(1)

☒ **A** they have the same chemical formula

☒ **B** they have the same empirical formula

☒ **C** they have the same general formula

☒ **D** they have the same molecular formula

(c) When fuels such as diesel oil are burned, the high temperatures produced can cause nitrogen and oxygen in the air to form the pollutant nitrogen dioxide.

Complete the balanced equation for the reaction.

(2)

$N_2 + 2O_2 \rightarrow$ .....

(d) Explain how the greenhouse effect is caused by the gases produced by the complete combustion of diesel oil.

(3)

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(Total for Question 2 = 7 marks)

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3 This question is about potassium and zinc.

(a) Which of the following temperatures is most likely to be the melting point of potassium?

(1)

- ☒ **A** –63 °C
- ☒ **B** 6.3 °C
- ☒ **C** 63 °C
- ☒ **D** 630 °C

(b) Explain how the electronic configuration of an atom of potassium is related to its position in the periodic table.

(2)

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(c) Potassium reacts with oxygen to form potassium oxide.

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

(2)

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(ii) Potassium oxide is ionic.

Write the electronic configurations for the ions in potassium oxide, K_2O.

(2)

potassium ion: .....

oxide ion: .....

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(d) Figure 4 shows two gas syringes connected by a glass tube.

Inside the glass tube there are some pieces of zinc.
Zinc reacts with oxygen at a temperature of over 225 °C.
Not all the oxygen reacts at once, the oxygen reacts only when in contact with the zinc.

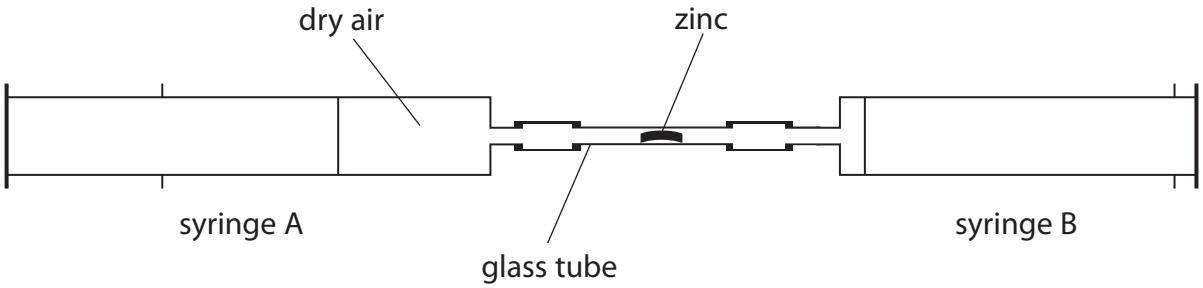

Figure 4

Devise a plan to find the volume of oxygen contained in a known volume of air, using the apparatus shown in Figure 4.

(4)

(Total for Question 3 = 11 marks)

4 This question is about the rate of reaction between calcium carbonate and dilute hydrochloric acid.

The word equation for this reaction is

calcium carbonate + hydrochloric acid → calcium chloride + water + carbon dioxide

(a) Which of the following is the formula for calcium carbonate?

(1)

- ☒ **A** $CaCO_2$
- ☒ **B** $CaCO_3$
- ☒ **C** $Ca(CO)_3$
- ☒ **D** $Ca(CO_3)_2$

(b) Some pieces of calcium carbonate were added to dilute hydrochloric acid in a conical flask and the volume of carbon dioxide produced was measured.

Complete the diagram in Figure 5 to show the apparatus to collect the gas produced and measure its volume.

(2)

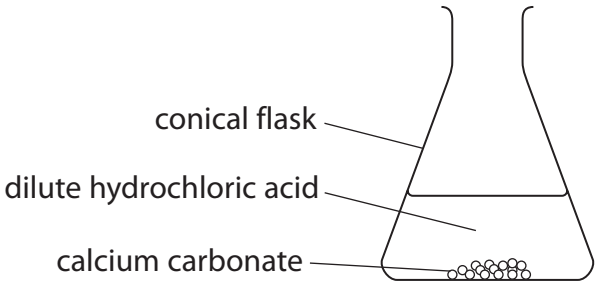

Figure 5

(c) The reaction between calcium carbonate and dilute hydrochloric acid was investigated at different temperatures.

(i) State what could be used to keep the temperature of the conical flask and its contents at a temperature of 45 °C throughout the reaction.

(1)

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(ii) Figure 6 shows a graph of volume of gas collected in this investigation.

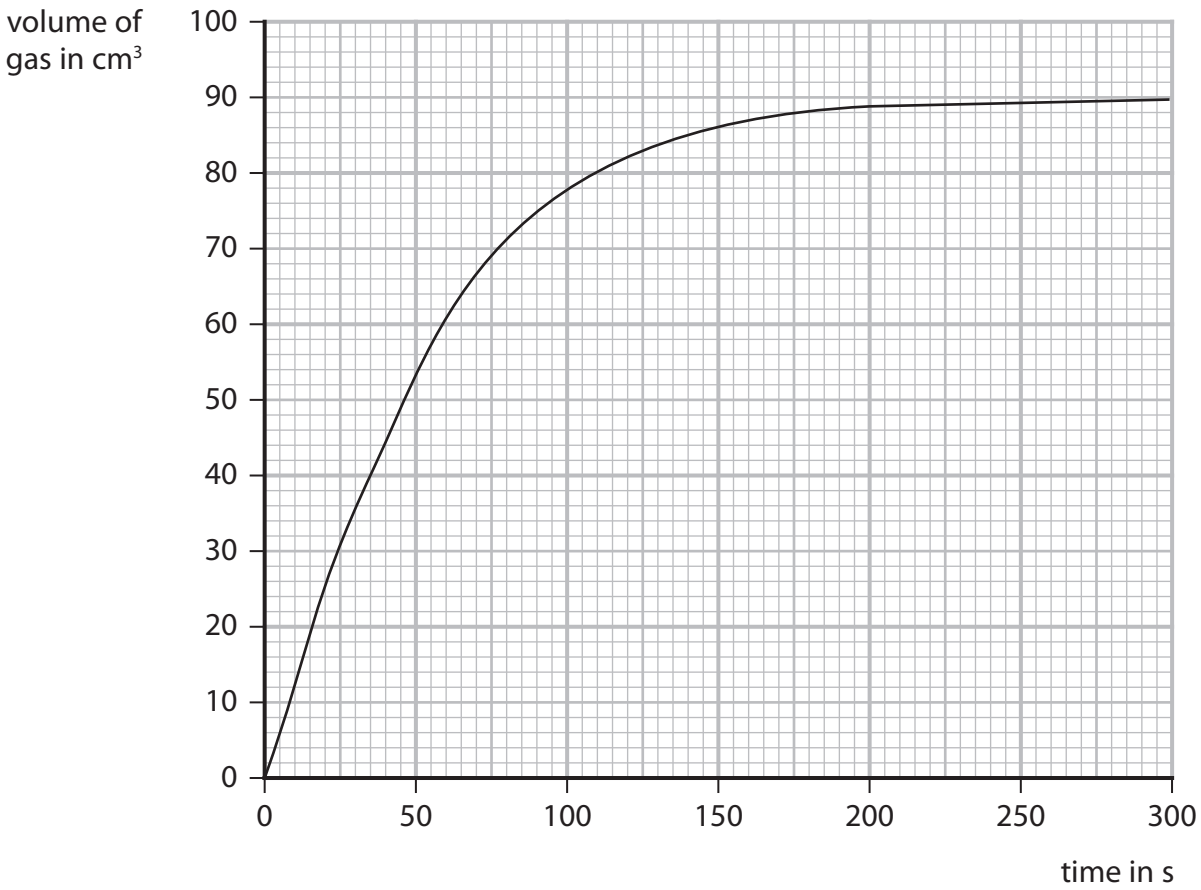

Figure 6

Draw a tangent at 100 seconds on Figure 6.
Use this tangent to calculate the rate of reaction at this time.

(2)

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.....

rate of reaction = ... $cm^3 s^{-1}$

(iii) The temperature of the acid was kept at 45 °C.

State **one** other variable that needs to be controlled during this investigation.

(1)

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(iv) Explain, in terms of particles, how decreasing the temperature affects the rate of this reaction.

(3)

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(Total for Question 4 = 10 marks)

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5 This question is about some of the elements in group 7 of the periodic table.

(a) Which row in the table correctly shows the colours and physical states of the elements at room temperature?

(1)

☒	**A**	iodine: purple gas	bromine: yellow liquid
☒	**B**	chlorine: pale green gas	iodine: brown solid
☒	**C**	bromine: red-brown liquid	chlorine: yellow liquid
☒	**D**	iodine: dark grey solid	bromine: red-brown liquid

(b) The compound phosphorus oxychloride has the formula $POCl_3$.

Calculate the percentage by mass of chlorine in phosphorus oxychloride.

(relative atomic masses: O = 16.0, P = 31.0, Cl = 35.5)

(2)

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percentage by mass of chlorine = ...

(c) When iron reacts with chlorine, iron chloride is formed.

Two possible equations for this reaction are

A $Fe + Cl_2 \rightarrow FeCl_2$

B $2Fe + 3Cl_2 \rightarrow 2FeCl_3$

In an experiment, 8.40 g iron reacts with chlorine to form 19.05 g iron chloride.

Show, using a calculation, which reaction, **A** or **B**, is taking place.

You must show your working.

(relative atomic masses: Cl = 35.5, Fe = 56.0)

(3)

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*(d) Group 1 metals react with the elements from group 7 to form salts.

Some examples of these reactions are shown in Figure 7.

reaction	word equation
W	lithium + chlorine → lithium chloride
X	potassium + fluorine → potassium fluoride
Y	rubidium + iodine → rubidium iodide
Z	potassium + bromine → potassium bromide

Figure 7

You will find the position of these elements in their groups on the periodic table.

Explain, in terms of their electronic configurations and the relative reactivity of these elements, which of the reactions shown in Figure 7 would be the most violent.

(6)

(Total for Question 5 = 12 marks)

6 Pentadecane, $C_{15}H_{32}$, is a hydrocarbon and is used as a fuel.

(a) The incomplete combustion of pentadecane produces carbon monoxide. Carbon monoxide is a toxic gas.

(i) Explain why the incomplete combustion of pentadecane can produce carbon monoxide as one of the products.

(2)

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(ii) Explain how carbon monoxide behaves as a toxic gas.

(2)

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(b) 1 mole of pentadecane can be cracked to form 1 mole of octane, C_8H_{18}, and 1 mole of propene, C_3H_6, and 2 moles of another product.

Complete the balanced equation for this reaction by adding the formula of the missing product.

(1)

$$C_{15}H_{32} \rightarrow C_8H_{18} + C_3H_6 + 2 \text{ .....}$$

(c) Figure 8 shows the reaction of propene, C_3H_6, with water.

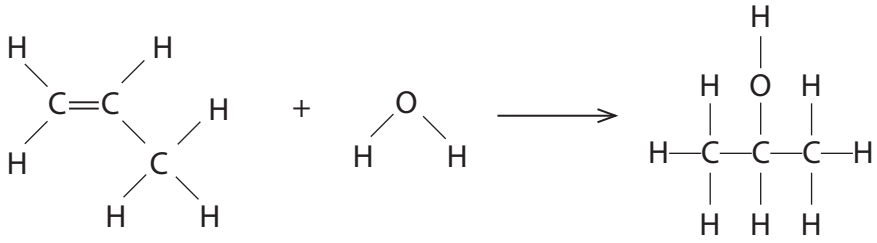

Figure 8

Figure 9 shows some bond energies.

bond	bond energy in kJ mol^{-1}
C—C	347
C—O	358
C—H	413
O—H	464
C═C	612

Figure 9

Use the bond energies in Figure 9 to calculate the energy change of the reaction in Figure 8.

(4)

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

(d) Methane gas, CH_4, was burned using the apparatus shown in Figure 10.

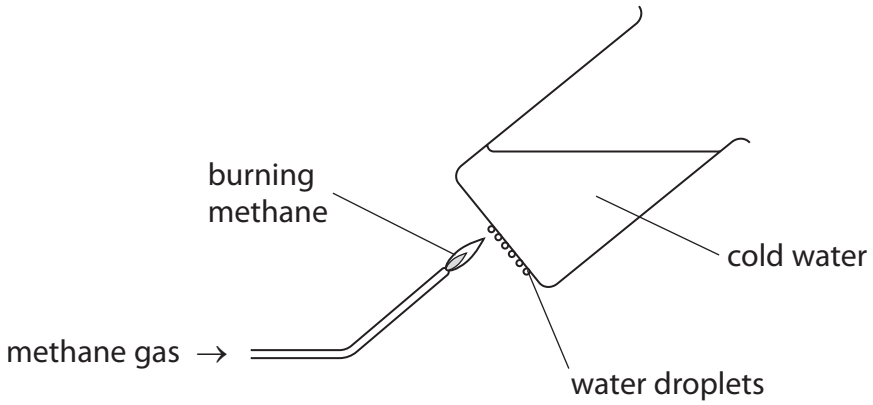

Figure 10

Explain why water droplets form on the bottom of the beaker of cold water.

(2)

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(Total for Question 6 = 11 marks)

TOTAL FOR PAPER = 60 MARKS

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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.