PEARSON EDEXCEL GCSE CHEMISTRY · 1CH0

CHEMISTRY



EXAM QUESTION PACK

TOPIC 3: CHEMICAL CHANGES (PACK 1)

SCORE	PERCENTAGE
/131	%

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Q1.

State the colour of Universal indicator in a solution of ethanoic acid.

(1)

.....

Q2.

Hydrogen reacts with chlorine to form hydrogen chloride.

When hydrogen chloride gas, HCl, is dissolved in water an acidic solution is formed.

(i) Give the name of the acid.

(1)

.....

(ii) What colour is seen when methyl orange is added to this acidic solution?

(1)

☒ **A** blue

☒ **B** green

☒ **C** pink-red

☒ **D** orange

(Total for question = 2 marks)

Q3.

(a) An acid can be reacted with a base in a titration experiment.

(i) State the name of the type of reaction when an acid reacts with a base.

(1)

.....

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The general equation for the reaction of an acid with a base is

(1)

☒ **A** acid + base → alkali + water

☒ **B** acid + base → salt + carbon dioxide

☒ **C** acid + base → salt + water + hydrogen

☒ **D** acid + base → salt + water

(b) A solution of sodium hydroxide is prepared.

The mass of a container with solid sodium hydroxide is determined.
The sodium hydroxide is transferred to a flask.
The mass of the empty container is determined.
The sodium hydroxide is dissolved in water and the volume made up to 2 dm^3.

The results are
mass of container + solid sodium hydroxide = 17.12g
mass of empty container = 7.02g

The results are used to calculate the concentration of the sodium hydroxide solution.

(i) Calculate the mass of solid sodium hydroxide transferred to the flask.

(1)

.....

mass of solid sodium hydroxide = ... g

(ii) Calculate the concentration of the sodium hydroxide solution in g dm^{-3}.

(1)

.....

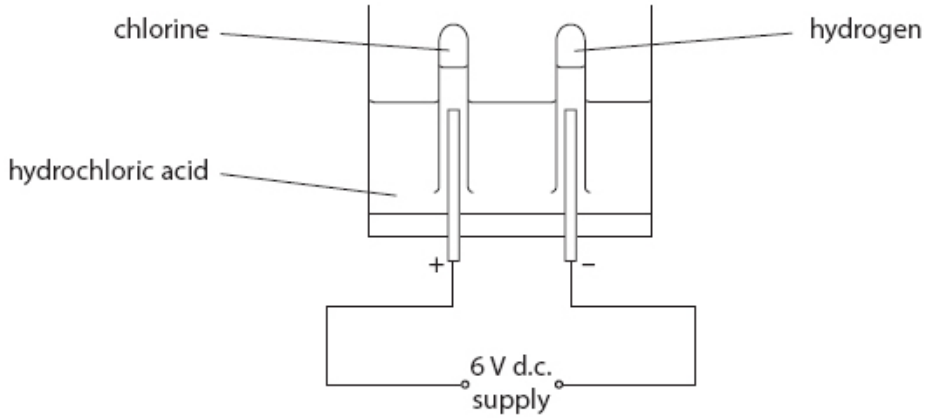
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concentration of sodium hydroxide solution = ... g dm^{-3}

Q4.

(a) In this apparatus hydrochloric acid is decomposed by passing a direct electric current through it.

Chlorine and hydrogen are formed.



(i) Give the name of this process in which substances, such as hydrochloric acid, are decomposed by a direct electric current.

(1)

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(ii) Describe what happens when a burning splint is applied to a mixture of hydrogen and air in a test tube.

(2)

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.....

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(b) (i) Complete the sentence by putting a cross (☒) in the box next to your answer.

An acid is present in the stomach of humans.

This acid is

(1)

☒ **A** ethanoic acid

☒ **B** hydrochloric acid

☒ **C** nitric acid

☒ **D** sulfuric acid

(ii) Some people suffer from indigestion and take indigestion remedies.

Which of these could cure indigestion caused by excess acid?

Put a cross (☒) in the box next to your answer.

(1)

- ☒ **A** sodium chloride
- ☒ **B** carbon dioxide
- ☒ **C** calcium carbonate
- ☒ **D** hydrogen chloride

(iii) Explain how an indigestion remedy works when it cures acid indigestion.

(2)

.....

.....

.....

.....

(c) Metal oxides react with acids to form a salt and water.

Complete the word equation for the reaction of magnesium oxide with nitric acid.

(2)

magnesium oxide + nitric acid → ..... + ...

(Total for Question = 9 marks)

Q5.

Acids

(a) Magnesium carbonate reacts with dilute nitric acid.

Give the names of the products formed in this reaction.

(2)

.....

(b) Zinc oxide, ZnO, reacts with dilute hydrochloric acid to form zinc chloride, $ZnCl_2$, and water.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

This reaction is an example of

(1)

☒ **A** combustion

☒ **B** thermal decomposition

☒ **C** neutralisation

☒ **D** oxidation

(ii) Write the balanced equation for the reaction between zinc oxide and dilute hydrochloric acid.

(3)

.....

*(c) Electrolysis of hydrochloric acid can produce hydrogen and chlorine.

The apparatus for the electrolysis is

hydrochloric acid

two carbon rods

a suitable container for the electrolysis reaction

a suitable source of electricity

test tubes

Describe how the apparatus can be used to electrolyse hydrochloric acid and how the gases produced can be tested to show that they are hydrogen and chlorine.

You may use a diagram to help your answer.

(6)

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(Total for question = 12 marks)

Q6.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

Acids are neutralised by metal hydroxides to form

(1)

☒ **A** salt only

☒ **B** salt and hydrogen only

☒ **C** salt and oxygen only

☒ **D** salt and water only

(ii) Acids can also be neutralised by metal carbonates.

Dilute sulfuric acid is neutralised by copper carbonate as shown in the word equation.

$$\text{copper carbonate} + \text{sulfuric acid} \rightarrow \text{copper sulfate} + \text{carbon dioxide} + \text{water}$$

Copper carbonate is a green powder.

Describe what you would **see** when copper carbonate powder is added to dilute sulfuric acid.

(2)

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.....

Q7.

In the Haber process nitrogen and hydrogen are reacted together to form ammonia.

(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

The nitrogen used in the Haber process is obtained from

(1)

☒ **A** air

☒ **B** coal

☒ **C** crude oil

☒ **D** sea water

(b) The balanced equation for the reaction forming ammonia is

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

(i) All substances in this reaction are in the same physical state.

Give the name of this physical state.

(1)

.....

(ii) State the meaning of the symbol $\rightleftharpoons$ in the equation.

(1)

.....

.....

(c) Some ammonia is reacted with sulfuric acid to make ammonium sulfate.

Write the word equation for this reaction.

(2)

.....

(d) Ammonium sulfate is used as a fertiliser.

State why farmers use fertilisers on their fields.

(1)

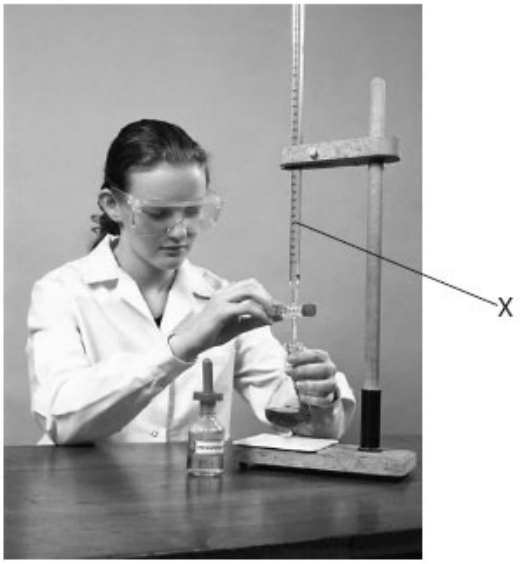
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(e) Titration can be used to determine the exact volume of ammonia solution that reacts with 25.0 cm^3 of sulfuric acid.

The photograph shows a student carrying out a titration.

(1)



(i) Give the name of the piece of apparatus labelled X.

.....

(ii) State what is added to the sulfuric acid to show when it has been neutralised by the ammonia solution.

(1)

.....

(Total for Question = 8 marks)

Q8.

A student plans to heat the pure solution of ammonium chloride to dryness to obtain a sample of pure, dry ammonium chloride.

A teacher explains that if dry ammonium chloride is heated, the following reaction can occur.

$$NH_4Cl \rightarrow NH_3 + HCl$$

(i) Which statement describes this reaction of ammonium chloride to form ammonia and hydrogen chloride?

(1)

☒ **A** a crystallisation reaction

☒ **B** a decomposition reaction

☒ **C** a neutralisation reaction

☒ **D** a reaction at equilibrium

(ii) Describe how you could alter the method of obtaining the pure, dry ammonium chloride to avoid losing product by heating the sample too strongly.

(2)

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(Total for question = 3 marks)

Q9.

A titration is to be carried out to find the concentration of a solution of sodium hydroxide.

The sodium hydroxide solution is titrated with dilute sulfuric acid.

The available apparatus includes a burette, a pipette, a funnel, a conical flask and an indicator.

(a) State one safety precaution that must be taken when using sodium hydroxide solution and dilute sulfuric acid.

(1)

.....

.....

.....

(b) The sodium hydroxide solution is made by dissolving 4.3 g of sodium hydroxide in water and making the solution up to 250 cm^3 with water.

Calculate the concentration of the solution in g dm^{-3}.

(2)

concentration = ... g dm^{-3}

(c) Write the balanced equation for the reaction of dilute sulfuric acid, H_2SO_4, with sodium hydroxide.

(2)

.....

(d) The results of titrations to determine how much of an acid is required to neutralise a given volume of an alkaline solution are shown in Figure 14.

	titration 1	titration 2	titration 3	titration 4
final burette reading (cm^3)	27	27.40	29.20	29.30
initial burette reading (cm^3)	0	2.10	4.00	3.50
volume of acid used (cm^3)	27	25.30	25.20	25.80

Figure 14

Two of the titrations in Figure 14 should **not** be used to calculate the mean volume of acid required.

Identify each titration and give a reason why it should not be used in the calculation of the mean.

(2)

.....

.....

.....

.....

(Total for question = 7 marks)

Q10.

An experiment is planned to record the change in pH as a powdered base is added to 50 cm^3 dilute hydrochloric acid.

The method suggested is

step 1 add dilute hydrochloric acid up to the 50 cm^3 mark on a beaker;

step 2 add one spatula of the base and stir;

step 3 measure the pH of the mixture;

step 4 repeat steps 2 and 3 until the pH stops changing.

(i) State how you could change the method so that the amounts of dilute hydrochloric acid and of the base can be measured more accurately.

(2)

dilute hydrochloric acid

.....

.....

base

.....

.....

(ii) During the experiment the pH changes from 2 to 10.
If phenolphthalein indicator is added at the beginning of the experiment, a colour change occurs as the base is added.

State the colour change that occurs.

(1)

colour at start .....

colour at end .....

(iii) Explain, in terms of the particles present, why the pH increases during the experiment.

(2)

.....

.....

.....

.....

(Total for question = 5 marks)

Q11.

The reactivity of copper, magnesium and zinc was investigated.
Each metal was placed separately in dilute hydrochloric acid.
The amount of effervescence was observed.

(i) The same mass of metal was used in each experiment.
Which piece of apparatus should be used to find the mass of metal used?

(1)

☒ **A** a balance

☒ **B** a pipette

☒ **C** a stopwatch

☒ **D** a thermometer

(ii) State **two** variables, apart from the mass of the metals, that should be controlled in this investigation.

(2)

1 .....

.....

2 .....

.....

(iii) Magnesium produces the most vigorous effervescence.
Copper does not produce any effervescence.

Give the reason why copper does not produce any effervescence.

(1)

.....

(iv) The magnesium reacts with dilute hydrochloric acid to form magnesium chloride solution

and hydrogen gas.

The equation for the reaction is

$$Mg(s) + 2HCl(aq) \rightarrow MgCl_2(.....) + H_2(.....)$$

Fill in the missing state symbols in the spaces provided.

(2)

(Total for question = 6 marks)

Q12.

(a) Magnesium sulfate solution can be made by reacting magnesium oxide with dilute sulfuric acid.

The word equation for the reaction is

$$\text{magnesium oxide} + \text{sulfuric acid} \rightarrow \text{magnesium sulfate} + \text{water}$$

Describe how solid magnesium oxide and dilute sulfuric acid are used to prepare a sample of pure magnesium sulfate solution.

(2)

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.....

.....

.....

(b) Magnesium carbonate, $MgCO_3$, can be reacted with dilute sulfuric acid, H_2SO_4, to form magnesium sulfate, water and carbon dioxide.

Write the balanced equation for this reaction.

(2)

.....

(c) Samples of tap water from city A and city B were investigated.

Each sample of water was treated as follows.
The mass of an empty evaporating basin was determined.
500 cm^3 of tap water was added and evaporated to dryness.
The mass of the evaporating basin and remaining solid was determined.

Here are the results.

	city A	city B
mass of evaporating basin / g	261.500	258.450
mass of evaporating basin + solid / g	261.611	258.515
mass of solid / g	0.111	
concentration of dissolved solid in tap water / g dm^{-3}	0.222	

Calculate the concentration, in g dm–3, of dissolved solid in the tap water from city B.

(2)

.....

.....

.....

.....

.....

.....

concentration of solid = ... g dm^{-3}

*(d) Some dissolved solids cause hardness in water.
Hard water can be softened.
Water hardness can be temporary hardness or permanent hardness.
Not all softening processes remove both types of hardness.

Describe and explain different methods of softening water, indicating the type of hardness each method removes.

(6)

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(Total for Question = 12 marks)

Q13.

* Barium sulfate is prepared by reacting barium chloride with sodium sulfate.
The barium sulfate is formed as a precipitate.

Describe an experiment to prepare a pure, dry sample of barium sulfate, starting with barium chloride crystals and sodium sulfate crystals.

(6)

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Q14.

(a) Barium sulfate contains

barium ions, Ba^{2+}
sulfate ions, SO_4^{2-}

(i) Give the formula of barium sulfate.

(1)

.....

(ii) Give the meaning of the term **ion.**

(1)

.....

.....

(b) This is an X-ray photograph of part of a patient's body.
Before the photograph was taken a suspension of barium sulfate was introduced into his body to show the required part.



Source: andi-sheba.blogspot.com

Many barium salts are toxic.
Barium sulfate is insoluble in water.

Explain why it is safe for the patient to have barium sulfate in his body.

(2)

.....

.....

.....

*(c) Barium sulfate is prepared by reacting barium chloride with sodium sulfate.
The barium sulfate is formed as a precipitate.

Describe an experiment to prepare a pure, dry sample of barium sulfate, starting with barium chloride crystals and sodium sulfate crystals.

(6)

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(d) Barium reacts with chlorine to produce barium chloride, $BaCl_2$.

Write the balanced equation for this reaction.

(2)

.....

(Total for Question = 12 marks)

Q15.

Calcium nitrate solution can be made by adding solid calcium carbonate to dilute nitric acid in a beaker.

The solid calcium carbonate is added until some remains at the bottom of the beaker.

(i) After this reaction the liquid in the beaker is

(1)

☒ **A** acidic

☒ **B** alkaline

☒ **C** neutral

☒ **D** pure water

(ii) Explain why the calcium carbonate is added until some solid remains at the bottom of the

beaker.

(2)

.....

.....

.....

(iii) Write the balanced equation for the reaction between calcium carbonate and nitric acid to form calcium nitrate, $Ca(NO_3)_2$.

(3)

.....

(Total for question = 6 marks)

Q16.

(a) Calcium nitrate solution reacts with sodium carbonate solution.
The products are calcium carbonate and another salt.

Write the word equation for this reaction.

(2)

.....

.....

(b) (i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The colour produced in a flame test by calcium ions is

(1)

☒ **A** green

☒ **B** lilac

☒ **C** orange-red

☒ **D** yellow

(ii) Describe how a flame test is carried out on a solid.

(2)

.....

.....

.....

.....

(c) If calcium carbonate is heated strongly, it decomposes.

$$CaCO_3 \rightarrow CaO + CO_2$$

If 100 g of calcium carbonate is heated a calculation shows that 44 g carbon dioxide should be formed.

(i) In an experiment 100 g of calcium carbonate was heated and only 40 g carbon dioxide was formed.

Calculate the percentage yield of carbon dioxide in this reaction.

(2)

.....

.....

percentage yield of carbon dioxide =.....%

(ii) Suggest a reason why only 40 g of carbon dioxide was formed in the experiment.

(1)

.....

.....

.....

(d) Complete the sentence by putting a cross (☒) in the box next to your answer.

Ionic compounds

(1)

☒ **A** conduct electricity when solid

☒ **B** do not conduct electricity when molten

☒ **C** have low boiling points

☒ **D** have high melting points

(Total for Question = 9 marks)

Q17.

Calcium nitrate solution reacts with sodium carbonate solution.
The products are calcium carbonate and another salt.

Write the word equation for this reaction.

(2)

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.....

Q18.

A student has been asked to investigate how the pH changes when calcium oxide is added, a little at a time, to dilute hydrochloric acid.

Describe how the student should carry out this investigation.

(3)

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(Total for question = 3 marks)

Q19.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

This question is about electrolysis.

A sample of molten potassium bromide is electrolysed.

What are the two products formed?

(1)

☒ **A** hydrogen and oxygen

☒ **B** hydrogen and bromine

☒ **C** potassium and oxygen

☒ **D** potassium and bromine

(Total for question = 1 mark)

Q20.

The scientist John Dalton lived over 200 years ago.

Another gas that Dalton investigated was chlorine.

Chlorine gas reacts with water.
The two products are a solution of hydrogen chloride and the substance HClO.

(i) Complete the balanced equation for this reaction, including the three missing state symbols.

(3)

..... (.....) + ... (.....) ↔ .....
(.....) + HClO (aq)

(ii) Hydrogen chloride solution is acidic.

The formulae of four ions are shown in Figure 3.

H^+	H^-	Cl^+	Cl^-

Figure 3

Give the formula of the ion in Figure 3 that causes the hydrogen chloride solution to be acidic.

(1)

formula .....

(iii) An acid reacts with an alkali.

Give the name of this type of reaction.

(1)

.....

(Total for question = 5 marks)

Q21.

When burnt completely in air, butene forms carbon dioxide and water.

(i) Balance the equation for this reaction by putting numbers in the spaces provided.

(2)

$C_4H_8 + 6O_2 \rightarrow$ ..... CO_2 + ... H_2O

(ii) Describe the test to show that a gas is carbon dioxide.

(2)

.....

.....

.....

.....

(Total for question = 4 marks)

Q22.

The scientist John Dalton lived over 200 years ago.

Another gas that Dalton investigated was chlorine.

Chlorine gas reacts with water.
The two products are a solution of hydrogen chloride and the substance HClO.

(i) Complete the balanced equation for this reaction, including the three missing state symbols.

(3)

..... (.....) + ... (.....) ↔
.....(.....) + HClO (aq)

(ii) Hydrogen chloride solution is acidic.

The formulae of four ions are shown in Figure 9.

H^+	H^-	Cl^+	Cl^-

Figure 9

Give the formula of the ion in Figure 9 that causes the hydrogen chloride solution to be acidic.

(1)

formula .....

(iii) An acid reacts with an alkali.

Give the name of this type of reaction.

(1)

.....

(iv) Describe what you would **see** when some copper carbonate powder is added to a beaker of dilute sulfuric acid.

(2)

.....

.....

.....

(Total for question = 7 marks)

Q23.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

The word equation for the reaction between copper carbonate and dilute sulfuric acid is

$$\text{copper carbonate} + \text{sulfuric acid} \rightarrow \text{copper sulfate} + \text{carbon dioxide} + \text{water}$$

(i) Complete the balanced equation for this reaction.

(2)

$$CuCO_3 + \text{.....} \rightarrow \text{.....} + CO_2 + H_2O$$

(ii) Calculate the relative formula mass of copper carbonate, $CuCO_3$.
(relative atomic masses: C = 12.0, O = 16.0, Cu = 63.5)

(2)

.....

.....

.....

relative formula mass of $CuCO_3$ = ...

(iii) What is the chemical test to show that a gas is carbon dioxide?

(1)

☒ **A** bubble the gas through limewater, limewater turns cloudy

☒ **B** put damp blue litmus paper in the gas, litmus paper turns red

☒ **C** put a lighted splint into the gas, splint is extinguished

☒ **D** measure the pH of the gas, pH = 4

(Total for question = 5 marks)

Q24.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

The word equation for the reaction between copper carbonate and dilute sulfuric acid is

$$\underset{\text{carbonate}}{\text{copper}} + \underset{\text{acid}}{\text{sulfuric}} \rightarrow \underset{\text{sulfate}}{\text{copper}} + \underset{\text{dioxide}}{\text{carbon}} + \text{water}$$

(i) Complete the balanced equation for this reaction.

(2)

$$CuCO_3 + \text{.....} \rightarrow \text{.....} + CO_2 + H_2O$$

(ii) Calculate the relative formula mass of copper carbonate, $CuCO_3$.
(relative atomic masses: C = 12.0, O = 16.0, Cu = 63.5)

(2)

.....

.....

.....

relative formula mass of $CuCO_3$ = ...

(iii) What is the chemical test to show that a gas is carbon dioxide?

(1)

☒ **A** bubble the gas through limewater, limewater turns cloudy

☒ **B** put damp blue litmus paper in the gas, litmus paper turns red

☒ **C** put a lighted splint into the gas, the splint is extinguished

☒ **D** measure the pH of the gas, pH = 4

(Total for question = 5 marks)

Q25.

Molten lead bromide is electrolysed.

The products of this electrolysis are

(1)

☒ **A** hydrogen and bromine

☒ **B** hydrogen and oxygen

☒ **C** lead and bromine

☒ **D** lead and oxygen

(Total for question = 1 mark)

Q26.

Molten lead bromide is electrolysed.

The products of this electrolysis are

(1)

☒ **A** hydrogen and bromine

☒ **B** hydrogen and oxygen

☒ **C** lead and bromine

☒ **D** lead and oxygen

(Total for question = 1 mark)

Q27.

The fertiliser ammonium phosphate was made by reacting ammonia solution with dilute phosphoric acid.

(i) In the first step, 25 cm^3 of dilute phosphoric acid was placed in a beaker.

Give the name of a piece of apparatus that could be used to measure out the 25 cm^3 dilute phosphoric acid.

(1)

.....

(ii) Complete the word equation for this reaction.

(1)

ammonia + ... → .....

(iii) Some ammonium phosphate solution was made.

Describe how pure, dry crystals of ammonium phosphate are obtained from the ammonium phosphate solution.

(2)

.....

.....

.....

.....

(Total for question = 4 marks)

Q28.

A sample of rock salt contains a mixture of sodium chloride and some insoluble substances.

The rock salt is added to water and the mixture stirred.

The mixture is then filtered to obtain a filtrate of sodium chloride solution.

(i) Draw a labelled diagram of the apparatus used to filter the mixture and collect the sodium chloride solution.

(2)

(ii) Describe how a sample of pure, dry sodium chloride crystals can be obtained from the filtrate.

(3)

.....

.....

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.....

.....

.....

(Total for question = 5 marks)

Q29.

The word equation for the reaction between copper carbonate and dilute sulfuric acid is

$$\text{copper carbonate} + \text{sulfuric acid} \rightarrow \text{copper sulfate} + \text{carbon dioxide} + \text{water}$$

Figure 12 shows a conical flask containing dilute sulfuric acid.
Copper carbonate is added to the acid in the flask.
The copper carbonate is added one spatula measure at a time until the reaction has finished.

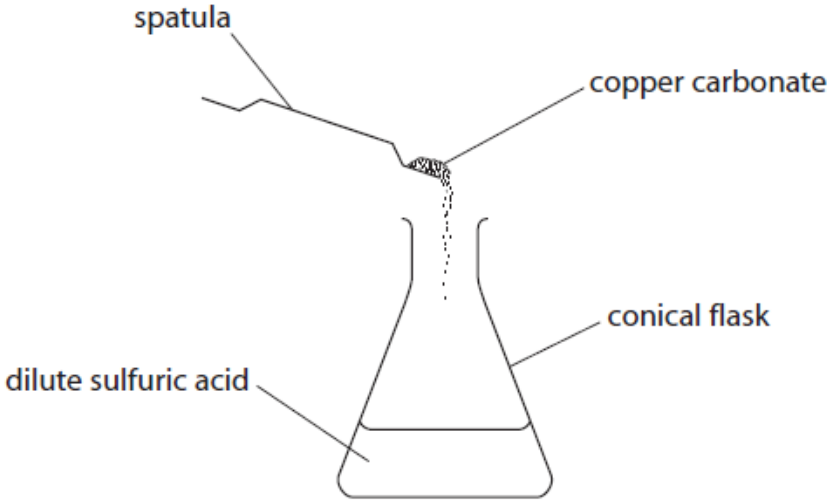


Figure 12

(i) State **two** observations that would show the reaction has finished.

(2)

1 .....

.....

2 .....

.....

*(ii) Describe how you would obtain a solution of copper sulfate from the mixture and how you would obtain pure,
dry copper sulfate crystals from this solution.

Your description should include the apparatus you would use.

You may wish to use diagrams in your answer.

(6)

(Total for question = 8 marks)

Q30.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Figure 11 shows the apparatus that can be used to electrolyse sodium sulfate solution using inert electrodes.

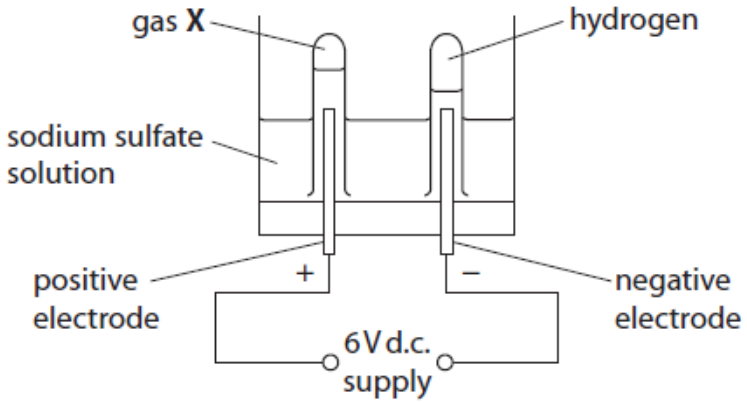


Figure 11

Hydrogen is produced at the negative electrode during electrolysis.

(i) Describe the test to show the gas is hydrogen.

(2)

.....

.....

.....

.....

(ii) What is the name of gas **X** that forms at the positive electrode?

(1)

☒ **A** ammonia

☒ **B** oxygen

☒ **C** nitrogen

☒ **D** sulfur dioxide

(iii) State what is meant by the term **electrolysis**.

(2)

.....

.....

.....

.....

(Total for question = 5 marks)

Q31.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Figure 3 shows the apparatus that can be used to electrolyse sodium sulfate solution using inert electrodes.

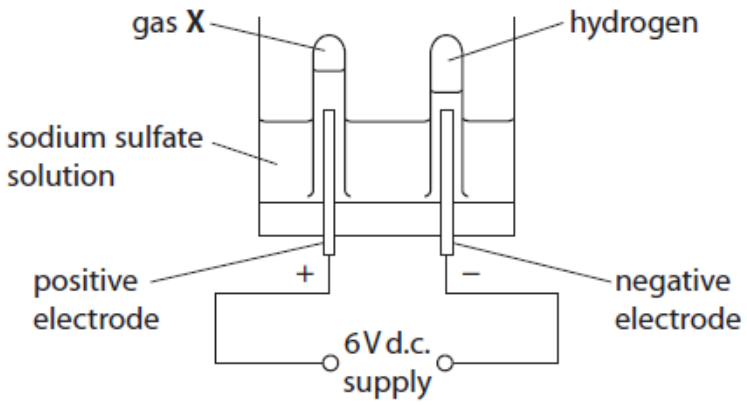


Figure 3

Hydrogen is produced at the negative electrode during electrolysis.

(i) Describe the test to show the gas is hydrogen.

(2)

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(ii) What is the name of gas **X** that forms at the positive electrode?

(1)

☒ **A** ammonia

☒ **B** oxygen

☒ **C** nitrogen

☒ **D** sulfur dioxide

(iii) State what is meant by the term **electrolysis**.

(2)

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(Total for question = 5 marks)

Q32.

Using different reactants, a solution of copper sulfate was prepared.

Describe what should be done to obtain copper sulfate crystals from this copper sulfate solution.

(2)

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(Total for question = 2 marks)

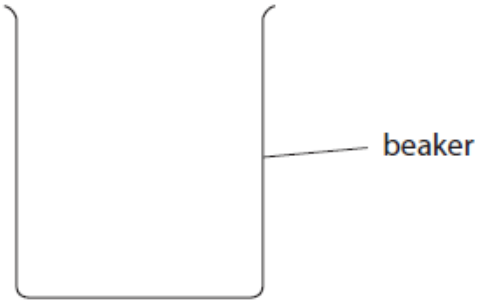
Q33.

A solution of copper sulfate in a beaker is electrolysed using copper electrodes.

(i) Draw a labelled diagram to show how this experiment would be set up.

The beaker has been drawn for you.

(2)



(ii) During the electrolysis, the anode gets smaller, the cathode gets larger and the solution remains the same shade of blue.

Give the reason for each of these observations.

(3)

the anode gets smaller .....

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the cathode gets larger .....

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the solution remains the same shade of blue.....

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(Total for question = 5 marks)

Q34.

(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

The Earth's earliest atmosphere is thought to have been formed by

(1)

☒ **A** animals breathing

☒ **B** photosynthesis in plants

☒ **C** the oceans cooling

☒ **D** gases from volcanoes

(b) (i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The Earth's earliest atmosphere contained large amounts of carbon dioxide.

The percentage of carbon dioxide in the Earth's atmosphere today is

(1)

☒ **A** less than 1%

☒ **B** 5%

☒ **C** 21%

☒ **D** 78%

(ii) Write the formula of a molecule of carbon dioxide.

(1)

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(iii) The percentage of carbon dioxide in the atmosphere has decreased since the Earth's earliest atmosphere.

Explain what has caused the amount of carbon dioxide in the atmosphere to decrease.

(2)

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(iv) State one human activity that increases the amount of carbon dioxide in the atmosphere today.

(1)

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(v) Describe the test to show that a gas is carbon dioxide.

(2)

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Q35.

Figure 11 shows the apparatus that can be used to electrolyse sodium chloride solution in the laboratory.

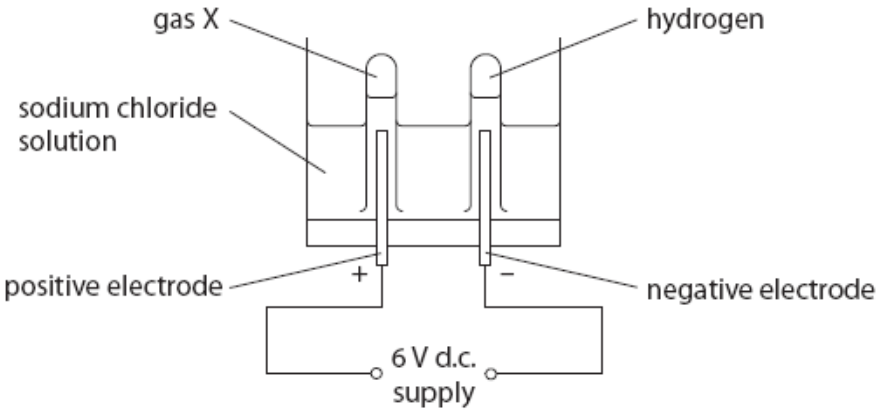


Figure 11

* Molten zinc chloride can be electrolysed.

Describe how this experiment can be carried out in a laboratory, explaining how the products of this electrolysis are formed.

(6)

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(Total for question = 6 marks)

Q36.

Figure 11 shows the apparatus that can be used to electrolyse sodium chloride solution in the laboratory.

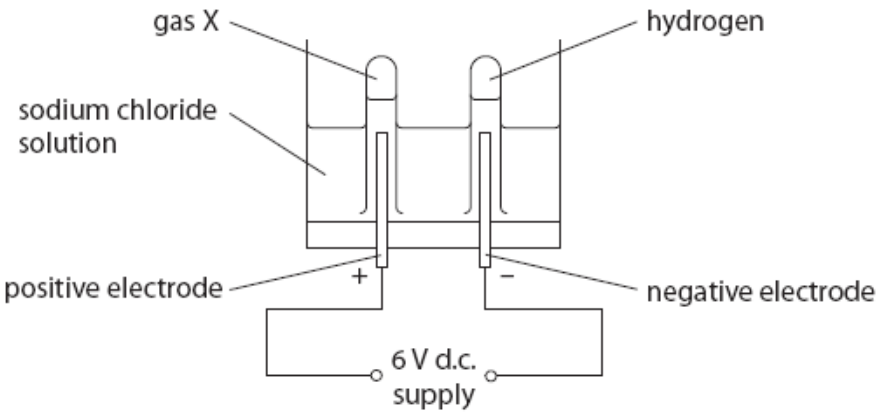


Figure 11

Gases are produced at both electrodes.

(i) State the name of the yellow-green gas X formed at the positive electrode.

(1)

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(ii) Describe the test to show that the gas formed at the negative electrode is hydrogen.

(2)

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(Total for question = 3 marks)

Q37.

Figure 5 shows the apparatus that can be used to electrolyse sodium chloride solution in the laboratory.

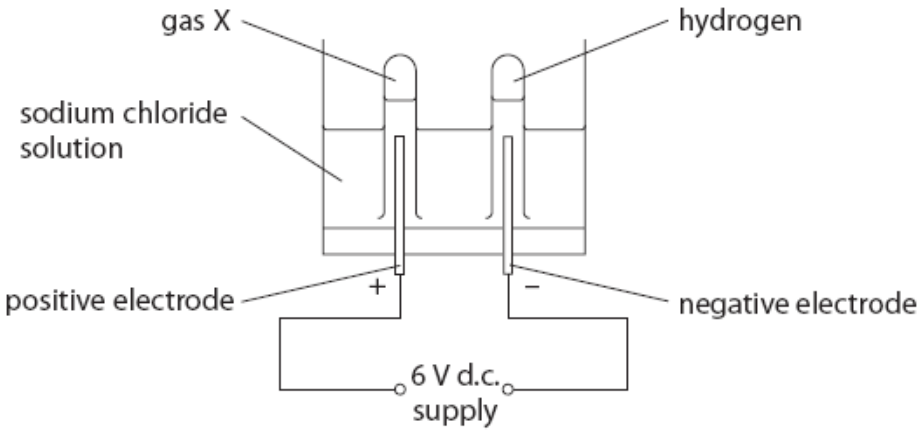


Figure 5

Gases are produced at both electrodes.

(i) State the name of the yellow-green gas X formed at the positive electrode.

(1)

.....

(ii) Describe the test to show that the gas formed at the negative electrode is hydrogen.

(2)

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(Total for question = 3 marks)

Q38.

Copper sulfate solution was electrolysed using copper electrodes.

(i) Draw a labelled diagram to show the apparatus that is used to carry out this electrolysis in the laboratory.

(2)

(ii) Before the electrolysis, the masses of the electrodes were determined.

After the electrolysis, the electrodes were washed and dried and their masses re-determined.

Figure 6 shows these masses and the resulting changes in masses of the electrodes.

	mass of electrode before electrolysis in g	mass of electrode after electrolysis in g	change in mass of electrode in g
anode	11.27	10.42	−0.85
cathode	11.32	12.17	+0.85

Figure 6

Explain these results.

(4)

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(Total for question = 6 marks)

Q39.

(i) When copper sulfate solution is electrolysed using inert electrodes, oxygen is formed at the positively charged anode.

Explain how the oxygen is formed from ions in the solution.

(2)

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(ii) The other product is copper.

1.27 g of copper were produced in an experiment.

Calculate the number of moles of copper, Cu, produced in this experiment.

(Relative atomic mass: Cu = 63.5)

(1)

.....

amount of copper produced = ... mol

Q40.

Molten zinc chloride is an electrolyte.

(i) Which row shows the products formed at the anode and at the cathode when molten zinc chloride is electrolysed?

(1)

		product at anode	product at cathode
☒	**A**	oxygen	zinc
☒	**B**	chlorine	hydrogen
☒	**C**	chlorine	zinc
☒	**D**	oxygen	hydrogen

(ii) Which of the following is the reason why molten zinc chloride is an electrolyte?

(1)

☒ **A** it contains molecules that can move

☒ **B** it has a giant structure

☒ **C** it contains delocalised electrons

☒ **D** it contains ions that can move

(Total for question = 2 marks)

Q41.

Two compounds of barium are barium sulfide and barium chloride.

The sodium chloride solution is electrolysed in the apparatus shown in Figure 8.

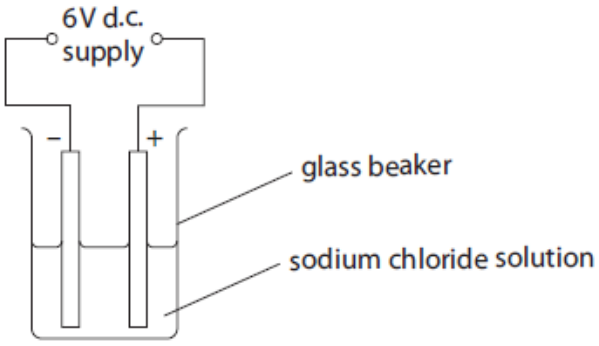


Figure 8

(i) State why sodium chloride solution, rather than solid sodium chloride, must be used in this experiment.

(1)

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(ii) The formulae of the ions present in the sodium chloride solution are

Na^+ Cl^- H^+ OH^-

Circle the ions that would be attracted to the anode.

(1)

(iii) Molten lead bromide can be electrolysed to form molten lead and bromine gas.

Explain how a student could modify the apparatus shown in Figure 8 to carry out this electrolysis.

(2)

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(Total for question = 4 marks)

Q42.

The ions in sodium chloride solution are

sodium ions, Na^+
chloride ions, Cl^-
hydrogen ions, H^+
hydroxide ions, OH^-

Sodium chloride solution is electrolysed using a direct electric current.

(i) Which of these ions will be attracted to the cathode during the electrolysis of sodium chloride solution?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** H^+ ions only

☒ **B** H^+ and Na^+ ions

☒ **C** Cl^- ions only

☒ **D** Cl^- and OH^- ions

(ii) Chlorine is one of the products of the electrolysis.

The half-equation for the production of chlorine is

$$2Cl^- \rightarrow Cl_2 + 2e$$

Explain how the half-equation shows that chloride ions are oxidised.

(2)

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(iii) Suggest why the solution remaining at the end of the electrolysis is alkaline.

(1)

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(iv) The electrolysis of sodium chloride solution does not produce metallic sodium.

State what change you would make to the electrolyte to obtain metallic sodium.

(1)

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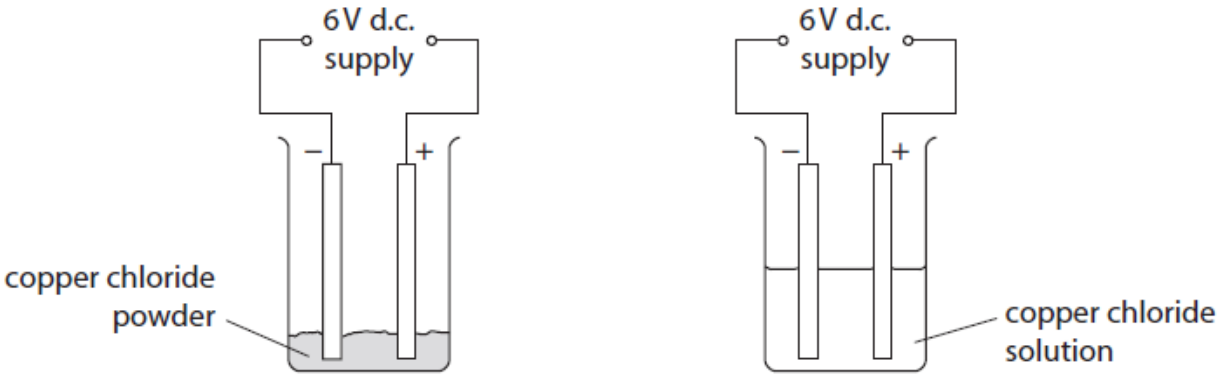
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Q43.

* Carbon electrodes were placed in copper chloride powder.

Some more copper chloride was dissolved in water to make a solution and carbon electrodes were placed in this solution.

In both cases the electrodes were connected to a direct current supply.



The following results were obtained.

substance tested	observation at the cathode (–)	observation at the anode (+)
copper chloride powder	no change	no change
copper chloride solution	red-brown solid formed	bubbles of a yellow-green gas

Explain the results shown in the table for copper chloride powder and the copper chloride solution.

(6)

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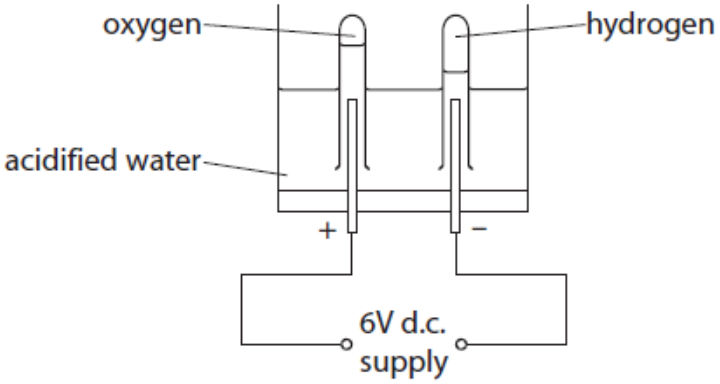
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Q44.

Water, acidified with a small amount of dilute sulfuric acid, can be decomposed by electrolysis using the apparatus shown.



(i) State the form of energy used to carry out the electrolysis.

(1)

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(ii) During the electrolysis, hydrogen is formed at one of the electrodes.

Describe a test to show that this gas is hydrogen.

(2)

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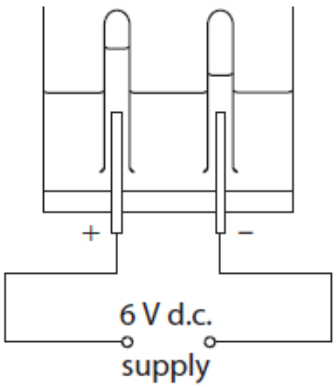
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Q45.

Sodium sulfate solution is electrolysed in the apparatus shown.



Sodium sulfate solution contains sodium ions, Na^+, sulfate ions, SO_4^{2-}, hydrogen ions, H^+, and hydroxide ions, OH^-.

Hydrogen is produced at one electrode and oxygen is produced at the other electrode.

Explain how these products are formed from the ions in the electrolysis process, indicating how you would identify the products.

You may give ionic equations in your answer.

(6)

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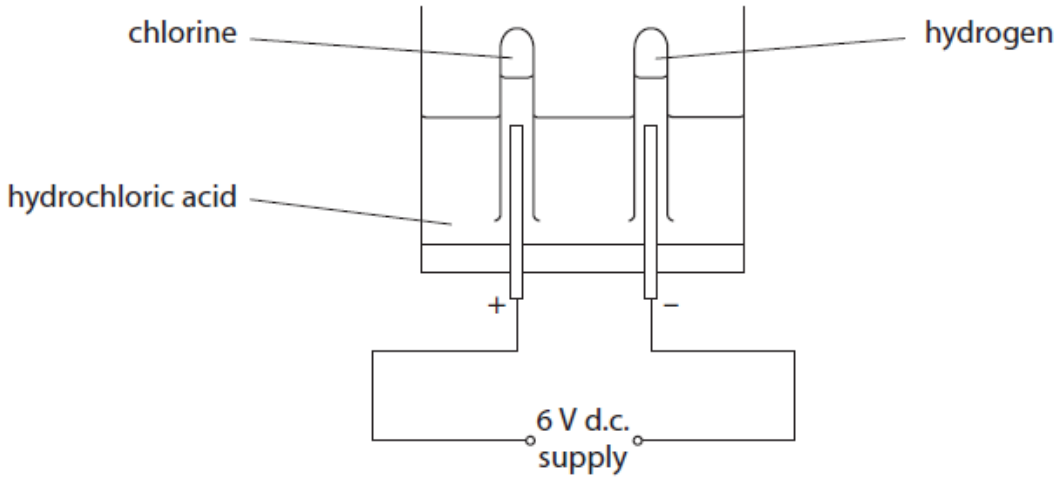
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Q46.

Hydrochloric acid can be used to make chlorine in the apparatus shown.



(i) The experiment shown is an example of electrolysis.

Explain the meaning of **electrolysis**.

(2)

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(ii) Describe the test to show a gas is chlorine.

(2)

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(iii) Great care has to be taken when chlorine is manufactured on a large scale.

Explain the potential hazards of storing large volumes of chlorine.

(2)

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(iv) State a large-scale use of chlorine.

(1)

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Q47.

(a) A solution contains a mixture of ions with the formulae shown.

Na^+	Cl^-	Mg^{2+}	SO_4^{2-}

Give the formulae of **all** the ions that will be attracted to the negatively charged cathode during electrolysis.

(1)

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(b) During electrolysis, reduction takes place at the cathode.

Explain, in terms of electrons, what is meant by reduction.

(2)

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(c) Solid lead bromide cannot be electrolysed.
Molten lead bromide can be electrolysed.

Explain how, when solid lead bromide is melted and electrolysed, bromine is formed at the anode.

(3)

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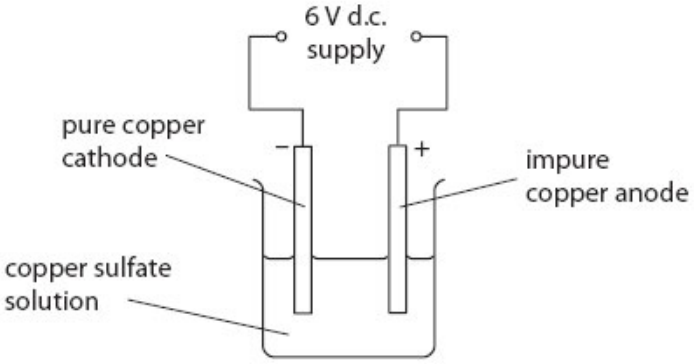
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*(d) Impure copper can be purified using electrolysis.

The impure copper is used as the anode.
A pure copper cathode is used.
The electrodes are placed in copper sulfate solution.
A direct electric current is passed through the solution.



Describe and explain what is seen when this apparatus is used to purify a piece of impure copper.

(6)

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(Total for Question = 12 marks)