

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE COMBINED SCIENCE: TRILOGY

H

Higher Tier
Chemistry Paper 1H

Monday 22 May 2023

Morning

Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:

- a ruler
- a scientific calculator
- the periodic table (enclosed).

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.
- 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 maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	



J U N 2 3 8 4 6 4 C 1 H O 1

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ANSWER IN THE SPACES PROVIDED**



0	1
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This question is about carbon dioxide.

Carbon dioxide is soluble in water and forms an acidic solution.

0	1	.	1
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Which ion makes the solution acidic?

[1 mark]

0	1	.	2
---	---	---	---

Name an indicator that could be used to test if the solution is acidic.

Give the result of the test.

[2 marks]

Indicator

Result

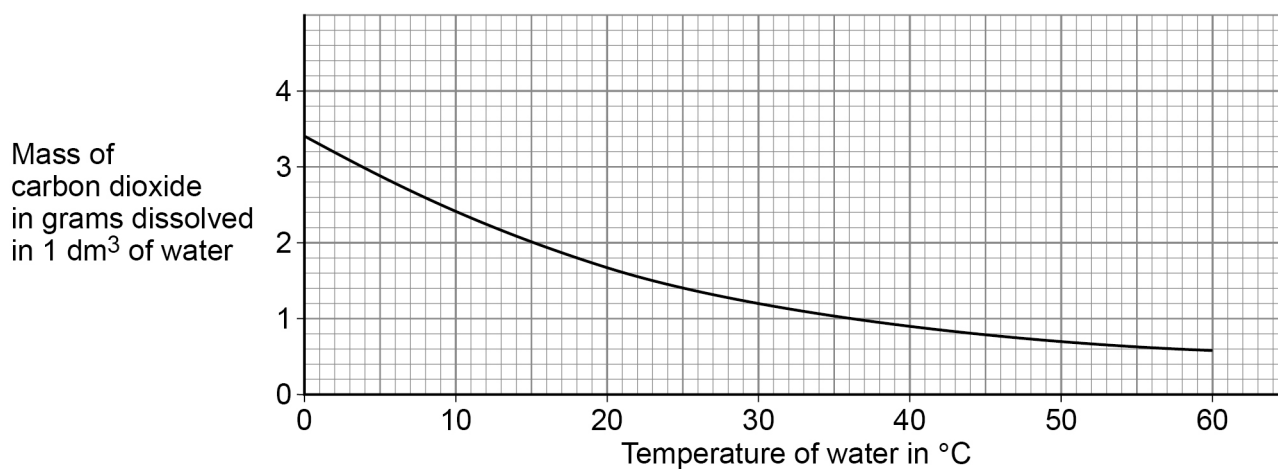
Question 1 continues on the next page

Turn over ►



Figure 1 shows the mass of carbon dioxide that will dissolve in 1 dm³ of water at different temperatures.

Figure 1



0 1 . 3

How does the solubility of carbon dioxide change as the temperature of the water increases?

[1 mark]

Tick (✓) **one** box.

The solubility decreases

☐

The solubility does not change

☐

The solubility increases

☐


0 1 . 4

Carbon dioxide dissolves in water to form an acidic solution.

How does the pH of the solution change as the temperature of the water increases?

Use **Figure 1**.

[1 mark]

Tick (✓) **one** box.

pH of the solution decreases

☐

pH of the solution does not change

☐

pH of the solution increases

☐

Calcium carbonate reacts with hydrochloric acid to produce carbon dioxide.

The equation for the reaction is:



0 1 . 5

What is the state symbol (x) in the equation?

[1 mark]

Tick (✓) **one** box.

(aq) ☐

(g) ☐

(l) ☐

(s) ☐

Question 1 continues on the next page

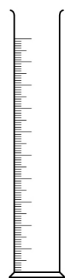
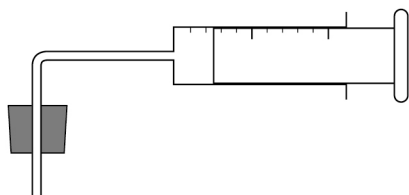
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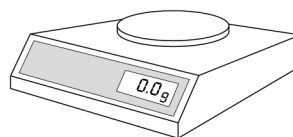
0 1 . 6

Figure 2 shows equipment a student used for an investigation.

Figure 2



Gas syringe



Describe a method the student could use.

[illegible]

12

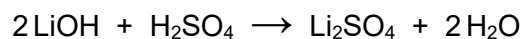
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0 2

Lithium hydroxide reacts with sulfuric acid to produce lithium sulfate.

The equation for the reaction is:

**0 2 . 1**

What type of reaction is this?

[1 mark]

0 2 . 2

Calculate the relative formula mass (M_r) of sulfuric acid (H_2SO_4).

Relative atomic masses (A_r): H = 1 O = 16 S = 32

[2 marks]

Relative formula mass (M_r) = _____



0 2 . 3 Calculate the percentage by mass of oxygen in lithium sulfate (Li_2SO_4).

Relative atomic mass (A_r): O = 16

Relative formula mass (M_r): $\text{Li}_2\text{SO}_4 = 110$

Give your answer to 2 significant figures.

[4 marks]

Percentage by mass of oxygen (2 significant figures) = _____ %

0 2 . 4 A solution of lithium sulfate contains 0.30 g of lithium sulfate in 25 cm^3 .

Calculate the concentration of lithium sulfate in g/dm^3 .

[3 marks]

Concentration = _____ g/dm^3

10

Turn over ►



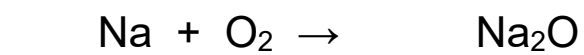
0 3

Sodium is in Group 1 of the periodic table.

Sodium reacts with oxygen to produce sodium oxide.

0 3 . 1

Balance the equation for the reaction.

[1 mark]**0 3 . 2**Explain what happens to sodium atoms and to oxygen atoms when sodium reacts with oxygen to produce sodium oxide (Na_2O).

Answer in terms of electrons.

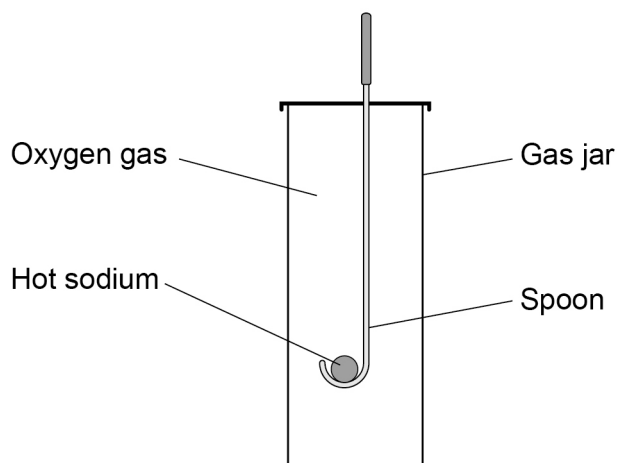
[4 marks]



0 3 . 3 Sodium burns in a gas jar of oxygen.

Figure 3 shows the apparatus.

Figure 3



Give **two** observations seen during the reaction.

[2 marks]

- 1 _____
- 2 _____

0 3 . 4 Describe **two** differences in the observations if potassium is used instead of sodium.

[2 marks]

- 1 _____
- 2 _____

Turn over ►



0 4

Group 7 elements are known as the halogens.

All atoms of Group 7 elements contain protons, neutrons and electrons.

0 4 . 1

What is the order of discovery of the proton, neutron and electron?

[1 mark]

Tick (✓) **one** box.

electron → neutron → proton

☐

electron → proton → neutron

☐

neutron → proton → electron

☐

proton → electron → neutron

☐

0 4 . 2

Table 1 shows the mass of a proton and of an electron.**Table 1**

Name of particle	Mass in kg
Proton	1.673×10^{-27}
Electron	9.109×10^{-31}

Calculate how many times heavier a proton is than an electron.

[2 marks]

Times heavier a proton is than an electron = _____



A bromine atom can be represented as $^{81}_{35}\text{Br}$.

0 4 . 3

What is the number of neutrons in this bromine atom?

[1 mark]

0 4 . 4

What is the number of electrons in a bromide **ion**?

[1 mark]

0 4 . 5

Chlorine has two isotopes.

Table 2 shows the percentage abundance of the two isotopes of chlorine.

Table 2

Isotope	Percentage (%) abundance
$^{35}_{17}\text{Cl}$	75.77
$^{37}_{17}\text{Cl}$	24.23

Calculate the relative atomic mass (A_r) of chlorine.

Give your answer to 2 decimal places.

[3 marks]

Relative atomic mass (2 decimal places) = _____

Turn over ►



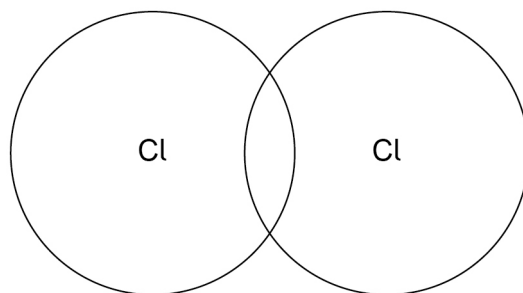
0 4 . 6

Figure 4 shows the outer shells in one molecule of chlorine (Cl_2).

Complete the dot and cross diagram to show the electrons in the outer shells.

[2 marks]

Figure 4



10



0 5

During electrolysis ions are discharged at the electrodes to produce elements.

A student investigates the electrolysis of sodium chloride.

0 5 . 1

Why does solid sodium chloride **not** conduct electricity?

[1 mark]

0 5 . 2

Sodium chloride solution conducts electricity.

Complete the sentence.

[1 mark]

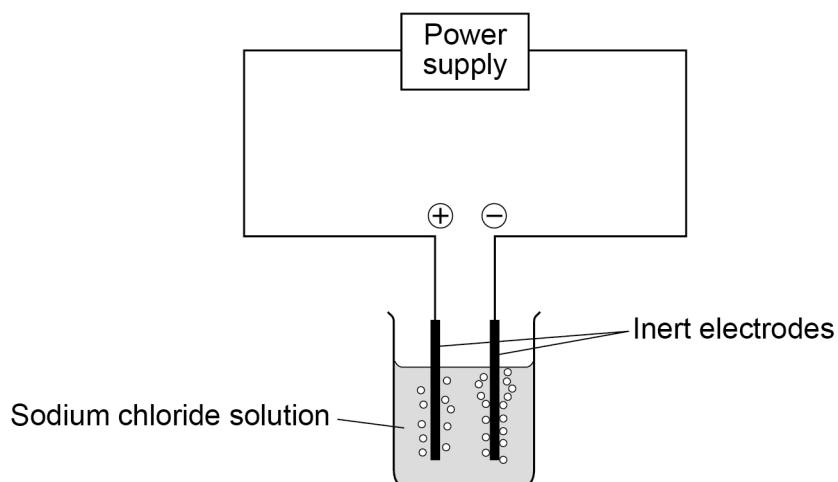
Sodium chloride **also** conducts electricity when _____.

Question 5 continues on the next page

Turn over ►

Figure 5 shows the apparatus for the electrolysis of sodium chloride solution.

Figure 5



0 5 . 3

Suggest an element that could be used to make the inert electrodes.

[1 mark]

0 5 . 4

Complete the half equation for the production of chlorine (Cl_2) at the positive electrode.

[2 marks]



0 5 . 5 Sodium chloride solution has a pH of 7

During the electrolysis of sodium chloride solution:

- hydrogen gas is produced at the negative electrode
- the pH of the solution increases.

Explain why.

[4 marks]

9

Turn over for the next question

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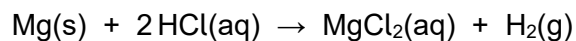


0 6

Acids react with some metals to produce soluble salts.

A student adds magnesium to hydrochloric acid until no more acid reacts and excess magnesium remains.

The equation for the reaction is:

**0 6 . 1**

Describe how solid magnesium chloride is obtained from the reaction mixture.

[2 marks]

0 6 . 2

The reaction between magnesium and hydrochloric acid is a redox reaction.

Explain what happens to the magnesium atoms in this reaction.

[2 marks]



The hydrochloric acid is in excess.

Relative atomic mass (A_r): Mg = 24

Relative formula mass (M_r): $\text{MgCl}_2 = 95$

[6 marks]

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Concentration = g/dm³

10

Turn over for the next question

Turn over ►



0 7

This question is about structure and properties.

0 7 . 1Which pair of substances **both** contain atoms in hexagonal rings?**[1 mark]**Tick (✓) **one** box.

Diamond and graphite

☐

Fullerenes and graphene

☐

Nanotubes and silica

☐**0 7 . 2**

Explain why the structure of copper allows the conduction of thermal energy.

[3 marks]



0	7	.	3
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Explain why copper oxide (CuO) has a high melting point.**[3 marks]**

0	7	.	4
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Explain why water (H_2O) has a low melting point.**[3 marks]**

10

END OF QUESTIONS

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