

Chem Measure; Con Mass + Quant Interp Eq Question Paper

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Chemistry
Exam Board	AQA
Topic	5.3 Quantitative Chemistry
Sub-Topic	Chem Measure; Con Mass + Quant Interp Eq
Difficulty Level	Gold Level
Booklet	Question Paper

Time Allowed: 57 minutes

Score: /55

Percentage: /100

Grade Boundaries:

Q1. Aqamed is a medicine for children.

- (a) The medicine is a formulation.

What is meant by a formulation?

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(1)

- (b) Children often do not like taking medicine.

Suggest a substance that could be added to Aqamed to increase the desire for children to take it.

Give a reason for your suggestion.

Substance

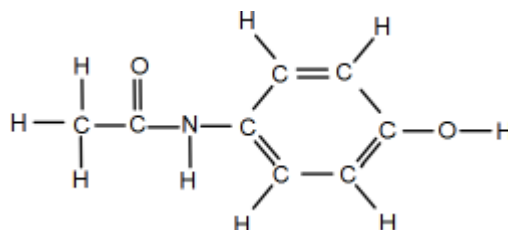
Reason

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(2)

- (c) The main ingredient in Aqamed is a painkiller called paracetamol.

The figure below represents a molecule of paracetamol.



Give the molecular formula of paracetamol.

Calculate its relative formula mass (M_r).

Relative atomic masses (A_r): H = 1; C = 12; N = 14; O = 16

Molecular formula

Relative formula mass

.....

$M_r =$

(2)

- (d) Aspirin is a medicine for use by adults.

An aspirin tablet contains 300 mg of acetylsalicylic acid.

Calculate the number of moles of acetylsalicylic acid in one aspirin tablet.

Give your answer in standard form to three significant figures.

Relative formula mass (M_r) of aspirin = 180

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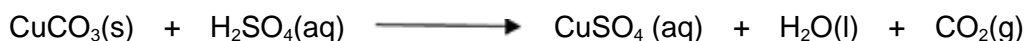
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Number of moles =

(4)

(Total 9 marks)

Q2. The salt copper sulfate can be made by reacting copper carbonate with dilute sulfuric acid.



- (a) Write a method that a student could use to prepare a pure, dry sample of copper

You do **not** need to write a risk assessment or include safety points.

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(6)

- (b) Calculate the **number of molecules** in 14 g of carbon dioxide.

Give your answer in standard form.

Relative atomic masses (A_r): C = 14; O = 16

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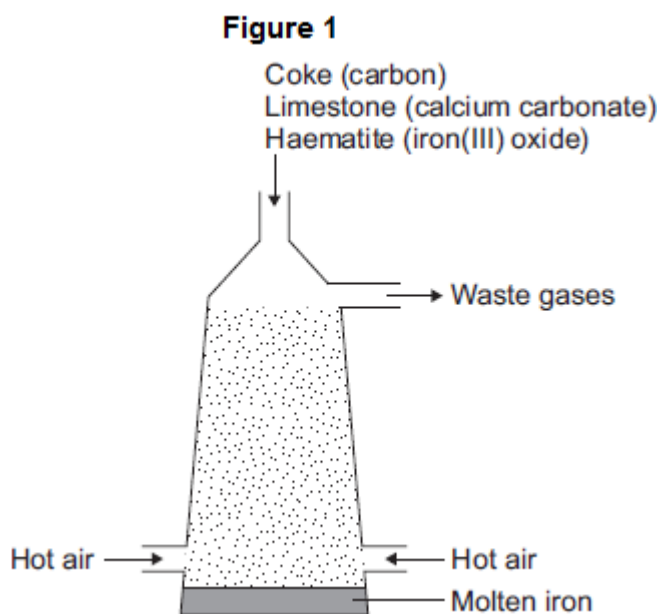
Answer = molecules

(4)

(Total 10 marks)

Q3. This question is about iron and aluminium.

- (a) Iron is extracted in a blast furnace. **Figure 1** is a diagram of a blast furnace.



- (i) Calcium carbonate decomposes at high temperatures.

Complete the word equation for the decomposition of calcium carbonate.

calcium carbonate \longrightarrow +
.....

(2)

- (ii) Carbon burns to produce carbon dioxide.

The carbon dioxide produced reacts with more carbon to produce carbon monoxide.

Balance the equation.



(1)

- (iii) Carbon monoxide reduces iron(III) oxide:



Calculate the maximum mass of iron that can be produced from 300 tonnes of iron(III) oxide.

Relative atomic masses (A_r): O = 16; Fe = 56

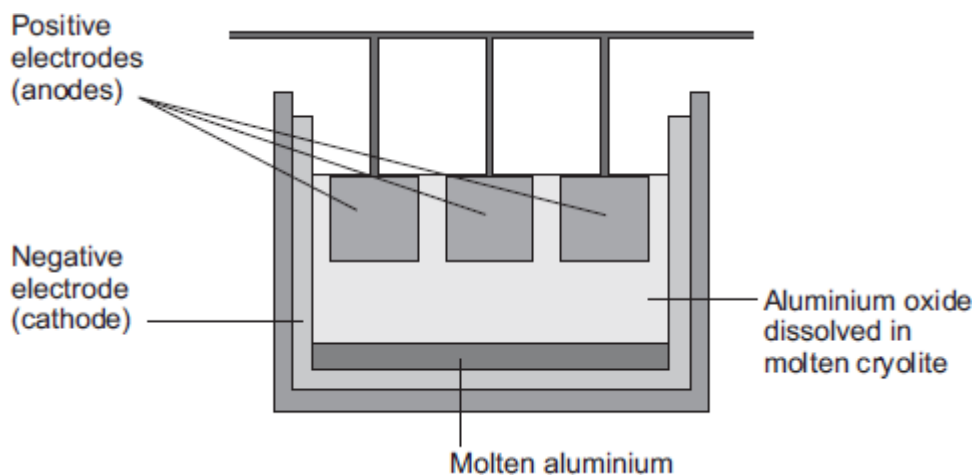
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Maximum mass = tonnes

(3)

- (b) Aluminium is extracted by electrolysis, as shown in **Figure 2**.

Figure 2



- (i) Why can aluminium **not** be extracted by heating aluminium oxide with carbon?

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(1)

- (ii) Explain why aluminium forms at the negative electrode during electrolysis.

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(3)

- (iii) Explain how carbon dioxide forms at the positive electrodes during electrolysis.

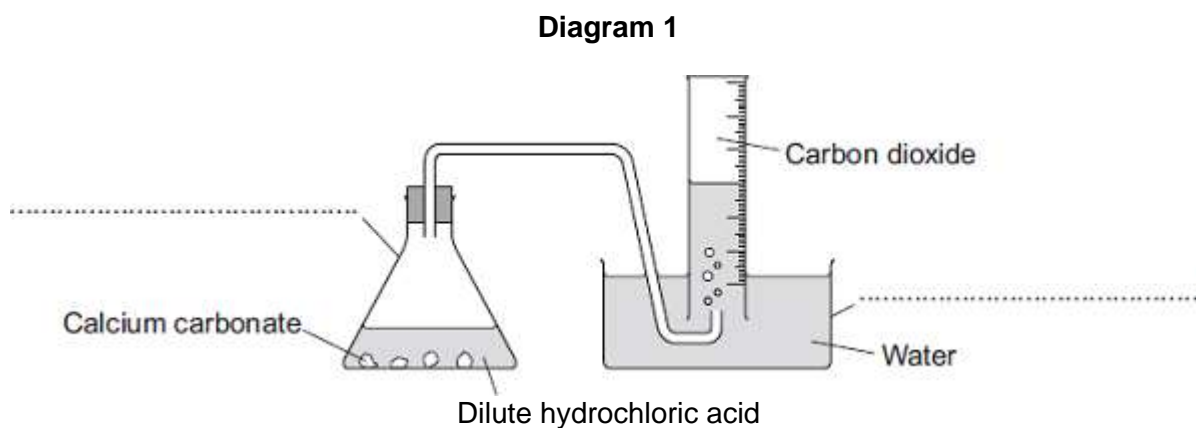
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(3)
(Total 13 marks)

Q4. Some students were investigating the rate at which carbon dioxide gas is produced when metal carbonates react with an acid.

One student reacted 1.00 g of calcium carbonate with 50 cm³, an excess, of dilute hydrochloric acid.

The apparatus used is shown in **Diagram 1**.



(a) Complete the **two** labels for the apparatus on the diagram.

(2)

(b) The student measured the volume of gas collected every 30 seconds.

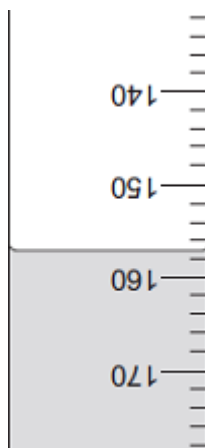
The table shows the student's results.

Time in seconds	Volume of carbon dioxide collected in cm ³
30	104
60	

90	198
120	221
150	232
180	238
210	240
240	240

- (i) **Diagram 2** shows what the student saw at 60 seconds.

Diagram 2



What is the volume of gas collected?

Volume of gas = cm³

(1)

- (ii) Why did the volume of gas stop changing after 210 seconds?

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(1)

- (c) Another student placed a conical flask containing 1.00 g of a Group 1 carbonate (M_2CO_3) on a balance.

He then added 50 cm³, an excess, of dilute hydrochloric acid to the flask and measured the mass of carbon dioxide given off.

The equation for the reaction is:



The final mass of carbon dioxide given off was 0.32 g.

- (i) Calculate the amount, in moles, of carbon dioxide in 0.32 g carbon dioxide.

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

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Moles of carbon dioxide = moles

(2)

- (ii) How many moles of the metal carbonate are needed to make this number of moles of carbon dioxide?

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Moles of metal carbonate = moles

(1)

- (iii) The mass of metal carbonate used was 1.00 g.

Use this information, and your answer to part **(c) (ii)**, to calculate the relative formula mass (M_r) of the metal carbonate.

If you could not answer part **(c) (ii)**, use 0.00943 as the number of moles of metal carbonate. This is **not** the answer to part **(c) (ii)**.

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Relative formula mass (M_r) of metal carbonate =

(1)

- (iv) Use your answer to part **(c) (iii)** to calculate the relative atomic mass (A_r) of the metal in the metal carbonate (M_2CO_3) and so identify the Group 1 metal in the metal carbonate.

If you could not answer part **(c) (iii)**, use 230 as the relative formula mass of

the metal carbonate. This is **not** the answer to part **(c) (iii)**.

To gain full marks, you must show your working.

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Relative atomic mass of metal is

Identity of metal

(3)

(d) Two other students repeated the experiment in part **(c)**.

- (i) When the first student did the experiment some acid sprayed out of the flask as the metal carbonate reacted.

Explain the effect this mistake would have on the calculated relative atomic mass of the metal.

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(3)

- (ii) The second student used 100 cm³ of dilute hydrochloric acid instead of 50 cm³.

Explain the effect, if any, this mistake would have on the calculated relative atomic mass of the metal.

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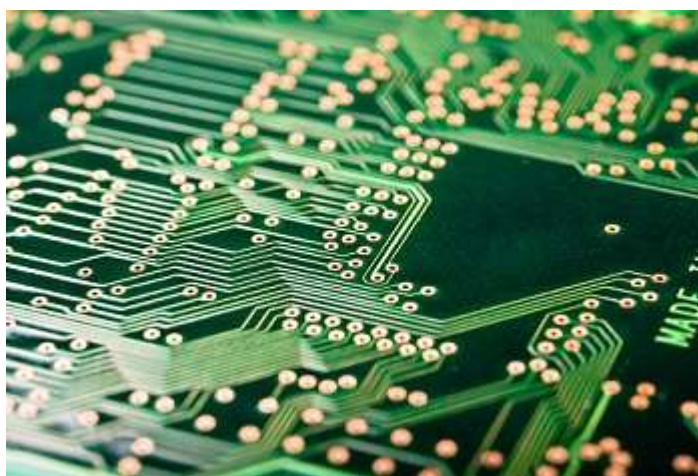
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(3)
(Total 17 marks)

Q5. Etching is a way of making printed circuit boards for computers.



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Printed circuit boards are made when copper sheets are etched using iron(III) chloride solution. Where the copper has been etched, only plastic remains.

- (a) Copper is a good conductor of electricity.

Explain why.

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(2)

- (b) Iron(III) chloride can be produced by the reaction shown in the equation:



- (i) Calculate the maximum mass of iron(III) chloride (FeCl_3) that can be produced

from 11.20 g of iron.

Relative atomic masses (A_r): Cl = 35.5; Fe = 56.

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Maximum mass of iron(III) chloride = g

(3)

- (ii) The actual mass of iron(III) chloride (FeCl_3) produced was 24.3 g.

Calculate the percentage yield.

(If you did not answer part (b)(i) assume that the maximum theoretical mass of iron(III) chloride (FeCl_3) is 28.0 g. This is **not** the correct answer to part (b)(i).)

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Percentage yield =%

(1)

(Total 6 marks)