

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)

Monday 22 May 2023

Morning (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 the question 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 ►

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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 In an experiment, powdered calcium hydroxide was added to dilute hydrochloric acid and the pH was measured.

The method used was

step 1 measure 200 cm^3 dilute hydrochloric acid into a beaker

step 2 add 0.1 g of powdered calcium hydroxide to the beaker

step 3 find the pH of the mixture

step 4 repeat steps 2 and 3 until the pH stops changing.

- (a) State what should be done after **step 2** to make sure that any reaction is complete.

(1)

- (b) Complete the word equation for the reaction.

(2)

calcium hydroxide + hydrochloric acid →

- (c) Which row of the table shows the state symbols for powdered calcium hydroxide and dilute hydrochloric acid in the balanced chemical equation?

(1)

	calcium hydroxide	hydrochloric acid
☐ A	aq	l
☐ B	l	aq
☐ C	s	aq
☐ D	s	l



(d) The results of the experiment are shown in Figure 1.

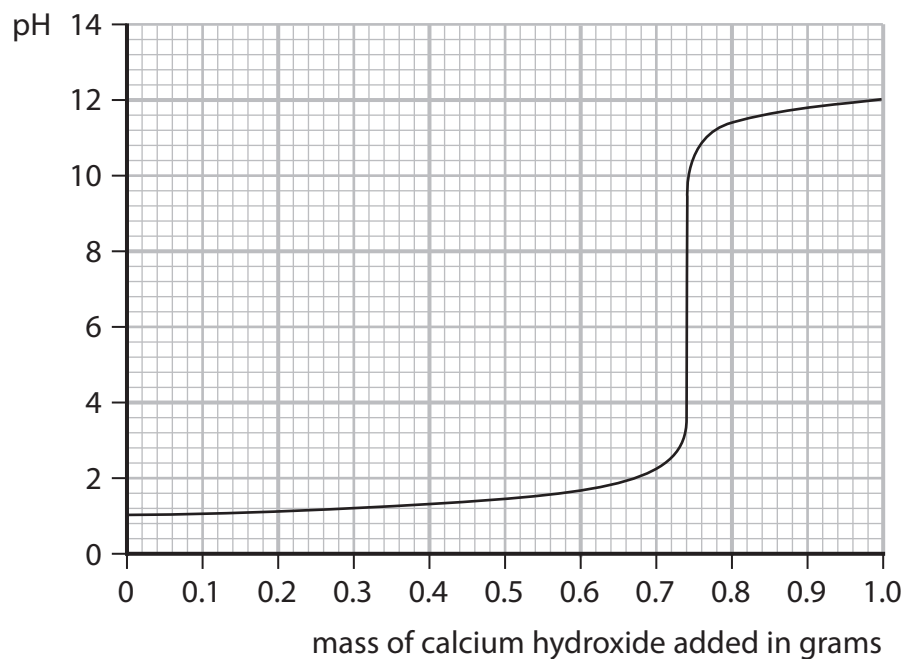


Figure 1

(i) Using Figure 1, give the pH of the acid at the start of the experiment.

(1)

pH = ...

(ii) Using Figure 1, give the mass of calcium hydroxide required to make a neutral mixture.

(1)

mass of calcium hydroxide = ... g

(iii) Explain why the pH starts at a low value and ends at a higher value.

(3)

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(Total for Question 1 = 9 marks)



P 7 2 5 5 7 A 0 3 2 0

2 Figure 2 shows part of the reactivity series of metals.

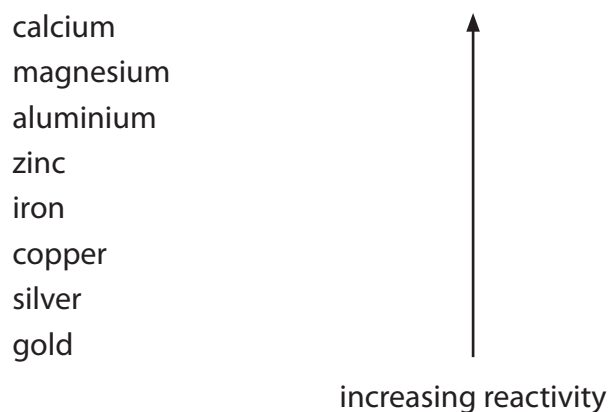


Figure 2

(a) Which metal reacts when added to cold water?

(1)

- ☐ **A** calcium
- ☐ **B** copper
- ☐ **C** gold
- ☐ **D** silver

(b) A student investigates the reactivity of four different metals.

The student adds an equal-sized piece of each metal to separate test tubes containing dilute hydrochloric acid.

The student's observations for zinc and copper are recorded in Figure 3.

metal	observations
magnesium	
zinc	bubbles produced at a steady rate test tube feels slightly warm
iron	
copper	no reaction

Figure 3



- (i) Use the information in Figure 2 and in Figure 3 to predict the observations for the reactions of magnesium and of iron with dilute hydrochloric acid.

(2)

magnesium

iron

- (ii) When metals react with acids, hydrogen gas is produced.

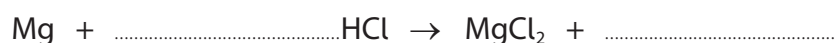
Describe the test to show that the gas is hydrogen.

(2)

- (iii) When magnesium reacts with hydrochloric acid, magnesium chloride and hydrogen are formed.

Complete the balanced equation for the reaction.

(2)



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- (c) An excess of magnesium is added to some dilute hydrochloric acid of pH 2.
The mass of hydrogen gas produced is measured.

The experiment is repeated with excess magnesium but with the same volume of dilute hydrochloric acid of pH 1.

- (i) State how many times greater the concentration of hydrogen ions is in the acid of pH 1 than in the acid of pH 2.

(1)

- (ii) With the acid of pH 2, the mass of hydrogen gas produced when the reaction is complete is 0.005 g.

Predict the mass of hydrogen gas produced in the reaction with acid of pH 1.

(1)

mass = ... g

(Total for Question 2 = 9 marks)



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3 (a) Ammonia is manufactured in the Haber process by the reversible reaction between nitrogen and hydrogen.

- (i) Write the balanced equation for the reversible reaction between nitrogen and hydrogen to make ammonia, NH_3 .

(3)

- (ii) Which row shows the typical conditions of temperature and pressure used in the Haber process?

(1)

	temperature in $^{\circ}\text{C}$	pressure in atmospheres
☐ A	250	100
☐ B	250	200
☐ C	450	500
☐ D	450	200

- (iii) In the Haber process, iron is added to the vessel where the nitrogen and hydrogen react.

State the purpose of the iron.

(1)

- (iv) The reaction between nitrogen and hydrogen to make ammonia can reach dynamic equilibrium.

The reaction gives out heat.

Explain how the position of equilibrium changes if the temperature is decreased.

(2)



(b) Compound **A** is a dark brown gas.

Compound **B** is a colourless gas.

Two molecules of **A** combine to form one molecule of **B** in a reversible reaction.

You are given

- a sealed glass tube containing an equilibrium mixture of **A** and **B**
- a beaker
- a kettle
- some ice

At room temperature, the equilibrium mixture is a pale brown colour.

Devise an experiment to show how the position of equilibrium of this reaction is affected by temperature.

The sealed tube must **not** be opened.

(3)

(Total for Question 3 = 10 marks)

- 4 A student investigates the mass of copper produced when copper chloride solution in a beaker is electrolysed using inert electrodes.

(a) Where is copper formed during the electrolysis?

(1)

- ☐ **A** at the anode
- ☐ **B** at the bottom of the beaker
- ☐ **C** at the cathode
- ☐ **D** on the surface of the electrolyte

- (b) The student investigated the change in the mass of copper formed when the current was altered.

The results are shown in Figure 4.

current in A	mass of copper formed in g
0.0	0.000
0.2	0.040
0.4	0.080
0.6	0.118
0.8	0.158
1.0	0.196

Figure 4

- (i) State and explain the trend shown in these results.

(3)

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(relative atomic mass Cu = 63.5; Avogadro constant = 6.02×10^{23})

(3)

number of atoms = ...

(Total for Question 4 = 9 marks)



- 5 Crystals of copper sulfate are prepared by reacting copper oxide, a base, with dilute sulfuric acid.

(a) Name the other product of this reaction.

(1)

- (b) During the experiment, a spatula measure of copper oxide, a black powder, is added to warm, dilute sulfuric acid in a beaker.

When the mixture is stirred, the black powder disappears and the mixture turns pale blue.

The student then adds more copper oxide until the maximum amount of copper sulfate is formed without wasting copper oxide.

Explain how the student knows when to stop adding copper oxide.

(3)

- (c) The reaction produces an aqueous solution of copper sulfate.

What is the best way to obtain crystals of copper sulfate from an aqueous solution?

(1)

- ☐ **A** pour the solution through filter paper in a funnel
- ☐ **B** heat the solution with a Bunsen burner until dry
- ☐ **C** heat the solution using a water bath
- ☐ **D** leave the solution in a cold, damp place



- (d) When some water is removed from the aqueous solution of copper sulfate, crystals of copper sulfate are made.

Describe how the arrangement and movement of the particles change as crystals are formed from a solution.

(3)

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- (e) In this reaction, copper oxide, CuO , forms copper sulfate, CuSO_4 .

Explain, in terms of electrons, whether the copper in copper oxide has been oxidised, has been reduced, or has not been oxidised or reduced.

(2)

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- (f) In another experiment, a copper sulfate solution with a concentration of 39.875 g dm^{-3} is used.

Calculate the mass of copper sulfate dissolved in 0.300 dm^3 of this solution.

(1)

.....

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mass = ... g

(Total for Question 5 = 11 marks)

.....

- 6 (a) Figure 5 shows the structure of a molecule of compound **S**.

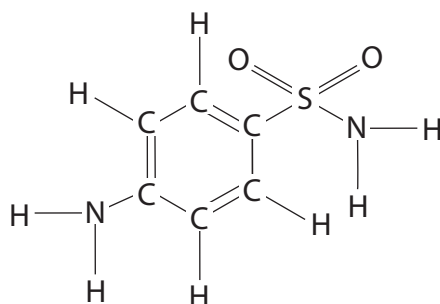


Figure 5

- (i) Use Figure 5 to deduce the empirical formula of compound **S**.

(1)

- (ii) The melting points of three samples of **S** are shown in Figure 6.

sample	melting point in °C
A	160–164
B	166
C	163–165

Figure 6

State whether each of these samples, **A**, **B** and **C**, is pure or impure and justify your answers using the information in Figure 6.

(3)

(b) A scientist uses chromatography in an investigation of compound **S**.

In the conditions used, compound **S** has an R_f value of 0.22.

Calculate the distance the spot of compound **S** moves if the solvent front has moved by 2.4 cm.

(2)

distance = ... cm



- *(c) A solution of sodium chloride in water needs to be separated to obtain a sample of pure, dry sodium chloride and a sample of pure water.

Figure 7 shows the boiling points of sodium chloride and water.

substance	boiling point in °C
sodium chloride	1465
water	100

Figure 7

Explain this difference in boiling points in terms of the structure and bonding of sodium chloride and water and how this difference is used to choose a method to separate sodium chloride solution into pure, dry sodium chloride and pure water.

(6)



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(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS



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The periodic table of the elements

1	2	Key										3	4	5	6	7	0
		relative atomic mass atomic symbol name atomic (proton) number															
7	9											11	12	14	16	19	20
Li lithium 3	Be beryllium 4											B boron 5	C carbon 6	N nitrogen 7	O oxygen 8	F fluorine 9	Ne neon 10
23	24											27	28	31	32	35.5	40
Na sodium 11	Mg magnesium 12											Al aluminium 13	Si silicon 14	P phosphorus 15	S sulfur 16	Cl chlorine 17	Ar argon 18
39	40											70	73	75	79	80	84
K potassium 19	Ca calcium 20											Ga gallium 31	Ge germanium 32	As arsenic 33	Se selenium 34	Br bromine 35	Kr krypton 36
85	88											115	119	122	128	127	131
Rb rubidium 37	Sr strontium 38											In indium 49	Sn tin 50	Sb antimony 51	Te tellurium 52	I iodine 53	Xe xenon 54
133	137											204	207	209	[209]	[210]	[222]
Cs caesium 55	Ba barium 56											Tl thallium 81	Pb lead 82	Bi bismuth 83	Po polonium 84	At astatine 85	Rn radon 86

* 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.

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