

# GCSE Chemistry Summer Work 2021

## Calculations Practice

**Please complete this booklet of questions and bring along in September**

Meadowhead internal exams in 2021 did not assess on the C3 calculations topic. It is an essential topic for success in A-level chemistry! It would be best if you came back in September ready to use these skills, and not rusty. This is why we have chosen this topic for you to work on.

**Q1.**

This question is about oxygen (O<sub>2</sub>) and sulfur dioxide (SO<sub>2</sub>).

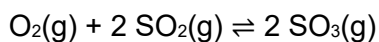
- (a) Give the test and result for oxygen gas.

Test \_\_\_\_\_

Result \_\_\_\_\_

(2)

- (b) The reaction between oxygen and sulfur dioxide is at equilibrium.



Some of the sulfur trioxide (SO<sub>3</sub>) is removed.

Explain what happens to the position of the equilibrium.

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\_\_\_\_\_

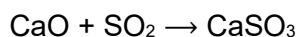
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(2)

- (c) Sulfur dioxide is an atmospheric pollutant.

Sulfur dioxide pollution is reduced by reacting calcium oxide with sulfur dioxide to produce calcium sulfite.



7.00 g of calcium oxide reacts with an excess of sulfur dioxide.

Relative atomic masses (A<sub>r</sub>): O = 16 S = 32 Ca = 40

Calculate the mass of calcium sulfite produced.

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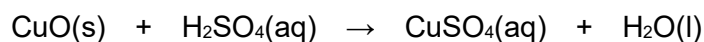
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Mass of calcium sulfite produced = \_\_\_\_\_ g

**Q2.**

A student planned to make copper sulfate crystals from excess copper oxide and dilute sulfuric acid.

The equation for the reaction is:



(a) Why is it necessary to add excess copper oxide?

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(1)

(b) This is the method used.

1. Add 25 cm<sup>3</sup> of dilute sulfuric acid to a conical flask.
2. Gently warm the dilute sulfuric acid.
3. Add excess copper oxide to the dilute sulfuric acid.
4. Stir the mixture.
5. Heat to evaporate all the water from the mixture.

Suggest **two** improvements to the method.

Explain why each improvement is needed.

1 \_\_\_\_\_

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2 \_\_\_\_\_

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(4)

(c) The student used:

- 2 g of copper oxide (in excess)
- 25 cm<sup>3</sup> of a solution of dilute sulfuric acid with a concentration of 49 g/dm<sup>3</sup>

Determine by how many moles the copper oxide (CuO) was in excess.

Relative atomic masses ( $A_r$ ): Cu = 63.5 O = 16

Relative formula mass ( $M_r$ ) of sulfuric acid = 98

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(5)

(Total 10 marks)

**Q3.**

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 \_\_\_\_\_

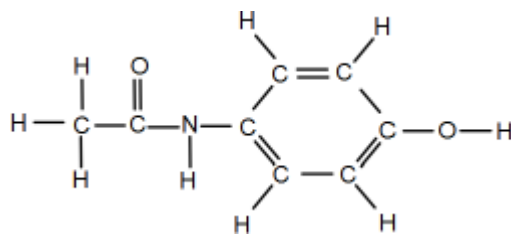
Reason \_\_\_\_\_

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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)

#### Q4.

Copper can be produced from copper(II) sulfate solution by two different methods.

##### Method 1 – Electrolysis

(a) To produce copper by electrolysis a student has inert electrodes, a d.c. power

supply, a switch and electrical wires for the external circuit.

Draw and label the apparatus set up to produce copper from copper(II) sulfate solution by electrolysis.

(2)

- (b) Suggest why the colour of the copper(II) sulfate solution fades during the electrolysis.

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(3)

- (c) Explain how copper is produced from copper(II) sulfate solution by electrolysis.

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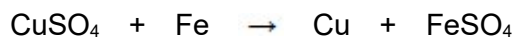
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(4)

**Method 2 – Displacement**

- (d) The chemical equation for the displacement of copper using iron is:



Calculate the minimum mass of iron needed to displace all of the copper from 50 cm<sup>3</sup> of copper(II) sulfate solution.

The concentration of the copper(II) sulfate solution is 80 g CuSO<sub>4</sub> per dm<sup>3</sup>.

Relative atomic masses (*A<sub>r</sub>*): O = 16; S = 32; Fe = 56; Cu = 63.5

Give your answer to 2 significant figures.

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Mass of iron = \_\_\_\_\_ g

(4)

(Total 13 marks)

**Q5.**

This question is about iron.

Iron reacts with dilute hydrochloric acid to produce iron chloride solution and one other product.

- (a) Name the other product.

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(1)

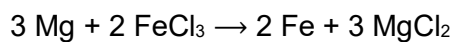
- (b) Suggest how any unreacted iron can be separated from the mixture.

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(1)

Magnesium reacts with iron chloride solution.



- (c) 0.120 g of magnesium reacts with excess iron chloride solution.

Relative atomic masses ( $A_r$ ): Mg = 24 Fe = 56

Calculate the mass of iron produced, in mg

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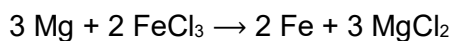
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Mass of iron = \_\_\_\_\_ mg

(5)

- (d) Explain which species is reduced in the reaction between magnesium and iron chloride.



Your answer should include the half equation for the reduction.

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(3)

(Total 10 marks)

### Q6.

This question is about crude oil.

- (a) The table shows information about crude oil fractions.

Crude oil fraction	Number of carbon atoms	Approximate percentage (%) in crude oil	Approximate percentage (%) demand
Gas	1–4	3	4
Petrol	5–10	9	23
Naphtha	8–12	10	5
Kerosene	9–16	14	8
Diesel	15–25	16	22
Residue	20–30+	48	38

Explain the advantage of cracking hydrocarbons.

Give **one** example from the table.

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(3)

(b) Ethene is a product of cracking.

Relative formula mass ( $M_r$ ) of ethene = 28

Calculate the number of moles of ethene ( $C_2H_4$ ) in 50.4 kg

Give your answer in standard form.

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Numbers of moles = \_\_\_\_\_

(3)

(c)  $C_{21}H_{44}$  can be cracked to produce ethene.



Relative formula mass ( $M_r$ ) of  $C_{21}H_{44}$  = 296

Calculate the mass of  $C_{21}H_{44}$  needed to produce 50.4 kg of ethene.

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Mass = \_\_\_\_\_ kg

(3)

(Total 9 marks)