

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

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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 cm³ 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
<input type="checkbox"/> A	aq	l
<input type="checkbox"/> B	l	aq
<input type="checkbox"/> C	s	aq
<input type="checkbox"/> D	s	l



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

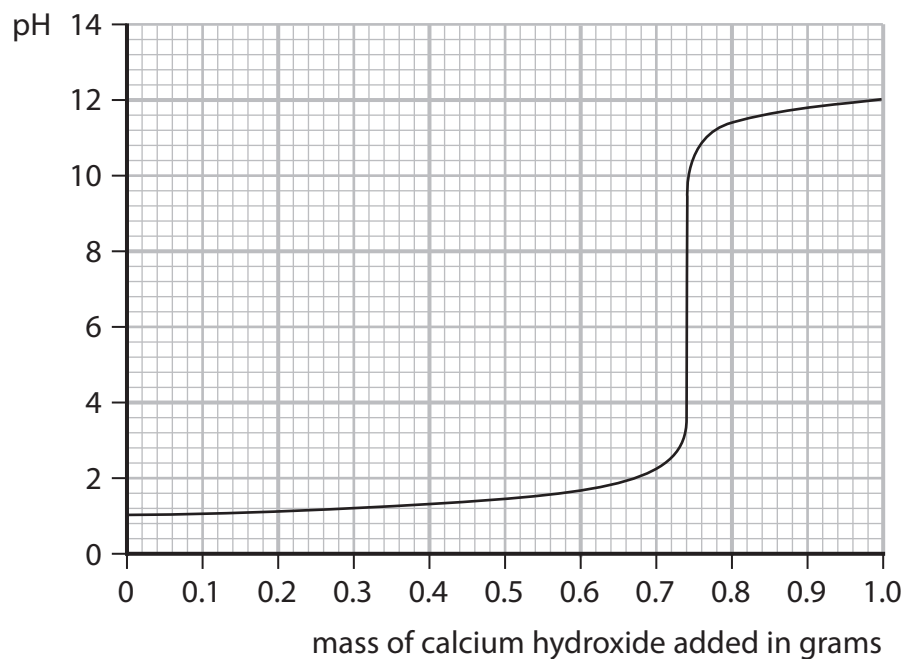


Figure 1

(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)



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

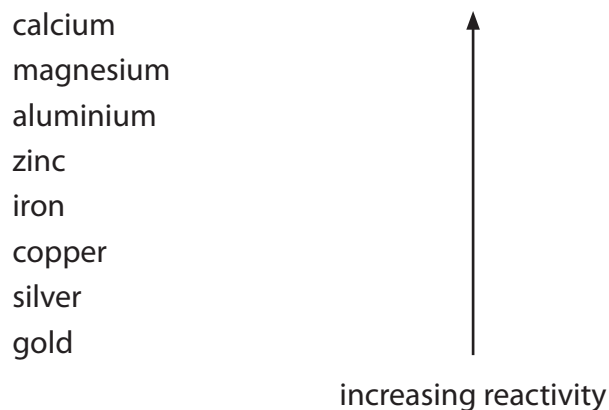


Figure 2

(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

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iron

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

Describe the test to show that the gas is hydrogen.

(2)

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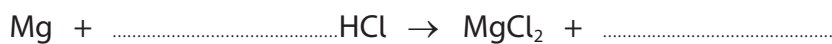
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(iii) When magnesium reacts with hydrochloric acid, magnesium chloride and hydrogen are formed.

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)

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.....

- (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)

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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
<input type="checkbox"/> A	250	100
<input type="checkbox"/> B	250	200
<input type="checkbox"/> C	450	500
<input type="checkbox"/> 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)



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(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)

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(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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(ii) Describe how, after the power supply has been switched off, the mass of copper formed can be measured.

(2)

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(c) In another experiment, 74 mg of copper is formed.

Calculate the number of copper atoms in 74 mg of copper.

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

(3)

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number of atoms =

(Total for Question 4 = 9 marks)

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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



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- (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, CuSO₄.

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 dm³ of this solution.

(1)

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mass = g

(Total for Question 5 = 11 marks)



P 7 2 5 5 7 A 0 1 3 2 0

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

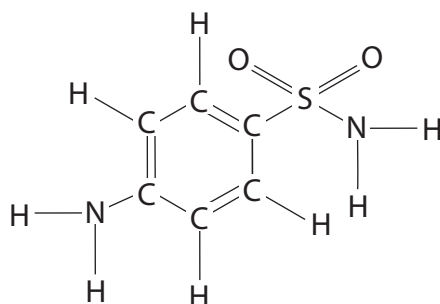


Figure 5

- (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)



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(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)

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distance = cm



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Handwriting practice area with 20 horizontal dotted lines.

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS



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P 7 2 5 5 7 A 0 1 9 2 0

The periodic table of the elements

1	2	3	4	5	6	7	0																										
7 Li lithium 3	9 Be beryllium 4	11 Na sodium 11	12 C carbon 6	13 Al aluminium 13	14 N nitrogen 7	15 P phosphorus 15	16 O oxygen 8	17 F fluorine 9	18 Ne neon 10																								
19 K potassium 19	20 Ca calcium 20	23 Sc scandium 21	24 Ti titanium 22	25 V vanadium 23	26 Cr chromium 24	27 Mn manganese 25	28 Fe iron 26	29 Co cobalt 27	30 Ni nickel 28	31 Cu copper 29	32 Zn zinc 30	33 Ga gallium 31	34 Ge germanium 32	35 As arsenic 33	36 Se selenium 34	37 Rb rubidium 37	38 Sr strontium 38	39 Y yttrium 39	40 Zr zirconium 40	41 Nb niobium 41	42 Mo molybdenum 42	43 Tc technetium 43	44 Ru ruthenium 44	45 Rh rhodium 45	46 Pd palladium 46	47 Ag silver 47	48 Cd cadmium 48	49 In indium 49	50 Sn tin 50	51 Sb antimony 51	52 Te tellurium 52	53 I iodine 53	54 Xe xenon 54
55 Cs caesium 55	56 Ba barium 56	57 La* lanthanum 57	72 Hf hafnium 72	73 Ta tantalum 73	74 W tungsten 74	75 Re rhenium 75	76 Os osmium 76	77 Ir iridium 77	78 Pt platinum 78	79 Au gold 79	80 Hg mercury 80	81 Tl thallium 81	82 Pb lead 82	83 Bi bismuth 83	84 Po polonium 84	85 At astatine 85	86 Rn radon 86																

1	H
hydrogen	1

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.

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