

Answer **all** the questions.

Section A – Module C4

1 This question is about fertilisers.

The picture shows a farmer spreading fertiliser on a field.



(a) Why does the farmer add fertiliser to the field?

.....
..... [1]

(b) Fertilisers contain three essential elements.

Phosphorus and potassium are two of these essential elements.

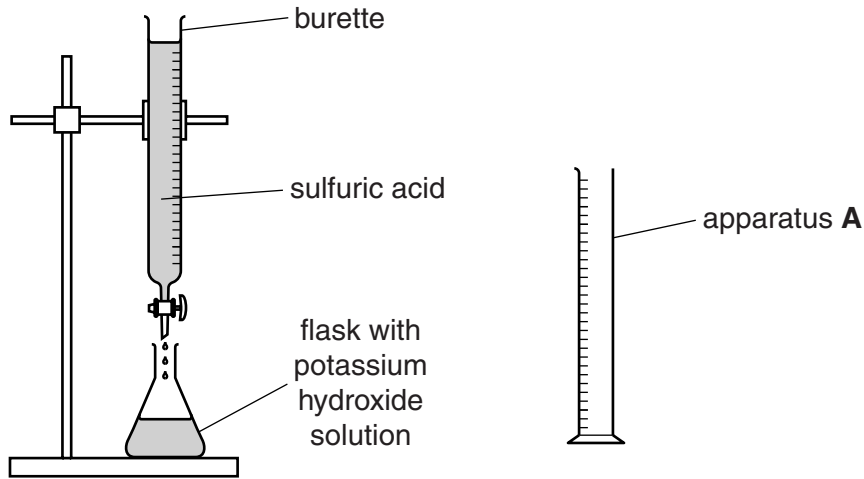
Write down the name of the **other** essential element.

..... [1]

(c) Fertilisers can be made by neutralisation.

Jenny makes some potassium sulfate.

Look at the diagram. It shows the apparatus she uses.



(i) Write down the name of apparatus **A**.

..... [1]

(ii) Jenny adds the sulfuric acid to the alkali, potassium hydroxide.

The pH of the solution in the flask changes as Jenny adds the sulfuric acid.

Write about how the pH changes.

..... [1]

(d) The formula of potassium sulfate is K_2SO_4 .

(i) What is the total number of **elements** in the formula K_2SO_4 ?

answer [1]

(ii) Calculate the relative formula mass, M_r , of K_2SO_4 .

Relative atomic mass, A_r :

$$K = 39, S = 32, O = 16.$$

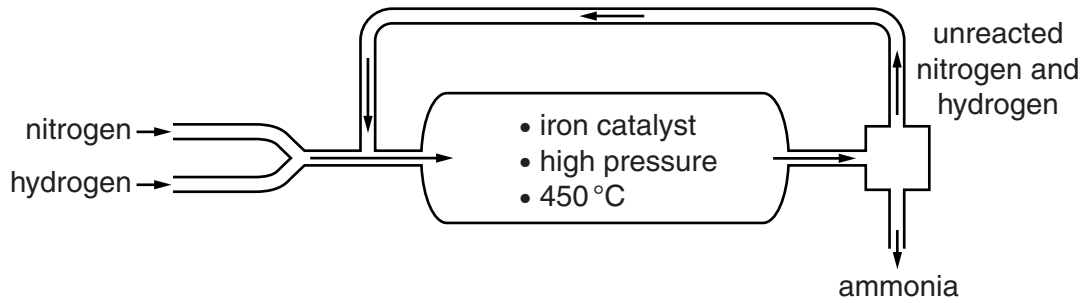
.....

answer [1]

[Total: 6]

2 This question is about ammonia.

The diagram shows how ammonia is made by the Haber process.



(a) The equation for the reaction is



What does the symbol \rightleftharpoons mean?

..... [1]

(b) Nitrogen is needed to make ammonia.

Where does the nitrogen come from?

Choose from this list.

air

natural gas

oil

water

answer [1]

(c) Some of the nitrogen and hydrogen does not react.

What happens to the unreacted nitrogen and hydrogen?

..... [1]

- (d) The table shows the percentage yield of ammonia made at different temperatures and pressures.

pressure in atmospheres	percentage yield of ammonia at 350 °C	percentage yield of ammonia at 450 °C	percentage yield of ammonia at 550 °C
100	16	12	6
200	30	22	12
300	40	28	16
400	50	36	20
500	56	42	24

- (i) How does **increasing** the **temperature** change the percentage yield?

.....
 [1]

- (ii) Write down the conditions that give the **greatest** yield of ammonia.

pressure atmospheres

temperature °C

[1]

[Total: 5]

3 This question is about water.



(a) Look at the picture.

It shows a reservoir behind a dam.

A reservoir is a water resource.

Write down the name of **one other** water resource.

..... [1]

(b) The water from the reservoir contains many substances before it is purified.

The water may contain

- dissolved salts and minerals
- microbes
- pollutants
- insoluble materials.

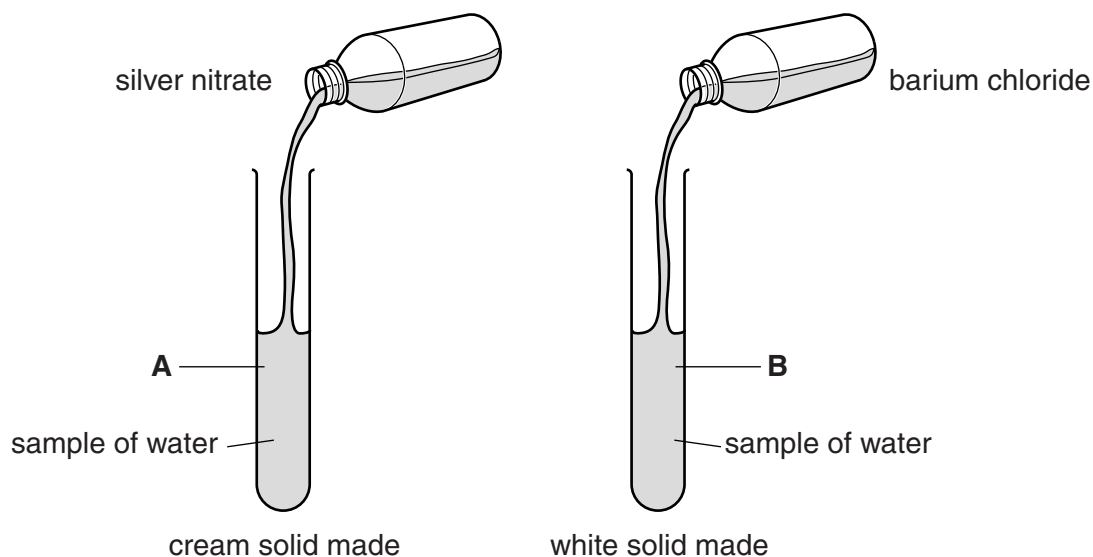
The water is chlorinated before it is used as drinking water.

Explain why.

.....
..... [1]

(c) Ruth tests a sample of water.

She pours the water into two test tubes, **A** and **B**.



She adds silver nitrate solution to test tube **A**. A cream solid is made.

She adds barium chloride solution to test tube **B**. A white solid is made.

Use the information in the box to decide which ions are present in the water.

silver nitrate solution is used to test for halide ions

- chloride ions give a white solid
- bromide ions give a cream solid
- iodide ions give a pale yellow solid

barium chloride solution is used to test for sulfate ions

- sulfate ions give a white solid

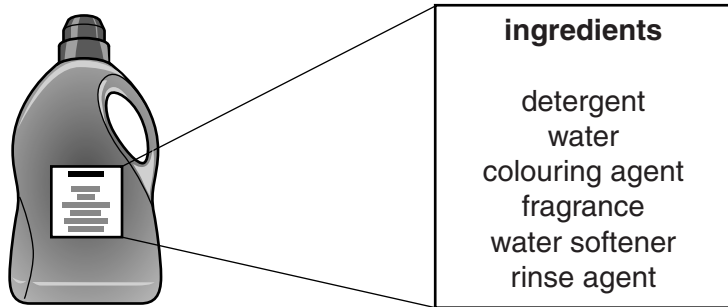
Write down the names of the **two** ions present in the sample of water.

..... and [2]

[Total: 4]

4 This question is about cleaning materials.

(a) The picture shows a bottle of washing up liquid used to wash plates.



(i) Which ingredient is the main cleaning agent?

Choose **one** from the list of ingredients.

..... [1]

(ii) Which ingredient helps the water drain off the plates?

Choose **one** from the list of ingredients.

..... [1]

(b) Jamie's shirt needs washing.

He uses a washing powder designed to wash at a low temperature of 30°C.

One advantage of washing clothes at low temperatures is that it is cheaper.

Write down **two other** advantages of washing clothes at low temperatures.

.....
.....
..... [2]

(c) Jamie needs to clean his suit.

He reads the clothes label. It says 'dry clean only'.

What is meant by **dry cleaning**?

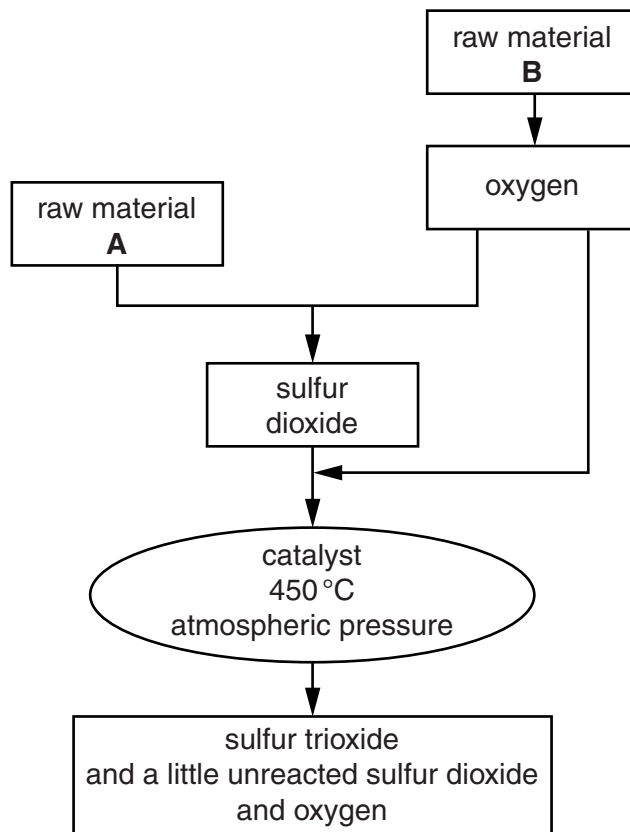
..... [1]

[Total: 5]

Section B – Module C5

- 5 Sulfuric acid is made in the Contact Process.

Look at the diagram. It shows part of the Contact Process.



- (a) Write down the names of raw materials **A** and **B**.

raw material **A**

raw material **B**

[2]

- (b) Sulfur dioxide, SO_2 , reacts with oxygen, O_2 , to make sulfur trioxide, SO_3 .

Write the **balanced symbol** equation for this reaction.

..... [2]

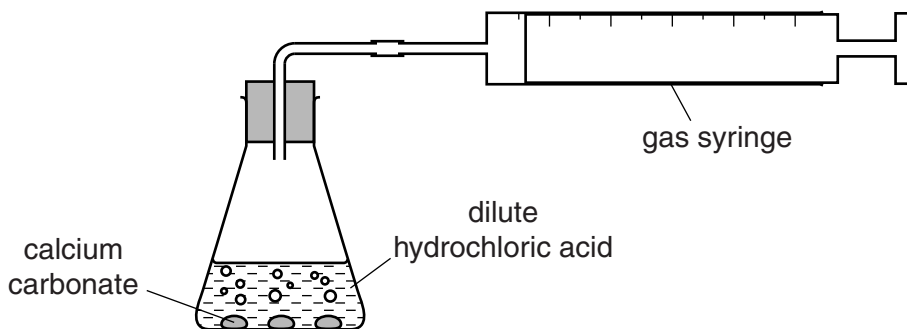
[Total: 4]

6 Sophie investigates the reaction between calcium carbonate and hydrochloric acid.

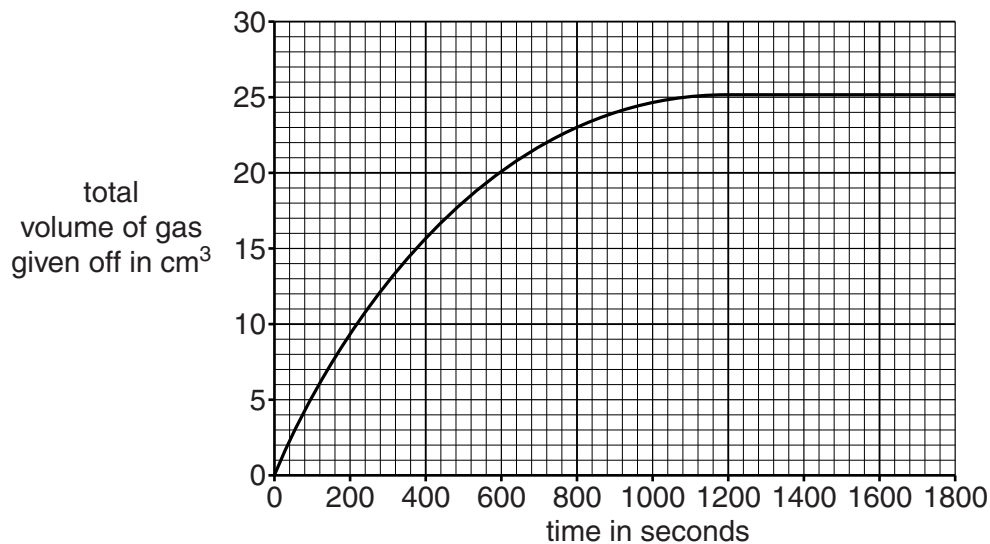
Carbon dioxide is made.

The diagram shows the apparatus Sophie uses.

Every 200 seconds she measures the total volume of carbon dioxide in the gas syringe.



Look at the graph of Sophie's results.



(a) (i) How long does it take to make **20 cm³** of gas?

answer seconds

[1]

(ii) When is the reaction **fastest**?

Choose from this list.

0 – 200 seconds

200 – 400 seconds

400 – 600 seconds

600 – 800 seconds

answer..... [1]

(iii) Eventually the reaction stops.

Explain why.

..... [1]

(b) Sophie repeats her experiment using a **weak** acid, ethanoic acid.

She uses the same volume and concentration of ethanoic acid as hydrochloric acid.

She finds that the reaction is much slower with ethanoic acid.

Explain why.

Use ideas about particles.

.....
.....
.....
..... [3]

[Total: 6]

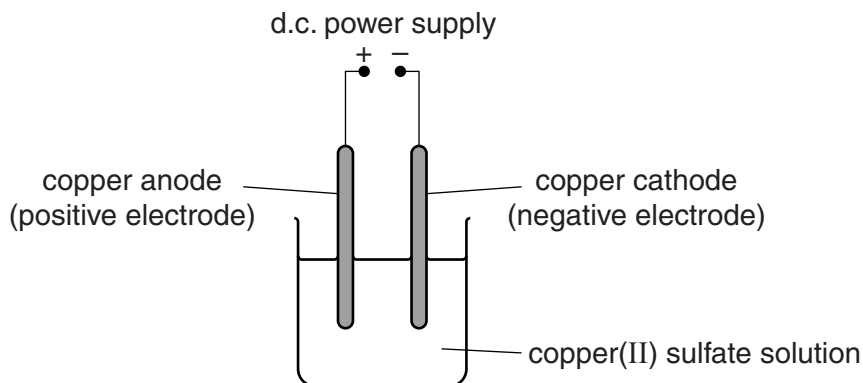
7 This question is about electrolysis.

(a) Jean electrolyses copper(II) sulfate solution.

She does three experiments.

Look at the diagram.

It shows the apparatus Jean uses.



After each experiment she records the mass of copper made at the cathode.

She uses a different time or a different current for each experiment.

The table shows her results.

experiment number	current used in amps	time taken in minutes	mass of copper made at the cathode in grams
1	0.15	40	0.12
2	0.30	40	0.24
3	0.15	80	0.24

(i) What is the effect of **increasing** the **current** on the mass of copper made?

..... [1]

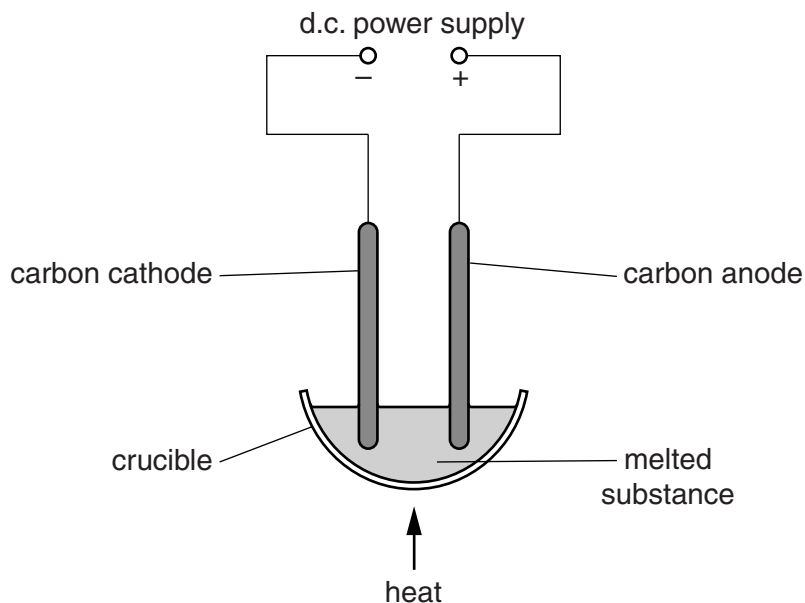
(ii) Describe what will happen to the **copper anode**.

.....

..... [1]

(b) Jean watches her teacher electrolyse some melted substances.

Look at the diagram. It shows the equipment her teacher uses.



Her teacher shows the electrolysis of lead bromide.

Jean's teacher tells her about the electrolysis of two other solids.

Look at the table.

substance electrolysed	product at cathode	product at anode
lead bromide	lead	bromine
potassium chloride	chlorine
lead iodide	lead

Complete the table.

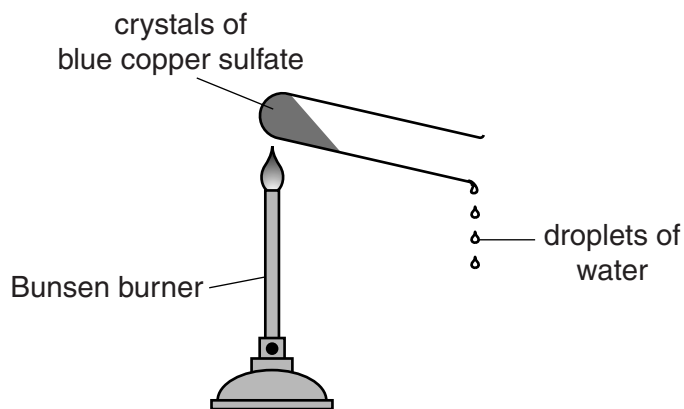
[2]

[Total: 4]

8 Coleen heats blue copper sulfate in a test tube.

Water and a white solid are made.

Look at the apparatus Coleen uses.



At the end of the experiment Coleen finds out how much white solid she has made.

Look at her table of results.

substance	mass in grams
mass of blue copper sulfate at the start	1.25
mass of white solid made	0.80
mass of water made

(a) What is the mass of **water** made?

Write your answer in the table.

[1]

(b) Coleen repeats the experiment.

This time she heats **2.50 g** of blue copper sulfate instead of **1.25 g**.

Predict how much white solid she should make.

.....

mass of white solid = g

[1]

(c) The white solid is a compound with the formula CuSO_4 .

A 16.0 g sample of the white solid contains 3.2 g of sulfur and 6.4 g of oxygen.

What is the mass of copper contained in the 16.0 g sample?

.....
.....

mass of copper = g

[1]

[Total: 3]

- 9 Jim looks at this label on a packet of cereal.

It shows some information about the food types in 100 g of this cereal.

It also shows the recommended daily allowance (RDA) of each food type.

food type	mass of food type in g per 100 g of cereal	RDA in g
fat	2.0	70
sugars	4.4	90
fibre	10.0	24
salt	0.65	6
vitamin B1	0.0012	0.0014

- (a) Jim eats 100 g of this cereal for breakfast.

He gets **most** of his RDA of **one** food type at breakfast.

Which **food type**?

Choose from the table.

answer

[1]

- (b) Jim feeds his baby with some baby milk.

- (i) The baby milk has to be **diluted**.

Suggest why.

.....

..... [1]

- (ii) The diluted milk has a different concentration.

What is the unit for **concentration**?

Choose from this list.

cm^3 dm^3 g g/mol mol/dm^3

answer

[1]

[Total: 3]

Section C – Module C6

10 This question is about rusting.

One disadvantage of making ships from iron is that iron rusts.



(a) Two substances are needed for iron to rust.

Write down the names of these two substances.

..... and [1]

(b) Iron can be painted to stop it from rusting.

(i) Explain **how** painting stops iron from rusting.

.....
..... [1]

(ii) Write down two **other** ways of stopping iron from rusting.

1
2 [2]

[Total: 4]

11 This question is about fuel cells.

This new car uses hydrogen fuel cells.



(a) The reaction in the fuel cell produces energy to power the car.

What type of energy is produced in the fuel cell?

Choose from this list.

chemical

electrical

heat

sound

answer [1]

(b) The company producing the car says it will provide 'near pollution-free transport'.

Explain why a hydrogen-fuelled car produces little or no pollution.

.....
..... [1]

(c) Fuel cells are also used in spacecraft because

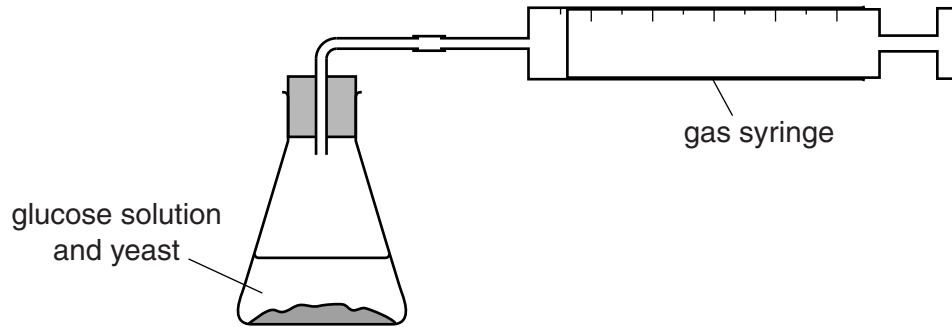
- there is no pollution
- they are low cost.

Write about **two other** advantages of using fuel cells in manned spacecraft.

.....
.....
.....
..... [2]

12 Ann-Marie and David investigate fermentation.

Look at the diagram. It shows the apparatus they use.



Ethanol is made when glucose ferments.

(a) Write down one **use** of ethanol.

..... [1]

(b) Fermentation needs glucose and yeast.

Write about the conditions needed for successful fermentation.

.....
.....
.....
..... [3]

[Total: 4]

13 Fred investigates the hardness of water.

He finds out how many drops of soap solution are needed to produce a lather.

He tests four different samples of water.

Look at his results.

water sample	number of drops of soap solution needed to produce a lather	
	before boiling	after boiling
A	25	1
B	22	21
C	1	1
distilled water	1	1

(a) (i) Which water sample is **soft** water?

Choose from **A**, **B** or **C**.

answer

[1]

(ii) Which sample of water contains only **temporary hardness**?

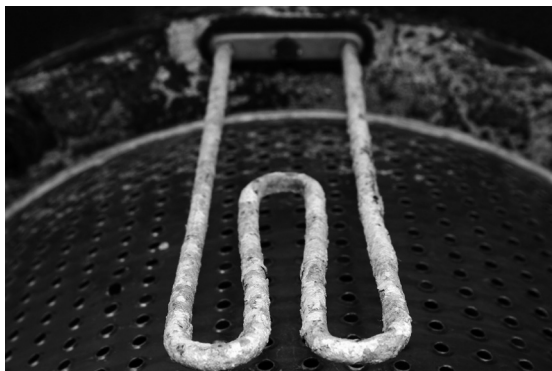
Choose from **A**, **B** or **C**.

answer

[1]

(b) Fred lives in a hard water area.

The heater element in Fred's washing machine is covered in limescale.



Fred uses a **weak** acid to remove the limescale.

Suggest why Fred does not use a **strong** acid to remove the limescale.

.....
 [1]

(c) (i) What is the chemical name for limescale?

Choose from this list.

calcium carbonate

calcium hydrogencarbonate

sodium carbonate

sodium chloride

answer..... [1]

(ii) Sodium carbonate has the formula Na_2CO_3 .

How many **atoms** are in the formula Na_2CO_3 ?

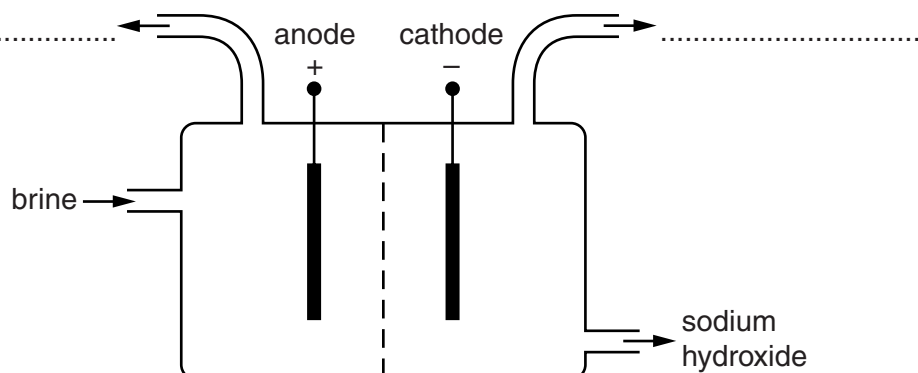
answer..... [1]

[Total: 5]

14 Sodium chloride (salt) is an important raw material in the chemical industry.

Look at the diagram.

It shows the apparatus used for the electrolysis of sodium chloride solution (brine).



(a) Complete the diagram to show the names of the gases made at the anode and cathode. [2]

(b) When melted sodium chloride is electrolysed, chlorine gas is made.

How would you **test** for chlorine gas?

test.....

result of test [1]

[Total: 3]

END OF QUESTION PAPER

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