

Please write clearly in block capitals.

H

Centre number

Candidate
number

Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE

COMBINED SCIENCE: TRILOGY

Higher Tier Chemistry Paper 1

Practice Paper Series – Set 1

Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:

- a ruler
- a scientific calculator
- the periodic table (printed at the back of this booklet).

Instructions

- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 70.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- When answering question 09.4 you need to make sure that your answer:
 - is clear, logical, sensibly structured
 - fully developed
 - shows how the points that you make are related or follow on from each other where appropriate.

For Examiner's Use

Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

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sciencegcse.co.uk | Practice Paper Series – Set 1 | SGC/S1/C/1H

01 Calcium carbonate, CaCO_3 , breaks down when it is heated.



01.1 Calculate the relative formula mass (M_r) of calcium carbonate, CaCO_3 . [2 marks]

Relative atomic masses (A_r): C = 12 O = 16 Ca = 40

Relative formula mass = ...

01.2 In a chemical reaction the total mass of the products is equal to the total mass of the reactants. [1 mark]

Explain why.

.....
.....

A student heated 10.0 g of calcium carbonate in an open crucible.

After heating, the mass of the solid in the crucible was 5.6 g.

01.3 Explain why the mass of the solid decreased. [1 mark]

.....
.....

01.4 Calculate the percentage decrease in the mass of the solid. [2 marks]

Percentage decrease = ... %

01.5 Calculate the percentage by mass of calcium in calcium carbonate. [2 marks]

Use your answer to **01.1**.

Percentage of calcium = ... %

- 0 1 . 6** The student made 200 cm³ of a solution containing 8.0 g of salt. [2 marks]
Calculate the concentration of the solution in g/dm³.

Concentration = ... g/dm³

- 0 2** A student investigated the temperature change when different metals react with dilute hydrochloric acid.

The student added 1 g of each metal to 25 cm³ of acid and measured the temperature rise. Each test was repeated three times.

Table 1 shows the results.

Table 1

Metal	Temperature rise in °C			Mean temperature rise in °C
	Test 1	Test 2	Test 3	
Magnesium	32	30	34	32
Zinc	12	14	13	
Iron	4	5	6	5
Copper	0	0	0	0

- 0 2 . 1** The temperature of the acid increased when magnesium was added. [1 mark]

What type of reaction is this?

Tick (✓) **one** box.

- Endothermic ☐
Exothermic ☐
Reversible ☐
Thermal decomposition ☐

- 0 2 . 2** Calculate the mean temperature rise for zinc. [1 mark]

Write your answer in **Table 1**.

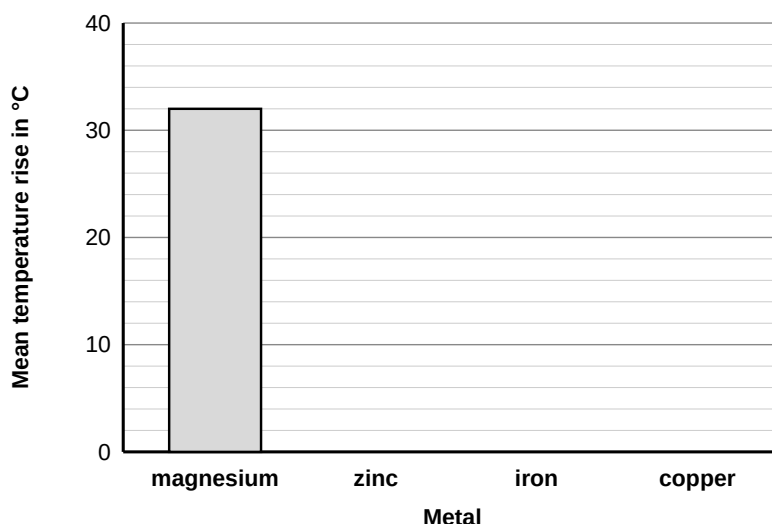
Question 2 continues on the next page

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- 0 2 . 3** Complete the bar chart in **Figure 1** to show the mean temperature rise for zinc and for iron. [2 marks]

The bar for magnesium has been drawn for you. Copper has no bar because its temperature rise was 0 °C.

Figure 1



- 0 2 . 4** Hand warmers use a reaction between a metal and another substance to release energy. [2 marks]

Which of the four metals would be best to use in a hand warmer?

Give a reason for your answer.

Metal

.....

- 0 2 . 5** Suggest why there was no temperature rise for copper. [1 mark]

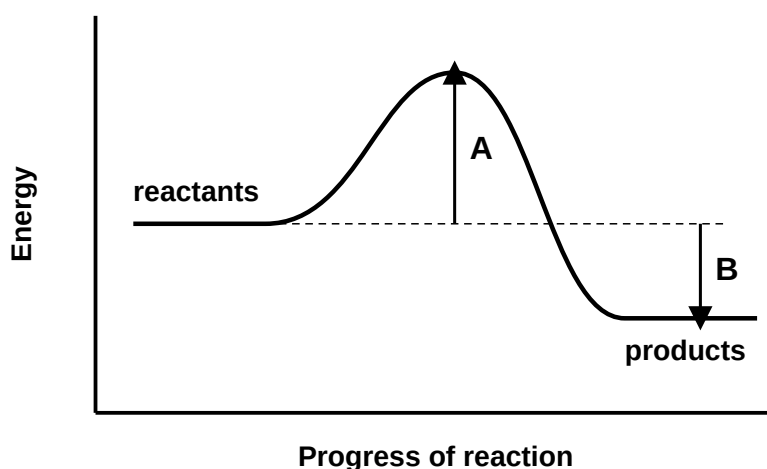
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- 0 2 . 6** How many times greater is the mean temperature rise for magnesium than the mean temperature rise for iron? [1 mark]

Number of times greater = ...

Figure 2 shows the reaction profile for the reaction of magnesium with hydrochloric acid.

Figure 2



0 2 . 7 Which letter, **A** or **B**, shows the activation energy? [1 mark]

Letter

0 3 Chlorine, bromine and iodine are in Group 7 of the periodic table.

0 3 . 1 Which of these halogens is the **most** reactive? [1 mark]

Tick (✓) **one** box.

Bromine	☐
Chlorine	☐
Iodine	☐

0 3 . 2 Explain why the reactivity of the halogens decreases down Group 7. [2 marks]

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Chlorine reacts with potassium bromide solution.

0 3 . 3 Write a balanced symbol equation for this reaction. [2 marks]

.....

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0 3 . 4 Write the ionic equation for this reaction. [2 marks]

0 3 . 5 In this reaction the bromide ions are oxidised. [1 mark]

Explain why, in terms of electrons.

0 4 Copper is a metal.

0 4 . 1 Describe the bonding in copper. [2 marks]

0 4 . 2 Explain why copper conducts electricity. [1 mark]

0 4 . 3 Explain why pure copper is soft. [1 mark]

Question 4 continues on the next page

Brass is an alloy of copper and zinc.

Table 2 shows the hardness of copper and of two types of brass.

Table 2

Metal	Percentage of zinc	Hardness in arbitrary units
Copper	0	40
Brass A	15	80
Brass B	30	110

0 4 . 4 Explain why brass is harder than pure copper. [2 marks]

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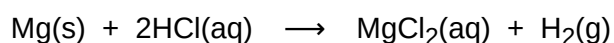
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0 4 . 5 Suggest which metal in **Table 2** would be best for making a door handle [1 mark]
that must not scratch easily.
Give a reason for your answer.

.....

.....

0 5 A student reacted magnesium with dilute hydrochloric acid.



Relative atomic masses (A_r): H = 1 Mg = 24 Cl = 35.5

0 5 . 1 Calculate the relative formula mass (M_r) of magnesium chloride, MgCl_2 . [1 mark]

Relative formula mass = ...

0 5 . 2 The student used 2.4 g of magnesium. [1 mark]
Calculate the number of moles of magnesium in 2.4 g.

Number of moles = ... mol

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0 5 . 3 Calculate the maximum mass of magnesium chloride that could be made from 2.4 g of magnesium. [2 marks]

Mass of magnesium chloride = ... g

0 5 . 4 The student used 0.15 mol of hydrochloric acid. [2 marks]
Show that hydrochloric acid is the limiting reactant.

.....

.....

.....

0 5 . 5 Calculate the mass of magnesium chloride made from 0.15 mol of hydrochloric acid. [2 marks]
Give your answer to 2 significant figures.

Mass of magnesium chloride = ... g

0 5 . 6 The student obtained less magnesium chloride than the mass calculated in **05.5**. [1 mark]
Suggest **one** reason why.

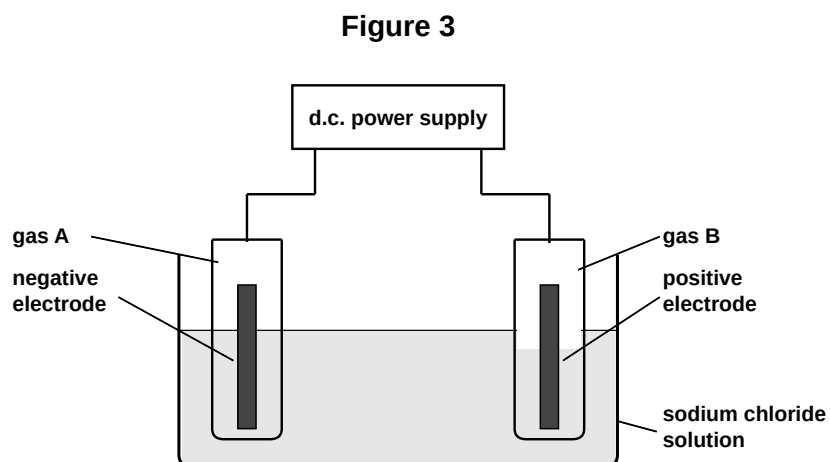
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Turn over for the next question

0 6 A student electrolysed sodium chloride solution using inert electrodes.

Figure 3 shows the apparatus.



0 6 . 1 Which gas is produced at the negative electrode (gas **A**)? [1 mark]

Tick (✓) **one** box.

Chlorine

☐

Hydrogen

☐

Oxygen

☐

Sodium vapour

☐

0 6 . 2 Explain why this gas, and **not** sodium, is produced at the negative electrode. [2 marks]

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0 6 . 3 Chlorine is produced at the positive electrode. [2 marks]
Write the half equation for the reaction at the positive electrode.

.....

.....

0 6 . 4 The student then electrolysed sodium sulfate solution using inert electrodes. [2 marks]

Name the product at each electrode.

Negative electrode

Positive electrode

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07 Hydrochloric acid is a strong acid. Ethanoic acid is a weak acid.

Table 3 shows the pH of solutions of the two acids.

Table 3

Acid	Concentration in mol/dm ³	pH
Hydrochloric acid	0.10	1.0
Ethanoic acid	0.10	2.9

07.1 Explain why the two solutions have different pH values, even though [3 marks]
they have the same concentration.

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07.2 The hydrochloric acid is diluted so that its concentration is 0.010 [1 mark]
mol/dm³.

Give the pH of the diluted hydrochloric acid.

pH = ...

Turn over for the next question

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08 Hydrogen burns in oxygen to form water.

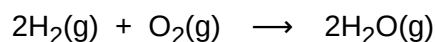


Table 4 shows some bond energies.

Table 4

Bond	Bond energy in kJ/mol
H-H	436
O=O	498
O-H	464

08.1 Calculate the overall energy change for this reaction.

[3 marks]

Use **Table 4**.

Overall energy change = ... kJ/mol

08.2 Explain how your answer to **08.1** shows that the reaction is exothermic. [1 mark]

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08.3 A mixture of hydrogen and oxygen does not react until a spark is added. [2 marks]

Explain why.

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09 Boron has two isotopes, ^{10}B and ^{11}B .

09.1 What is meant by **isotopes**? [1 mark]

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A sample of boron contains 20% ^{10}B atoms and 80% ^{11}B atoms.

09.2 Calculate the relative atomic mass of boron in this sample. [2 marks]

Relative atomic mass = ...

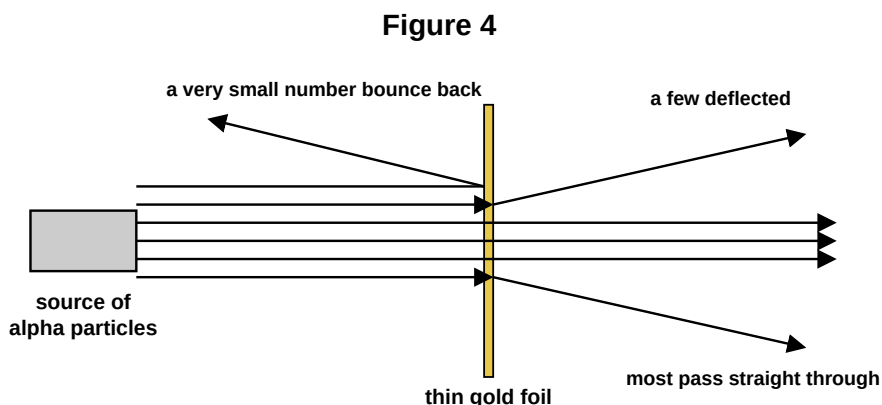
09.3 Explain why atoms of the two isotopes of boron have the same chemical properties. [1 mark]

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Before 1910, scientists used the plum pudding model of the atom.

In 1909, scientists fired alpha particles at a very thin sheet of gold foil.

Figure 4 shows what happened.



09.4 Describe the plum pudding model of the atom. [6 marks]

Explain how the results shown in **Figure 4** led to a new model of the atom, and describe how the model was developed further by later scientists.

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END OF QUESTIONS

Additional page, if required.

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Write the question numbers in the left-hand margin.

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The Periodic Table of Elements

1	2											3	4	5	6	7	0
relative atomic mass atomic symbol name atomic (proton) number Key												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
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	[285] Cn copernicium 112	[286] Nh nihonium 113	[289] Fl flerovium 114	[289] Mc moscovium 115	[293] Lv livermorium 116	[294] Ts tennessine 117	[294] Og oganesson 118

* The lanthanides (atomic numbers 58–71) and the actinides (atomic numbers 90–103) have been omitted. Relative atomic masses for Cu and Cl have not been rounded to the nearest whole number.