The rate and extent of chemical reaction – GCSE CS Chemistry

1. No.2

0 2 Different tests can be used to identify chemicals.

0 2 . 1 A student measured the melting points of four substances.

Table 1 shows the results.

Table 1

Substance	Melting point in °C
A	52 to 54
B	61
C	–2 to 0
D	80 to 82

Which substance was pure?

Give **one** reason for your answer.

[2 marks]

Substance _____

Reason _____

_____

Anhydrous copper sulfate can be used to test for water.

The word equation for the reaction is:

anhydrous copper sulfate + water ⇌ hydrated copper sulfate

0 2 . 2 Complete the sentence.

Choose answers from the box.

[2 marks]

blue	**green**	**red**	**white**	**yellow**

When water is added to anhydrous copper sulfate, the colour changes

from _____ to _____.

0 2 . 3 The reaction between anhydrous copper sulfate and water is reversible.

How does the word equation show that the reaction is reversible?

[1 mark]

_____

0 2 . 4 The formula of anhydrous copper sulfate is $CuSO_4$

What is the total number of atoms in the formula $CuSO_4$?

[1 mark]

Tick (✓) **one** box.

3 ☐ 4 ☐ 6 ☐ 7 ☐

0 2 . 5 Chlorine is a gas.

Describe the test for chlorine.

Give the result.

[2 marks]

Test _____

_____

Result _____

_____

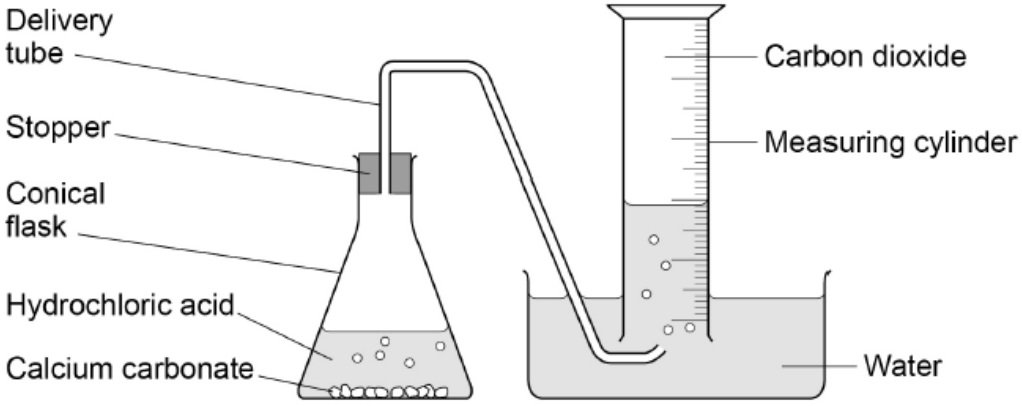
2. No.7

0 7 Some factors affect the rates of chemical reactions.

0 7 . 1 A student investigated the effect of changing the particle size of calcium carbonate on the rate of reaction with hydrochloric acid.

Figure 6 shows the apparatus.

Figure 6



Describe a method the student could use to produce valid results.

[6 marks]

0 7 . 2 The student investigated the effect of increasing the temperature on the rate of a reaction.

Explain the effect of increasing the temperature on the rate of a reaction.

Refer to particles and collisions in your answer.

[3 marks]

Catalysts affect the rate of reactions.

0 7 . 3 What is meant by a 'catalyst'?

[2 marks]

0 7 . 4 What are catalysts in biological systems called?

[1 mark]

3. No.2

0 2 Some factors affect the rates of chemical reactions.

0 2 . 1 A student investigated the effect of changing the particle size of calcium carbonate on the rate of reaction with hydrochloric acid.

Figure 3 shows the apparatus.

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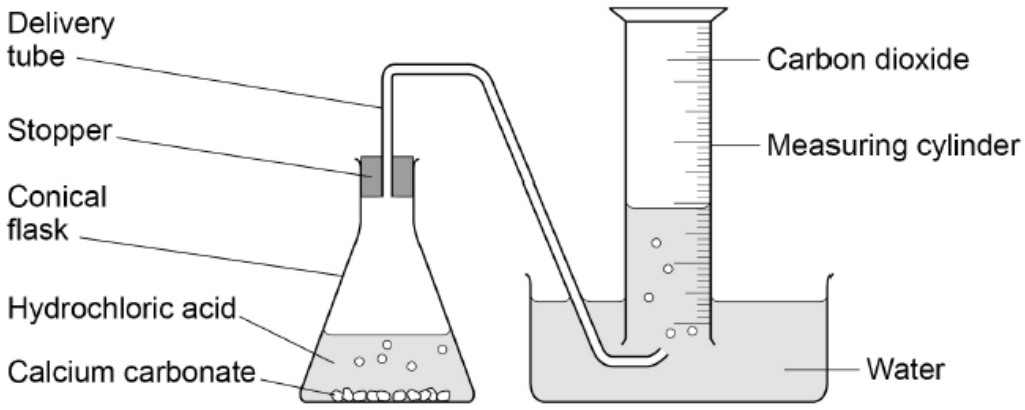


Describe a method the student could use to produce valid results.

[6 marks]

0 2 . 2 The student investigated the effect of increasing the temperature on the rate of a reaction.

Explain the effect of increasing the temperature on the rate of a reaction.

Refer to particles and collisions in your answer.

[3 marks]

Catalysts affect the rate of reactions.

0 2 . 3 What is meant by a 'catalyst'?

[2 marks]

0 2 . 4 What are catalysts in biological systems called?

[1 mark]

4. No.5

0 5 Sulfuric acid is produced by an industrial process.

In the process, sulfur dioxide (SO_2) reacts with oxygen (O_2) to produce sulfur trioxide (SO_3).

The equation for the reversible reaction is:

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

The forward reaction releases 198 kJ/mol of energy.

0 5 . 1 What is the amount of energy transferred during the reverse reaction?

[1 mark]

Tick (✓) **one** box.

< 198 kJ/mol ☐

= 198 kJ/mol ☐

> 198 kJ/mol ☐

0 5 . 2 The concentration of oxygen is increased.

What is the effect on the position of the equilibrium?

[1 mark]

Tick (✓) **one** box.

Equilibrium position shifts to the left ☐

Equilibrium position does not change ☐

Equilibrium position shifts to the right ☐

0 5 . 3 The pressure is decreased.

What is the effect on the position of the equilibrium?

[1 mark]

Tick (✓) **one** box.

Equilibrium position shifts to the left ☐

Equilibrium position does not change ☐

Equilibrium position shifts to the right ☐

0 5 . 4 The temperature is increased.

What is the effect on the position of the equilibrium?

[1 mark]

Tick (✓) **one** box.

Equilibrium position shifts to the left ☐

Equilibrium position does not change ☐

Equilibrium position shifts to the right ☐

0 5 . 5 A catalyst is used in the reaction.

Suggest what effect the catalyst has on the position of the equilibrium.

Give **one** reason for your answer.

[2 marks]

Effect _____

_____

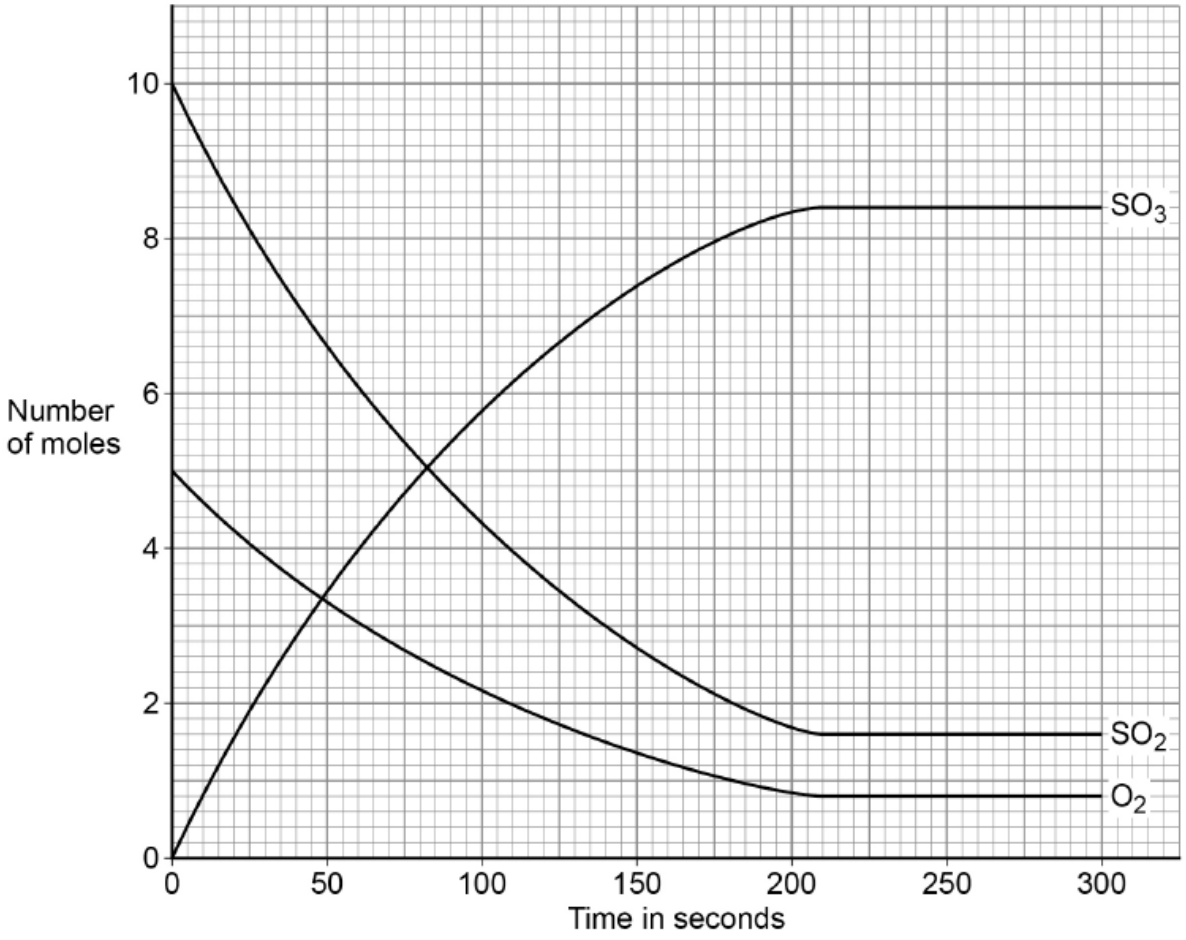
Reason _____

_____

A scientist measured how the number of moles of sulfur dioxide, oxygen and sulfur trioxide varied with time during the reaction.

Figure 5 shows the results.

Figure 5



0 5 . 6 Determine the time taken for the reaction to reach equilibrium.

Explain your answer.

Use **Figure 5**.

[3 marks]

Time _____ s

Explanation _____

_____

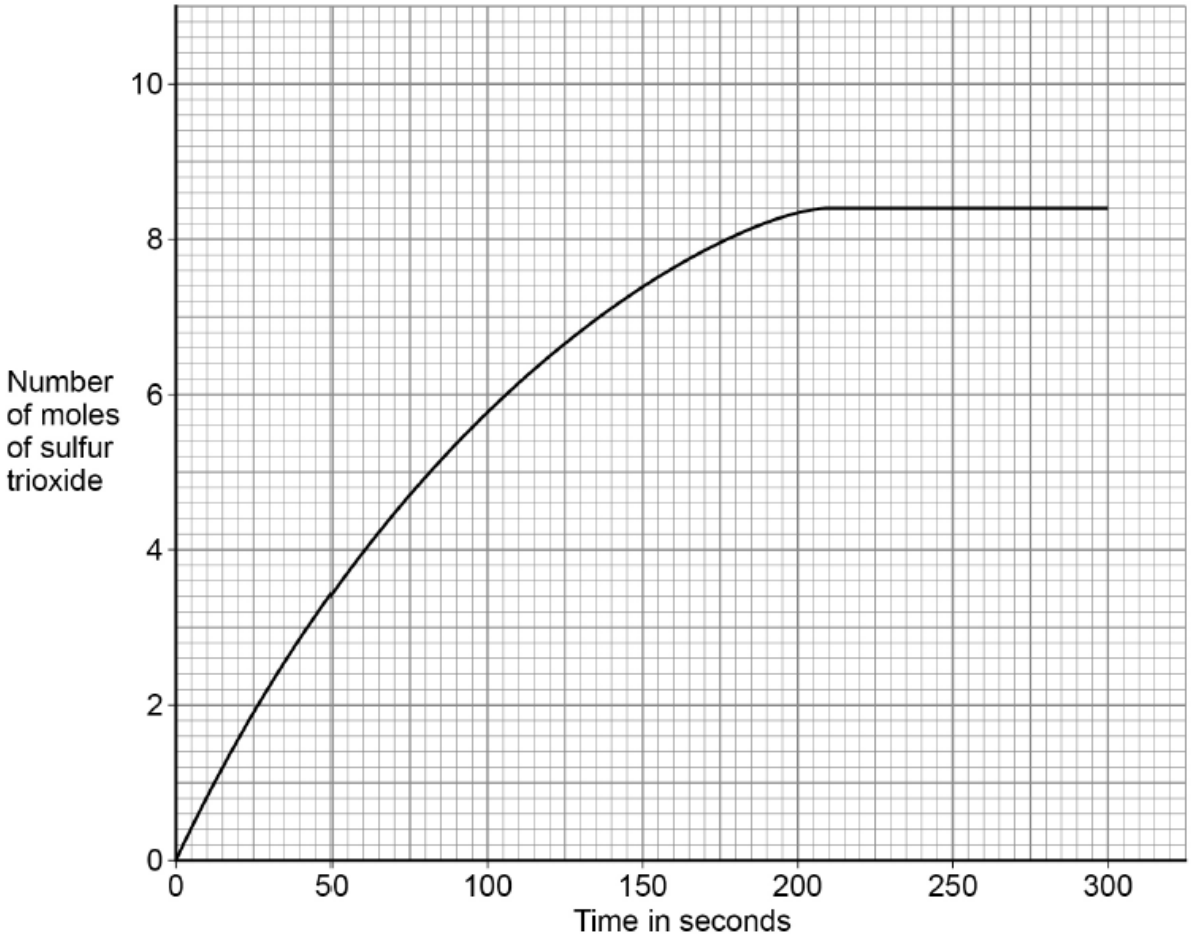
_____

_____

_____

0 5 . 7 **Figure 6** shows the results for sulfur trioxide.

Figure 6



Determine the rate of reaction at 60 seconds.

[4 marks]

Rate = _____ mol/s

5. No.6

0 6 The Earth's natural resources are used to manufacture useful products.

One useful product is potable water.

Potable water can be produced from sea water by distillation.

0 6 . 1 Give **one disadvantage** of using distillation to produce potable water.

[1 mark]

_____

_____

0 6 . 2 Describe **one** other method to produce potable water from sea water.

[2 marks]

_____

_____

_____

_____

A student investigated the mass of dissolved solids in a 100 cm^3 sample of sea water.

This is the method used.

1. Weigh an evaporating basin.
2. Measure 100 cm^3 of sea water.
3. Pour the sea water into the evaporating basin.
4. Heat the evaporating basin.
5. Weigh the evaporating basin and contents.
6. Calculate the mass of dissolved solids in the sea water.

0 6 . 3 Explain how repeating steps 4 and 5 would improve this method.

[2 marks]

0 6 . 4 The total mass of dissolved solids in a 100 cm^3 sample of sea water is 3.50 g.

The percentage of sodium chloride in the dissolved solids is 77.8%.

Calculate the mass of sodium chloride dissolved in the 100 cm^3 sample of sea water.

[2 marks]

Mass of sodium chloride = _____ g

Biological methods are used to extract metal compounds from metal ores.

0 6 . 5 One method of producing copper from low-grade copper ores is by using bacteria.

The bacteria produce leachate solutions that contain copper compounds.

Give **two** methods that can be used to extract copper from these leachate solutions.

[2 marks]

1 _____

_____

2 _____

_____

Phytomining uses plants to absorb metal compounds from low-grade ores.

0 6 . 6 Describe how the metal compounds are obtained from the plants.

[3 marks]

0 6 . 7 Nickel is produced by phytomining.

One hectare of plants produces 215 kg of nickel.

Determine the area required to produce 750 kg of nickel.

Give your answer in m^2.

One hectare = 10 000 m^2

[3 marks]

Area required = _____ m^2