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)

Time 1 hour 10 minutes

Paper reference **1SC0/1CH**

Combined Science

PAPER 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.
- 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.

Turn over ▶

P69480A

Q:1/1/

P 6 9 4 8 0 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 Barium hydroxide reacts with dilute hydrochloric acid to form barium chloride and water.

(a) The equation for the reaction is

$$Ba(OH)_2(s) + 2HCl(aq) \rightarrow BaCl_2(aq) + 2H_2O(l)$$

Which row of the table shows the correct state of each of the substances in the equation for the reaction?

(1)

		barium hydroxide	hydrochloric acid	barium chloride	water
☒	**A**	solid	aqueous	aqueous	liquid
☒	**B**	solid	liquid	solid	aqueous
☒	**C**	aqueous	aqueous	solid	liquid
☒	**D**	aqueous	liquid	aqueous	aqueous

(b) A student wanted to investigate how the pH of the mixture changes as barium hydroxide is added to dilute hydrochloric acid.

They followed this method.

step 1 measure out 50.0 cm^3 of dilute hydrochloric acid into a beaker using a measuring cylinder

step 2 use a glass rod to place a drop of the acid onto a piece of universal indicator paper and record the pH

step 3 add 0.2 g of barium hydroxide to the acid in the beaker and stir

step 4 use the glass rod to place a drop of the mixture onto a new piece of universal indicator paper and record the pH again

step 5 repeat steps 3–4 until there is no further change in the pH.

(i) Name a piece of equipment which could be used to measure out 50.0 cm^3 of dilute hydrochloric acid more accurately than the measuring cylinder.

(1)

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(ii) Describe how the pH of the mixture is determined when a drop of it is placed on the universal indicator paper.

(2)

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(iii) In the method, universal indicator paper is used to determine the pH.

Explain why litmus paper would not be a suitable indicator to use in this experiment.

(2)

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(iv) Figure 1 shows the student's results.

mass of barium hydroxide in g	pH of mixture
0.0	1
0.2	1
0.4	1
0.6	1
0.8	2
1.0	7
1.2	12
1.4	13
1.6	13

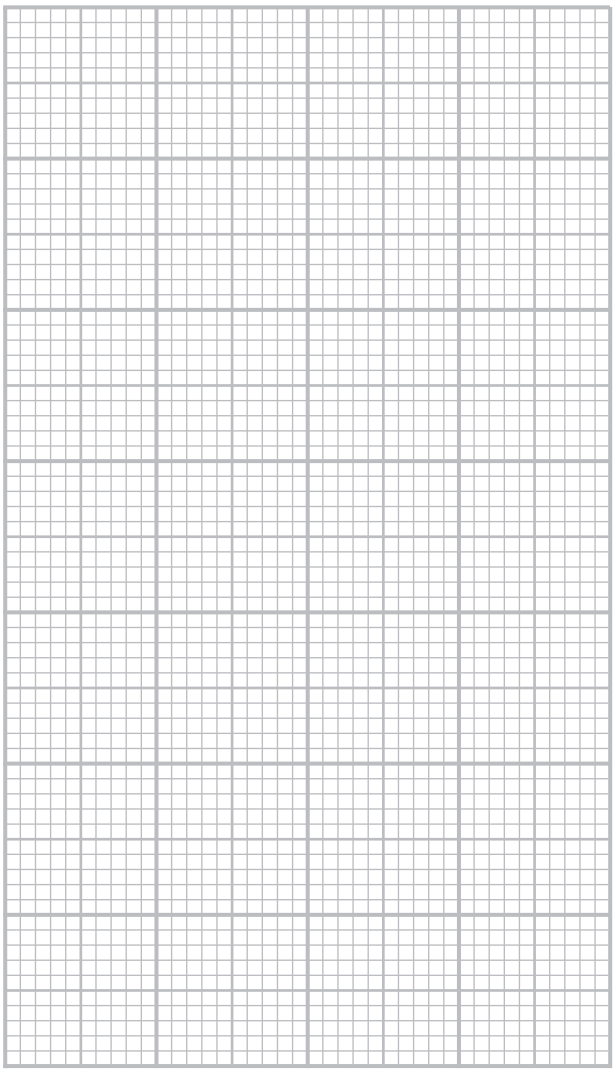
Figure 1

On the grid opposite:

- Add suitable scales to the vertical and horizontal axes.
- Plot a graph of the pH of the mixture against the mass of barium hydroxide.

(3)

pH of
the mixture



mass of barium hydroxide in g

(Total for Question 1 = 9 marks)

2 Magnesium carbonate has the formula $MgCO_3$.

(a) Magnesium carbonate contains Mg^{2+} and CO_3^{2-} ions.

(i) The atomic number of magnesium is 12.

What is the electronic configuration of the Mg^{2+} ion?

(1)

☒ **A** 2

☒ **B** 2.8

☒ **C** 2.8.2

☒ **D** 2.8.4

(ii) Explain why solid magnesium carbonate cannot conduct electricity but solid magnesium can.

(3)

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(b) Calculate the percentage by mass of magnesium in magnesium carbonate, $MgCO_3$.

(relative atomic masses: C = 12.0, O = 16.0, Mg = 24.0)

(3)

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percentage by mass of magnesium = ...

(c) Magnesium carbonate reacts with dilute hydrochloric acid.
Water and carbon dioxide are two of the products of the reaction.

Complete the balanced equation for this reaction.

(1)

$$MgCO_3 + 2HCl \rightarrow \text{.....} + H_2O + CO_2$$

(Total for Question 2 = 8 marks)

3 When copper sulfate solution is electrolysed using copper electrodes, the mass of each electrode changes.

(a) Draw a labelled diagram to show the apparatus that can be used to electrolyse copper sulfate solution using copper electrodes.

(2)

(b) Before the electrolysis is carried out, the mass of each electrode is determined.

Explain what should be done to the copper electrodes before their masses are determined.

(2)

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(c) Figure 2 shows the results obtained from an electrolysis experiment when copper sulfate solution was electrolysed for 10 minutes.

	electrodes	
	anode	**cathode**
mass of electrode before electrolysis in g	6.43	6.17
mass of electrode after electrolysis in g	5.62	6.95
change in mass in g	− 0.81	+ 0.78

Figure 2

(i) Explain, in terms of ions, the changes in mass of the two electrodes shown in the results in Figure 2.

(3)

(ii) The electrolysis was repeated using another pair of copper electrodes of the same masses.

Explain a change that could be made to the electrolysis experiment to cause the mass of the cathode to increase by 2.34 g in 10 minutes.

(2)

(Total for Question 3 = 9 marks)

4 The method used to extract a metal from its ore depends on the position of the metal in the reactivity series.

(a) Aluminium is extracted from its ore by electrolysis.

Explain why this method is used to extract aluminium from its ore.

(2)

(b) (i) One step in the extraction of titanium metal involves the displacement reaction between titanium chloride, $TiCl_4$, and magnesium.

$$TiCl_4 + 2Mg \rightarrow Ti + 2MgCl_2$$

This equation can be simplified as

$$Ti^{4+} + 2Mg \rightarrow Ti + 2Mg^{2+}$$

Explain why this displacement reaction can be described as a redox reaction.

(3)

(ii) The formula of the sulfate ion is SO_4^{2-}.

Which of the following is the formula of titanium sulfate containing the Ti^{4+} ion?

(1)

☒ **A** $TiSO_4$

☒ **B** Ti_2SO_4

☒ **C** $Ti(SO_4)_2$

☒ **D** $Ti_2S_2O_8$

(c) Phytoextraction is an alternative biological method that can be used to extract metals from very low-grade ores.

Give **one** disadvantage of phytoextraction as a method of extraction of metals.

(1)

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(d) Copper is low down in the reactivity series and can be obtained from copper oxide.

Devise a simple method to obtain a sample of copper from copper oxide in the laboratory.

(2)

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(Total for Question 4 = 9 marks)

5 (a) Bromine is a liquid at room temperature and vaporises readily.
Bromine has a simple molecular structure.

Which row of the table shows the most likely melting and boiling points of bromine?

(1)

	melting point in °C	boiling point in °C
☒ **A**	–70	–6.3
☒ **B**	–17	6.3
☒ **C**	–7	63
☒ **D**	17	630

(b) Part of the structure of graphene is shown in Figure 3.

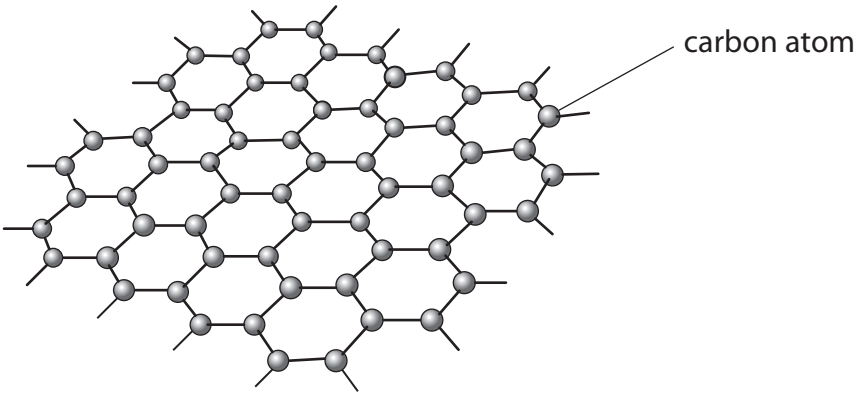

Figure 3

Explain why graphene will be a good conductor of an electric current.

(3)

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(c) Part of the structure of potassium chloride is shown in Figure 4.

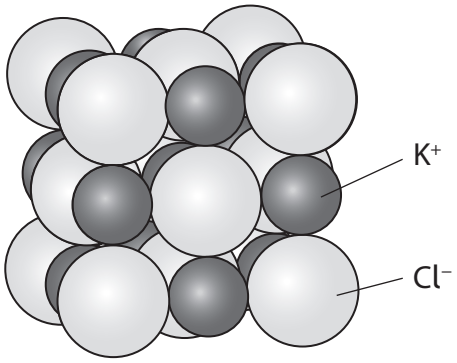

Figure 4

Potassium chloride has a melting point of 770 °C.

Explain why potassium chloride has a high melting point.

(2)

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*(d) A molecule of methane can be represented in several different ways as shown in Figure 5.
These representations have been labelled **A**–**E** to assist you in your answer.

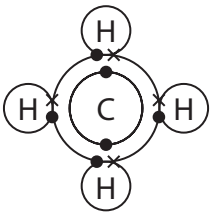
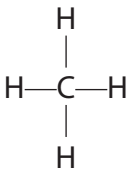
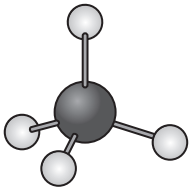
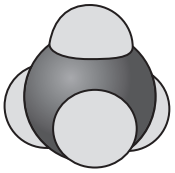
A	B	C	D	E
CH_4				

Figure 5

Describe what information can be obtained from each representation including the limitations of these representations of methane.

(6)

(Total for Question 5 = 12 marks)

6 (a) A student carried out an investigation to determine the order of reactivity of four metals, **W**, **X**, **Y** and **Z**.
A piece of metal **W** was added to a test tube containing excess dilute hydrochloric acid.
This was repeated with the other three metals, **X**, **Y** and **Z**.
In each case, the size of each piece of metal was the same.
The student recorded observations on each reaction for three minutes.

The observations obtained are shown in Figure 6.

metal	observations with dilute hydrochloric acid
W	Bubbles formed quickly with some metal remaining after three minutes.
X	A few bubbles were seen to form. The metal looked unchanged after three minutes.
Y	Bubbles formed quickly. After three minutes all the metal had reacted.
Z	Bubbles formed very quickly with no metal remaining after three minutes.

Figure 6

(i) Use the information in Figure 6 to place the metals in order of reactivity from the least reactive to the most reactive.

(2)

least reactive ⟶ most reactive

(ii) The experiment was repeated using an excess of dilute sulfuric acid in place of the dilute hydrochloric acid.

metal + sulfuric acid → metal sulfate + hydrogen

When metal **Y** reacts with dilute sulfuric acid, bubbles form quickly at first and then the reaction stops.
Most of the solid metal remains.

Explain why the reaction between metal **Y** and excess dilute sulfuric acid stopped even though there was solid metal **Y** left.

(2)

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(iii) The reactions between metals and dilute ethanoic acid are slower than reactions between metals and dilute hydrochloric acid.
This is because ethanoic acid is a weak acid.

Explain the meaning of the term **weak acid**.

(2)

(b) The formula of aluminium sulfate is $Al_2(SO_4)_3$.

Calculate the total number of atoms that combine to form 5.13 g of aluminium sulfate.

(relative atomic masses: O = 16.0, Al = 27.0, S = 32.0
Avogadro number = 6.02×10^{23})

(4)

number of atoms = ...

(c) Iron is more reactive than lead.
Iron reacts with lead nitrate solution to form solid lead.
Two possible balanced equations for the reaction are

Equation **1** $Fe + Pb(NO_3)_2 \rightarrow Fe(NO_3)_2 + Pb$

Equation **2** $2Fe + 3Pb(NO_3)_2 \rightarrow 2Fe(NO_3)_3 + 3Pb$

In one experiment, it was found that 4.48 g of iron reacted with excess lead nitrate solution to form 24.84 g of lead.

Carry out a calculation, using the information above, to show which equation represents the reaction taking place.

(relative atomic masses: Fe = 56.0, Pb = 207)

(3)

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(Total for Question 6 = 13 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.