PEARSON EDEXCEL GCSE CHEMISTRY · 1CH0

CHEMISTRY



EXAM QUESTION PACK

TOPIC 3: CHEMICAL CHANGES (PACK 2)

SCORE	PERCENTAGE
/115	%

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Q1.

Figure 2 shows a label from a bottle of drinking water.

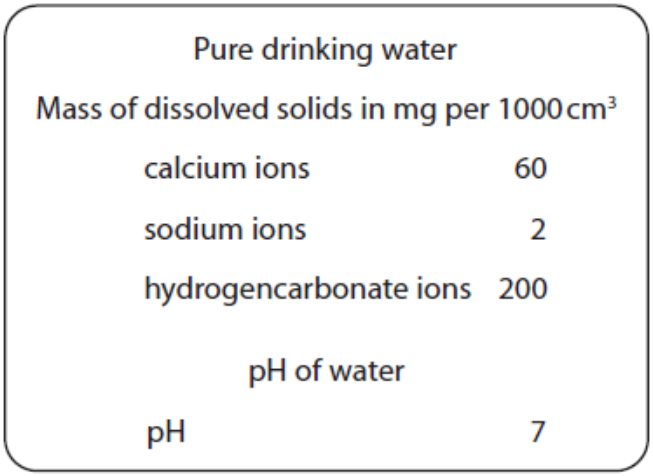


Figure 2

(i) Explain why this drinking water should not be described as pure water.

(2)

.....

.....

(ii) State the information from Figure 2 that shows that the drinking water is neutral.

(1)

.....

(iii) Calculate the mass of calcium ions in 250 cm^3 of this drinking water.

(2)

.....

.....

mass = ... mg

(Total for question = 5 marks)

Q2.

Potassium hydroxide reacts with hydrochloric acid to form potassium chloride and water.

potassium hydroxide + hydrochloric acid → potassium chloride + water

A student carried out a titration to find the exact volume of dilute hydrochloric acid that reacted with 25.0 cm^3 of potassium hydroxide solution.

There were five steps in the titration.
The steps shown are not in the correct order.

step J pour the potassium hydroxide solution into a conical flask and add a few drops of indicator to this solution

step K fill a burette with the dilute hydrochloric acid and record the initial reading from the burette

step L use a measuring cylinder to obtain 25 cm^3 of potassium hydroxide solution

step M take a final reading from the burette and calculate the volume of the dilute hydrochloric acid reacted

step N run the dilute hydrochloric acid from the burette into the conical flask until the indicator changes colour

A student was then asked to produce a pure sample of solid potassium chloride.

After finding the volume of acid reacted in step M, the student added this volume of acid to a fresh 25.0 cm^3 sample of the potassium hydroxide solution.
This mixture was then evaporated.

(i) Explain why this new mixture was evaporated rather than the original mixture from the titration, to produce a
pure sample of solid potassium chloride.

(2)

.....

.....

.....

.....

.....

(ii) After evaporation, the mass of the potassium chloride was determined.

The theoretical yield of the experiment was 0.70 g.
The actual yield was 0.84 g.

This gave a percentage yield greater than 100%.

Calculate the percentage yield of this experiment.

(2)

.....

.....

percentage yield = ...

(iii) Suggest a reason why the actual yield was greater than the theoretical yield.

(1)

.....

.....

.....

(iv) The equation for the reaction between potassium hydroxide solution and dilute hydrochloric acid is

$$KOH + HCl \rightarrow KCl + H_2O$$

Calculate the atom economy for the production of potassium chloride from potassium hydroxide and hydrochloric acid.
(relative formula masses: KOH = 56.0, HCl = 36.5, KCl = 74.5, H_2O = 18.0)

Give your answer to one decimal place.

(4)

.....

.....

.....

.....

.....

.....

atom economy = ... %

(Total for question = 9 marks)

Q3.

Potassium hydroxide reacts with hydrochloric acid to form potassium chloride and water.

potassium hydroxide + hydrochloric acid → potassium chloride + water

A student carried out a titration to find the exact volume of dilute hydrochloric acid that reacted with 25.0 cm^3 of potassium hydroxide solution.

There were five steps in the titration.
The steps shown are not in the correct order.

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This mixture was then evaporated.

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(2)

.....

.....

.....

.....

.....

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The theoretical yield of the experiment was 0.70 g.
The actual yield was 0.84 g.

This gave a percentage yield greater than 100%.

Calculate the percentage yield of this experiment.

(2)

.....

.....

.....

percentage yield = ...

(iii) Suggest a reason why the actual yield was greater than the theoretical yield.

(1)

.....

.....

.....

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Calculate the atom economy for the production of potassium chloride from potassium hydroxide and hydrochloric acid.
(relative formula masses: KOH = 56.0, HCl = 36.5, KCl = 74.5, H_2O = 18.0)

Give your answer to one decimal place.

(4)

.....

.....

.....

.....

.....

.....

atom economy = ... %

(Total for question = 9 marks)

Q4.

Zinc chloride and zinc carbonate contain ions.

Zinc chloride mixed with water can be electrolysed.
Zinc carbonate mixed with water cannot be electrolysed.

Explain this difference.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

Q5.

When sodium sulfate solution is electrolysed, using inert electrodes, hydrogen is formed at the cathode.

Write the half equation for the formation of hydrogen gas, H_2, from hydrogen ions, H^+.

(2)

.....

(Total for question = 2 marks)

Q6.

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

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

(1)

☒ **A** greater than 5%

☒ **B** 4%

☒

C 3%

☒ **D** less than 0.5%

(ii) The percentage of carbon dioxide in the Earth's atmosphere today is less than that in the Earth's earliest atmosphere.
Explain what has caused the percentage of carbon dioxide to decrease.

(2)

.....

.....

.....

(iii) Carbon dioxide and other gases in the atmosphere help to keep the Earth warm.
State how these gases keep the Earth warm.

(1)

.....

.....

.....

.....

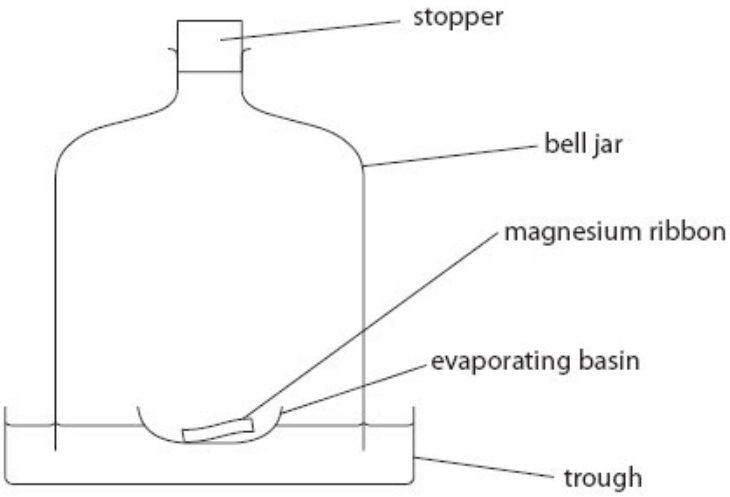
(b) Describe the test to show that a gas is oxygen.

(2)

.....

.....

(c) Magnesium reacts with oxygen to form magnesium oxide.
An excess of magnesium ribbon was placed in an evaporating basin that was floated on water in a trough.
The magnesium ribbon was lit.
A bell jar was placed over the evaporating basin and the stopper inserted to seal the experiment.



When the magnesium flame went out, there was some magnesium left in the basin.
When the apparatus had cooled, the water in the bell jar had risen.

(i) Explain why the water level had risen.

(2)

.....

.....

.....

.....

(ii) At the start of the experiment, the volume of the air in the bell jar was 1000 cm^3.
Assume that 21% of the air by volume is oxygen.
Calculate the volume of gas that was present in the bell jar at the end of the experiment.

(2)

.....

.....

.....

.....

volume of gas = ... cm^3

(d) Metal oxides react with acids to produce salts and water.
Dilute sulfuric acid was added to magnesium oxide.
State the name of the salt formed.

(1)

.....

(Total for Question = 11 marks)

Q7.

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 ☒.

Hydrochloric acid reacts with solid **B**.
Solid **B** is an alkali.

A student carries out an experiment to see how the pH changes when different masses of solid **B** are added to dilute hydrochloric acid.

The student uses the following method.

step 1 use a measuring cylinder to measure out 100 cm^3 of dilute hydrochloric acid

step 2 pour the acid into a beaker

step 3 measure the pH with a pH probe

step 4 add half a spatula of solid **B** and stir

step 5 repeat steps 3 and 4 until the pH stops changing.

(i) Give a safety precaution that should be taken during the experiment.

(1)

.....

.....

(ii) Give an improvement to step 4 that would produce more accurate results.

(1)

.....

.....

(iii) What is the most likely change in pH during the experiment?

(1)

☒ **A** from 1 to 7

☒ **B** from 1 to 12

☒ **C** from 7 to 12

☒

D from 12 to 1

(iv) If some methyl orange indicator is added to the acid in step 2, the mixture changes colour during the experiment.

State the colour change.

(2)

colour at start in acid ..... colour at end .....

(Total for question = 5 marks)

Q8.

In an experiment magnesium hydroxide powder is added in 0.1 g portions to 25 cm^3 of dilute hydrochloric acid until the magnesium hydroxide is just in excess.

Universal indicator paper can be used to test the pH of the solution after each addition of magnesium hydroxide.

(i) Give the name of an alternative piece of equipment that can be used to measure pH.

(1)

.....

(ii) State and explain how the pH changes as the magnesium hydroxide is added to the dilute hydrochloric acid.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 5 marks)

Q9.

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 ☒.

Concentrated hydrochloric acid can be broken down using electricity.
The apparatus that can be used is shown in Figure 6.

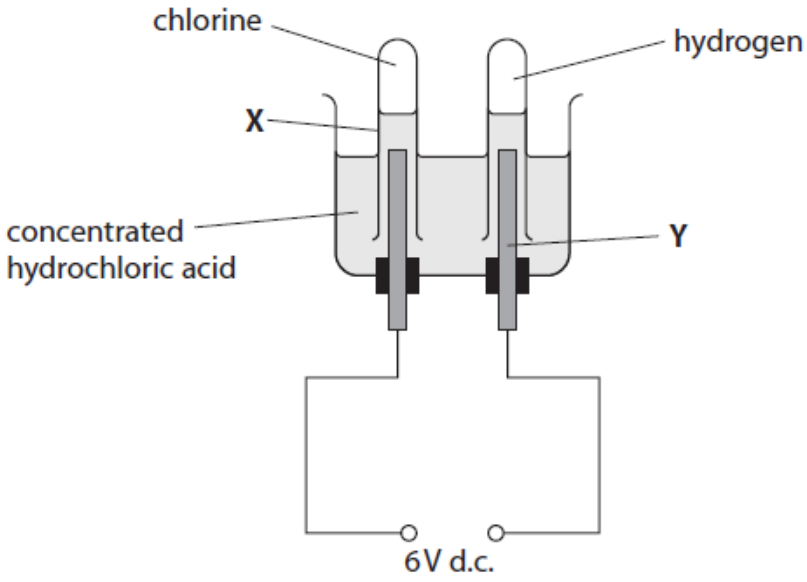


Figure 6

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

(1)

.....

(ii) The rod labelled **Y** in Figure 6 is made of graphite.

What is the name of this piece of apparatus?

(1)

☒ **A** electrode

☒ **B** electrolysis

☒ **C** electrolyte

☒ **D** electron

(iii) Give **one** reason why graphite is a suitable material to make **Y**.

(1)

.....

(iv) Complete the balanced equation for the reaction that occurs.

(1)

..... $HCl \rightarrow H_2 + Cl_2$

(Total for question = 4 marks)

Q10.

Metals are extracted from substances naturally occurring in the Earth's crust.

Aluminium is extracted from aluminium oxide by electrolysis.
Aluminium oxide is made up of ions.

(i) The formula of aluminium oxide is Al_2O_3.

Give the number of ions in the formula Al_2O_3.

(1)

.....

(ii) Complete the balanced equation for the overall reaction by putting numbers in the spaces.

(2)

$2Al_2O_3 \rightarrow$ ..... Al + ... O_2

(Total for question = 3 marks)

Q11.

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

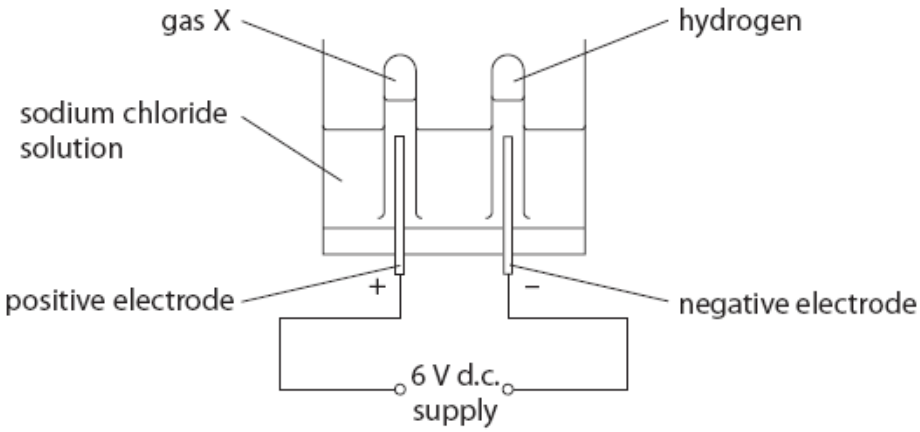


Figure 5

Write the half equation for the formation of hydrogen gas from hydrogen ions at a negative electrode.

(2)

.....

(Total for question = 2 marks)

Q12.

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

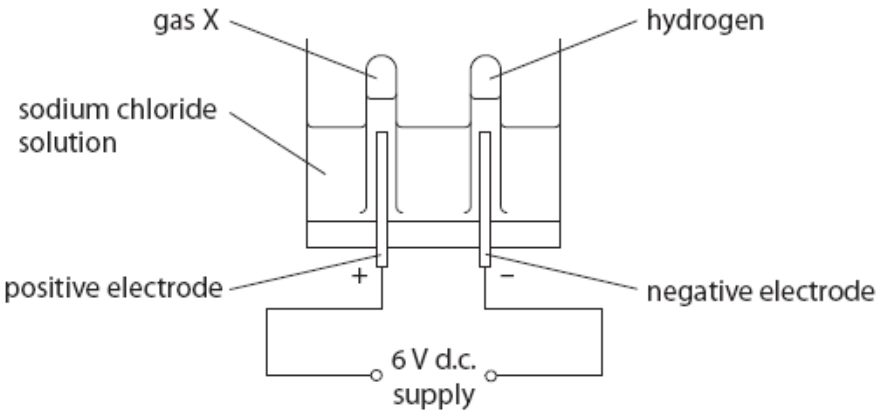


Figure 11

State what could be added to the circuit to show that an electric current is flowing.

(1)

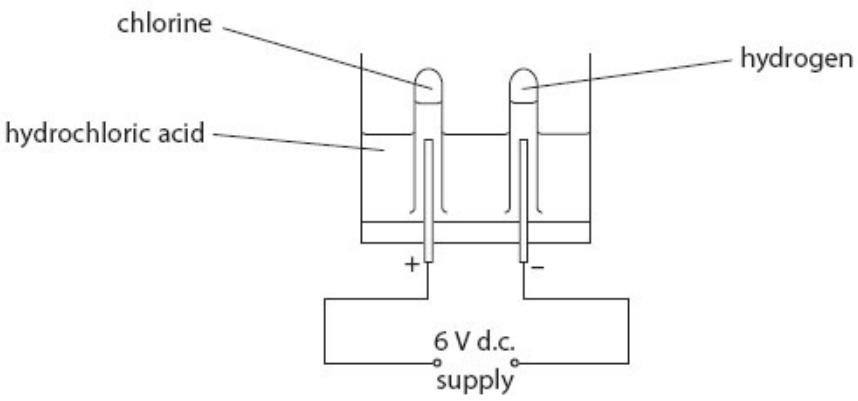
.....

(Total for question = 1 mark)

Q13.

(a) Electrolysis of hydrochloric acid produces chlorine and hydrogen.

The apparatus used is shown.



(i) Explain what is meant by **electrolysis.**

(2)

.....

.....

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

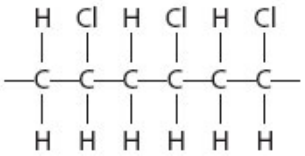
(2)

.....

.....

.....

(iii) Chlorine is used in the manufacture of a polymer.
Part of this polymer molecule is



State the name of the polymer.

(1)

.....

(b) Dilute hydrochloric acid reacts with silver nitrate solution to form silver chloride and nitric acid.

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

The reaction produces silver chloride as a precipitate.
In an equation this would be shown as

(1)

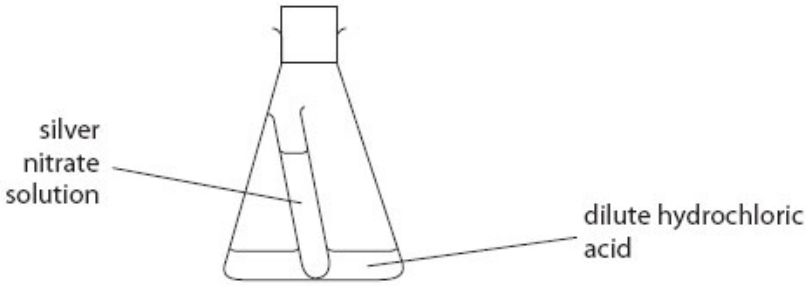
☒ **A** AgCl(aq)

☒ **B** AgCl(g)

☒ **C** AgCl(l)

☒ **D** AgCl(s)

(ii) This apparatus is used to investigate the mass of the reactants and the mass of products in this reaction.



The total mass of this apparatus was measured.
The flask was shaken to allow the silver nitrate solution and dilute hydrochloric acid to react.
After the reaction the total mass of the apparatus was measured again.

State how the total mass of the apparatus after the reaction will compare with the total mass of the apparatus before the reaction.

(1)

.....

(iii) Write the balanced equation for the reaction of silver nitrate solution, $AgNO_3$, with dilute hydrochloric acid to form silver chloride, AgCl, and nitric acid.

(2)

.....

(Total for Question = 9 marks)

Q14.

The hydrogen ion concentration in a solution is decreased by a factor of 10.

State how the pH of this solution changes.

(1)

.....

(Total for question = 1 mark)

Q15.

In the electrolysis of sodium chloride solution, bubbles of a colourless gas form at the cathode. This gas, when mixed with air, burns with a squeaky pop.

(i) Identify this gas.

(1)

.....

(ii) Explain how this gas is formed at the cathode.

(2)

.....

.....

.....

.....

(Total for question = 3 marks)

Q16.

The method used to prepare a salt depends on its solubility in water.

Complete Figure 9 by placing one tick in each row to show whether the salt is soluble or insoluble.

(2)

salt	soluble	insoluble
ammonium chloride		
lithium sulfate		
magnesium carbonate		

Figure 9

(Total for question = 2 marks)

Q17.

Objects made from transition metals are sometimes coated with a thin layer of another transition metal to improve their appearance and to protect against corrosion.

Figure 10 shows equipment that can be used to electroplate an iron spoon with silver.

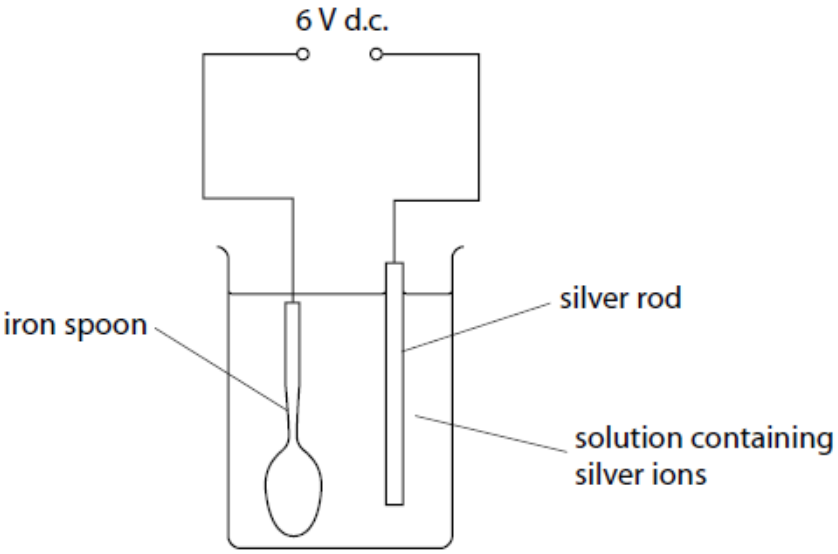


Figure 10

(i) Which row of the table correctly shows the charge on the silver rod electrode and the type of reaction occurring at this electrode?

(1)

	charge	type of reaction
☒ **A**	negative	oxidation
☒ **B**	negative	reduction
☒ **C**	positive	oxidation
☒ **D**	positive	reduction

(ii) Silver metal is deposited on the spoon.

Which half-equation represents this reaction?

(1)

☒ **A** $Ag + e \rightarrow Ag^+$

☒ **B** $Ag \rightarrow Ag^+ + e^-$

☒ **C** $Ag^+ + e \rightarrow Ag$

☒ **D** $Ag^+ \rightarrow Ag + e^-$

(Total for question = 2 marks)

Q18.

The method used to prepare a salt depends on its solubility in water.

Complete Figure 19 by placing one tick in each row to show whether the salt is soluble or insoluble.

(2)

salt	soluble	insoluble
ammonium chloride		
lithium sulfate		
magnesium carbonate		

Figure 19

(Total for question = 2 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 ☒.

When solid sodium chloride is mixed with water, sodium chloride solution forms.

What name is given to the process of mixing a solid with water to form a solution?

(1)

☐ **A** crystallising

☐ **B** diluting

☐ **C** dissolving

☐ **D** melting

(Total for question = 1 mark)

Q20.

Ethanol can be produced by a process called fermentation.
Carbon dioxide is formed during fermentation.

In the test for carbon dioxide, the gas is bubbled through limewater and a white precipitate forms.

What is the name of this white precipitate?

(1)

☒ **A** calcium oxide

☒ **B** calcium hydroxide

☒ **C** calcium hydrogencarbonate

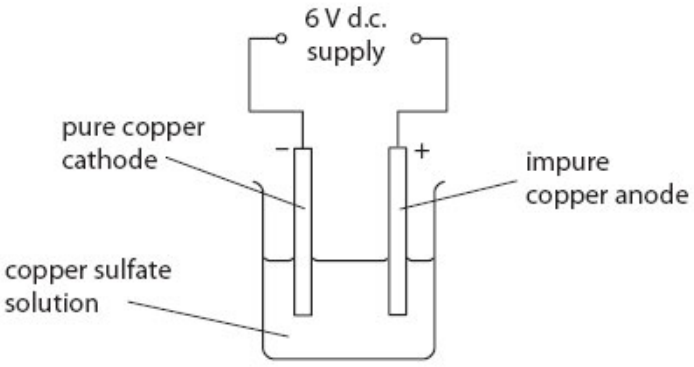
☒ **D** calcium carbonate

(Total for question = 1 mark)

Q21.

* 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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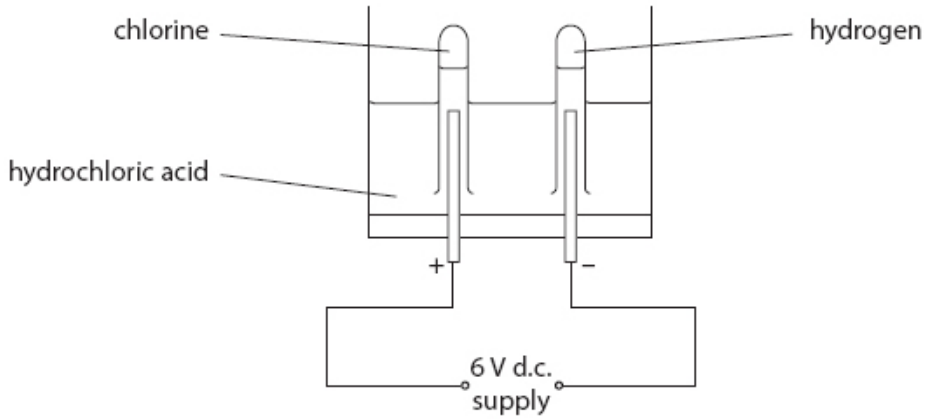
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Q22.

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)

.....

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

(2)

.....

.....

.....

Q23.

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)

.....

Q24.

(a) Sodium chloride is a metal chloride which is soluble in cold water.

(i) Give the name of a metal chloride which is insoluble in cold water.

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

(1)

☒ **A** copper chloride

☒ **B** lead chloride

☒ **C** magnesium chloride

☒ **D** potassium chloride

(ii) Sodium chloride has a melting point of 801 °C.

Explain why the melting point of sodium chloride is high.

(2)

.....

.....

.....

(iii) Describe how you would test for the presence of chloride ions in a solution of sodium chloride.

(3)

.....

.....

.....

.....

.....

.....

*(b) Magnesium has an electronic configuration of 2.8.2.
Oxygen has an electronic configuration of 2.6.

Explain, in terms of their electronic configurations, how magnesium and oxygen atoms react to form the ionic compound magnesium oxide, MgO, and include a description of the structure of solid magnesium oxide.

(6)

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.....

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.....

.....

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.....

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.....

.....

.....

(Total for Question = 12 marks)

Q25.

(a) Which of the following is the formula of a cation?

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

(1)

☒ **A** Mg

☒ **B** Na^+

☒ **C** H_2O

☒ **D** F^-

(b) (i) The formula of a potassium ion is K^+ and of a carbonate ion is CO_3^{2-}.

Which of the following is the formula of potassium carbonate?

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

(1)

☒ **A** KCO_3

☒ **B** $K(CO)_3$

☒ **C** K_2CO_3

☒ **D** $K(CO_3)_2$

(ii) When dilute hydrochloric acid is added to potassium carbonate, a gas is evolved.

Describe the test for this gas.

(2)

.....

.....

.....

.....

Q26.

When magnesium is added to dilute ethanoic acid, a colourless gas is formed. This gas gives a squeaky pop when mixed with air and ignited.

Give the name of the gas given off in this reaction.

(1)

.....

Q27.

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)

.....

Q28.

Making sodium chloride

To make pure sodium chloride from sodium hydroxide solution and dilute hydrochloric acid, a titration has to be used.

(a) Ethanol is produced by fermentation of carbohydrates.

The equation for the reaction is

$$HCl(aq) + NaOH(aq) \rightarrow NaCl(.....) + H_2O(.....)$$

(a) Which state symbols follow NaCl and H_2O to complete the equation?

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

(1)

		NaCl	H_2O
☒	**A**	s	l
☒	**B**	aq	aq
☒	**C**	s	aq
☒	**D**	aq	l

(b) The reaction above is a neutralisation reaction.

Write the ionic equation for the reaction.

(2)

.....

(c) When sodium hydroxide solution is titrated with dilute hydrochloric acid, an acid-base indicator is used.
The hydrochloric acid is added from a burette to the sodium hydroxide solution in a conical flask. At the end point the indicator changes colour.

(i) Give the name of a suitable indicator to use in this titration.

(1)

.....

(ii) State the colour change for this indicator at the end point.

(1)

from ..... to .....

(d) A sodium hydroxide solution was made up by dissolving 20.0 g of sodium hydroxide in water and making the volume of the solution up to 1.00 dm^3. Calculate the concentration of sodium hydroxide, NaOH, in this solution in mol dm^{-3}.

(relative atomic masses: H = 1.00, O = 16.0, Na = 23.0)

(2)

.....

.....

.....

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

(e) In another experiment, a titration was carried out.
25.0 cm^3 of 1.50 mol dm^{-3} sodium hydroxide solution, NaOH, was titrated with hydrochloric acid.
The volume of the hydrochloric acid required to neutralise the sodium hydroxide solution was 30.0 cm^3.

Calculate the concentration of the hydrochloric acid, HCl, in mol dm^{-3}.

$$HCl + NaOH \rightarrow NaCl + H_2O$$

(3)

.....

.....

.....

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.....

.....

.....

.....

.....

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

(Total for question = 10 marks)

Q29.

Two compounds of barium are barium sulfide and barium chloride.

(i) A beaker of barium chloride solution and a beaker of dilute sulfuric acid were placed on a balance, as shown in Figure 6.

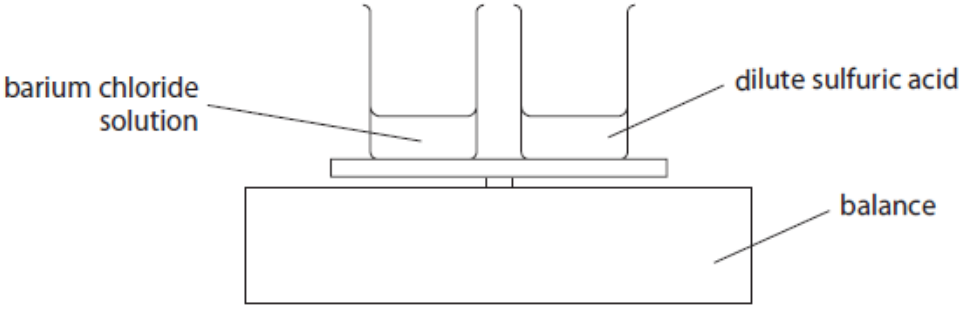


Figure 6

The total mass reading on the balance was 25.7 g.

The dilute sulfuric acid was poured into the barium chloride solution and the beaker replaced on the balance, as shown in Figure 7.

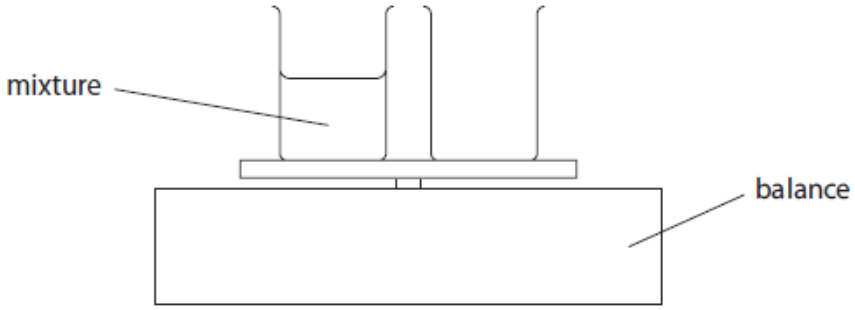


Figure 7

The mixture formed contained a white precipitate.

State the total mass reading on the balance after the reaction.

(1)

.....

(ii) Give the name of the white precipitate formed by the reaction of barium chloride solution with dilute sulfuric acid.

(1)

.....

(Total for question = 2 marks)

Q30.

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 → ..... + ...

Q31.

Calcium nitrate is a soluble salt.

Using the rules of solubility, suggest the name of a solution that will react with calcium nitrate solution to form an insoluble solid.

(1)

.....

(Total for question = 1 mark)

Q32.

Hydrochloric acid is present in the stomach to help digestion.

(a) State another effect hydrochloric acid has in the stomach.

(1)

.....

.....

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

Indigestion can occur when excess acid is present in the stomach.
To relieve the pain caused by indigestion, people take indigestion tablets.

Indigestion tablets in the stomach

(1)

☒ **A** dilute the excess acid

☒ **B** neutralise the excess acid

☒ **C** polymerise the excess acid

☒ **D** oxidise the excess acid

(c) Some indigestion remedies contain magnesium hydroxide.

Which of the following substances is formed when magnesium hydroxide reacts with hydrochloric acid in the stomach?

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

(1)

☒ **A** magnesium chloride

☒ **B** magnesium carbonate

☒ **C** magnesium nitrate

☒ **D** magnesium sulfate

Q33.

Excess solid nickel carbonate is added to dilute sulfuric acid in a beaker.

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

Nickel sulfate is formed in solution.

Describe how a sample of pure, dry nickel sulfate crystals can be obtained from the mixture of nickel sulfate solution and excess solid nickel carbonate in the beaker.

(3)

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(Total for question = 3 marks)

Q34.

Excess solid nickel carbonate is added to dilute sulfuric acid in a beaker.

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

Nickel sulfate is formed in solution.

Describe how a sample of pure, dry nickel sulfate crystals can be obtained from the mixture of nickel sulfate solution and excess solid nickel carbonate in the beaker.

(3)

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(Total for question = 3 marks)

Q35.

Vinegar contains ethanoic acid.

(a) Which of these is a use of vinegar?

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

(1)

☒ **A** fuel

☒ **B** perfume

☒ **C** preservative

☒ **D** soap

(b) An indicator can be used to show that ethanoic acid is acidic.

Give the name of an indicator that can be used and state its colour in the acid.

(2)

indicator

.....

colour in acid

.....

(c) Use the gases from the box to complete the sentences.

Each gas may be used once, more than once or not at all.

carbon dioxide	hydrogen	nitrogen	oxygen

(3)

(i) If a bottle of wine is left open, ethanoic acid is formed when

ethanol in the wine is oxidised by ..... .

(ii) Ethanoic acid reacts with magnesium to give a gas. When the gas is mixed

with air and ignited with a lighted splint, it gives a squeaky pop.

This gas is ..... .

(iii) When solid sodium carbonate is added to dilute ethanoic acid,

effervescence occurs. The effervescence is bubbles of ..... .

(d) Ethanoic acid is reacted with ethanol to produce an ester, ethyl ethanoate, and water.

Write the word equation for this reaction.

(2)

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Q36.

(a) (i) Which of the following is the formula for a molecule of butane?

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

(1)

☒ **A** C_3H_6

☒ **B** C_3H_8

☒ **C** C_4H_8

☒ **D** C_4H_{10}

(ii) Draw the structure of a molecule of propene, showing all covalent bonds.

(2)

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

Ethanol, C_2H_5OH, can be converted into ethanoic acid, CH_3COOH.

In this reaction, ethanol is

(1)

- ☒ **A** dehydrated
- ☒ **B** neutralised
- ☒ **C** neutralised
- ☒ **D** reduced

(c) (i) Describe what you would **see** when solid sodium carbonate is added to dilute ethanoic acid.

(2)

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(ii) When ethanoic acid reacts with ethanol, one of the products is the ester, ethyl ethanoate.

Complete the balanced equation for this reaction.

(2)

$CH_3COOH + C_2H_5OH \rightarrow$ ..... + ...

(Total for Question = 8 marks)

Q37.

Universal indicator solution is not a suitable indicator for an acid-alkali titration.

(i) Give the name of an indicator that is suitable for use in the titration of sodium hydroxide solution with hydrochloric acid.

(1)

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(ii) Universal indicator goes through a series of gradual colour changes as the pH changes in a solution.

Give a reason why universal indicator is not a suitable indicator to use in an acid-alkali titration.

(1)

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(Total for question = 2 marks)

Q38.

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 ☒.

Three different metals are added to separate test tubes of acid.

The observations are shown in Figure 4.

metal	observation
silver	no change is seen
iron	very slow bubbling
magnesium	steady bubbling

Figure 4

(i) Place the metals in order of reactivity from most to least reactive.

(1)

most reactive .....

.....

least reactive .....

(ii) Hydrogen is given off when magnesium reacts with acid.
The hydrogen is tested by collecting the gas in a test tube and igniting it.

What is the safest way to ignite the gas?

(1)

☒ **A** add fuel to the test tube

☒ **B** heat the test tube with a Bunsen burner

☒

C put a lighted splint at the open end of the test tube

☒ **D** put the test tube in an oven

(iii) State the observation made in this test that shows that the gas is hydrogen.

(1)

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.....

(Total for question = 3 marks)

Q39.

Barium nitrate solution is added to potassium sulfate solution in a beaker.
A white precipitate of barium sulfate forms in a mixture with potassium nitrate solution.

Describe how you would obtain a pure, dry sample of barium sulfate from the mixture in the beaker.

(3)

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Q40.

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

The word equation for the reaction is

magnesium oxide + sulfuric acid → magnesium sulfate + 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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Q41.

* A student is told to prepare pure, dry crystals of ammonium sulfate.

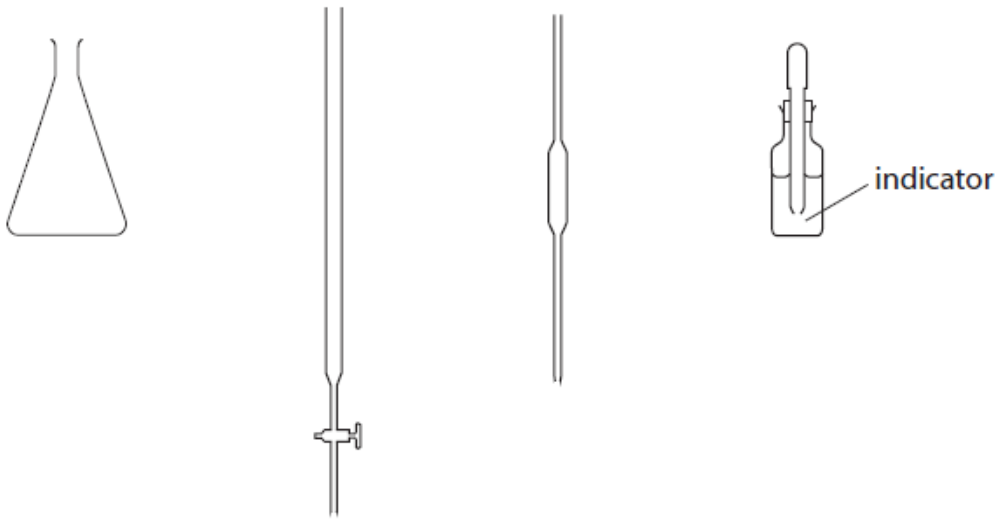
The student is told to carry out the experiment in four stages.

Stage 1: take 25.0 cm^3 of ammonia solution
Stage 2: find the volume of sulfuric acid that is needed to neutralise the ammonia solution
Stage 3: use this result to prepare an ammonium sulfate solution
Stage 4: prepare pure, dry crystals of ammonium sulfate from this solution

Describe how the student should carry out this experiment.

Some of the following apparatus may be used in the experiment.

(6)



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Q42.

A student investigated the rate of a reaction.
The student investigated the reaction between zinc and dilute sulfuric acid.
The products are zinc sulfate, $ZnSO_4$, and hydrogen.

(i) Write the balanced equation for this reaction.

(2)

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*(ii) The student carried out two experiments.
The same mass of zinc and the same sized pieces of zinc were used in each experiment.

The results are shown in the table.

	experiment 1	experiment 2
concentration of sulfuric acid / mol dm^{-3}	0.5	1.5
temperature / °C	20	40
rate of reaction	slow	fast

Evaluate these results, explaining the reasons why the rate of reaction in experiment 2 is faster than the rate of reaction in experiment 1.
In your answer you should refer to the frequency and energy of collisions between particles.

(6)

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Q43.

The word equation for the reaction of dilute ethanoic acid with sodium hydroxide solution is

ethanoic acid + sodium hydroxide → sodium ethanoate + water

Complete the balanced equation for this reaction.

CH_3COOH + ... → CH_3COONa + ...

Q44.

Titration can be used to determine the exact amount of hydrochloric acid that reacts with a given amount of sodium hydroxide solution.

$$HCl + NaOH \rightarrow NaCl + H_2O$$



What type of reaction takes place when hydrochloric acid reacts with sodium hydroxide solution?

(1)

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

☒ **A** neutralisation

☒ **B** oxidation

☒ **C** precipitation

☒ **D** reduction

Q45.

Dilute hydrochloric acid reacts with silver nitrate solution to form silver chloride and nitric acid.

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

The reaction produces silver chloride as a precipitate.
In an equation this would be shown as

(1)

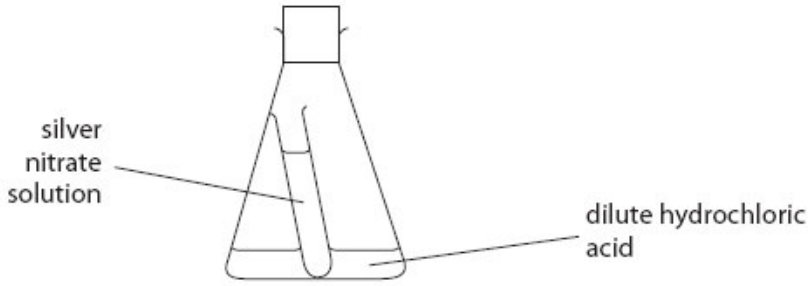
☒ **A** AgCl(aq)

☒ **B** AgCl(g)

☒ **C** AgCl(l)

☒ **D** AgCl(s)

(ii) This apparatus is used to investigate the mass of the reactants and the mass of products in this reaction.



The total mass of this apparatus was measured.
The flask was shaken to allow the silver nitrate solution and dilute hydrochloric acid to react.
After the reaction the total mass of the apparatus was measured again.

State how the total mass of the apparatus after the reaction will compare with the total mass of the apparatus before the reaction.

(1)

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(iii) Write the balanced equation for the reaction of silver nitrate solution, $AgNO_3$, with dilute hydrochloric acid to form silver chloride, AgCl, and nitric acid.

(2)

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Q46.

(i) Describe what you would **see** when solid sodium carbonate is added to dilute ethanoic acid.

(2)

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(ii) When ethanoic acid reacts with ethanol, one of the products is the ester, ethyl ethanoate.

Complete the balanced equation for this reaction.

(2)

$CH_3COOH + C_2H_5OH \rightarrow$ ..... + ...

Q47.

(a) A student investigated the rate of a reaction.
The student investigated the reaction between zinc and dilute sulfuric acid.
The products are zinc sulfate, $ZnSO_4$, and hydrogen.

(i) Write the balanced equation for this reaction.

(2)

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*(ii) The student carried out two experiments.
The same mass of zinc and the same sized pieces of zinc were used in each experiment.

The results are shown in the table.

	experiment 1	experiment 2
concentration of sulfuric acid / mol dm^{-3}	0.5	1.5
temperature / °C	20	40
rate of reaction	slow	fast

Evaluate these results, explaining the reasons why the rate of reaction in experiment 2 is faster than the rate of reaction in experiment 1.
In your answer you should refer to the frequency and energy of collisions between particles.

(6)

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(b) Zinc is reacted with copper sulfate solution.
The equation for the reaction is

$$Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$$

(i) What type of reaction is this?

(1)

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

☒ **A** decomposition

☒ **B** displacement

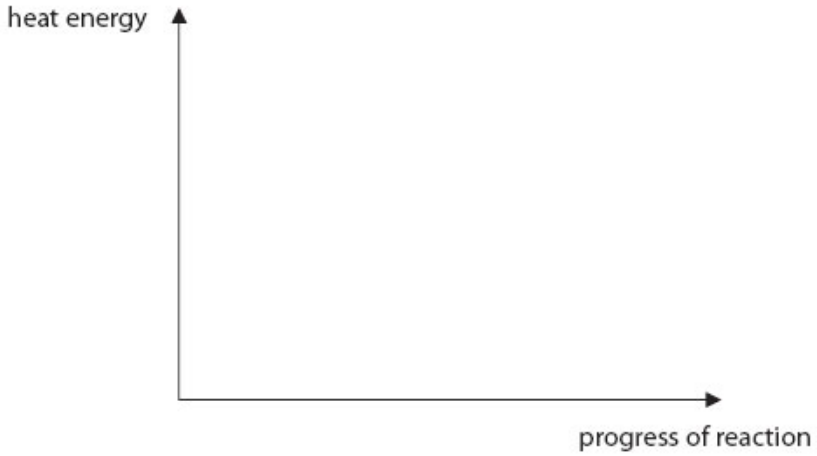
☒ **C** dissolving

☒ **D** neutralisation

(ii) This reaction is exothermic.

On the diagram below draw labelled lines to show the relative energies of the reactants and products in this reaction.

(2)



(Total for Question = 11 marks)

Q48.

During electrolysis, reduction takes place at the cathode.

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

(2)

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Q49.

Salts and analysis

(a) Which of the following pairs of substances contains one substance that is soluble in water and one that is insoluble in water?

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

(1)

☒ **A** aluminium nitrate and lead sulfate

☒ **B** ammonium chloride and copper sulfate

☒ **C** copper hydroxide and lead sulfate

☒ **D** sodium hydroxide and potassium nitrate

(b) Barium chloride is an ionic compound and has a high melting point.

Explain why barium chloride has a high melting point.

(2)

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(c) Barium chloride solution is used to test for the presence of sulfate ions in a solution.

When sulfate ions are present, insoluble barium sulfate is formed.

(i) Describe the appearance of barium sulfate.

(1)

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(ii) Complete the balanced equation for the reaction between barium chloride and potassium sulfate.

(2)

$BaCl_2 + K_2SO_4 \rightarrow$ .....

(d) Compound **X** is a metal carbonate.

(i) A flame test was carried out on compound **X**.
A lilac flame was seen.

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

(1)

The formula of the metal ion in compound **X** is

☒ **A** Ca^{2+}

☒ **B** Cu^{2+}

☒ **C** K^{+}

☒ **D** Na^{+}

(ii) Lead carbonate is an insoluble salt.

Describe how a pure, dry sample of solid lead carbonate can be obtained from sodium carbonate solution and lead nitrate solution.

(3)

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(Total for question = 10 marks)

Q50.

Salts

(a) A mass of magnesium sulfate was taken.

mass of watch glass + magnesium sulfate = 18.50 g

mass of watch glass = 18.20 g

The solid was dissolved in water to make 500 cm^3 solution.

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

(1000 cm^3 = 1 dm^3)

(2)

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

(b) A titration is used to determine the exact volumes of sulfuric acid and sodium hydroxide solution that neutralise each other.

25.00 cm^3 of sodium hydroxide solution is put into a conical flask and a few drops of indicator solution are added.

The sulfuric acid is added slowly from a burette until the indicator changes colour when all the sodium hydroxide is just neutralised.

(i) State what is used to measure out 25.00 cm^3 of sodium hydroxide solution.

(1)

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(ii) State the name of an indicator that could be used and the colour change seen in this titration.

(3)

indicator

.....

colour in sodium hydroxide solution

.....

colour at end of titration

.....

*(c) Copper sulfate is a soluble salt.
Copper sulfate can be prepared by reacting copper oxide with dilute sulfuric acid.
Copper oxide is an insoluble solid.

Describe how you would prepare some pure, dry crystals of copper sulfate by reacting excess copper oxide with dilute sulfuric acid.

(6)

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(Total for question = 12 marks)

Q51.

Metal oxides react with acids to produce salts and water.
Dilute sulfuric acid was added to magnesium oxide.
State the name of the salt formed.

(1)

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Q52.

Salts

(a) Solutions of soluble salts can react together to form an insoluble salt.

What name is given to this type of reaction?

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

(1)

☒ **A** combustion

☒ **B** neutralisation

☒ **C** precipitation

☒ **D** separation

(b) Information about the solubility of some salts is given below.

- all nitrates are soluble
- all common carbonates are insoluble except sodium carbonate, potassium carbonate and ammonium carbonate.

Copper carbonate can be made by reacting together solutions of sodium carbonate and copper nitrate.

Complete this equation by filling in the missing state symbols.

(2)

$$\text{sodium carbonate}(aq) + \text{copper nitrate}(aq) \rightarrow \text{copper carbonate}(\ldots\ldots) + \text{sodium nitrate}(\ldots\ldots)$$

(c) The symbol for a copper ion is Cu^{2+}.

The symbol for a carbonate ion is CO_3^{2-}.

Write the formula for copper carbonate.

(1)

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(d) In an experiment, solid lead iodide is produced in a mixture with a solution of a soluble salt.

Describe how a pure, dry sample of solid lead iodide can be obtained from this mixture.

(3)

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(e) Two tests were carried out to identify the ions in salt **X**.

(i) Test: flame test on solid salt **X**.

Result: lilac flame.

Identify the ion in salt **X** that gives the lilac flame.

(1)

ion in salt **X** .....

(ii) Test: addition of dilute nitric acid and silver nitrate solution to a solution of salt **X**.

Result: white solid formed.

Identify the ion in salt **X** that produces the white solid.

(1)

ion in salt **X** .....

(Total for question = 9 marks)

Q53.

A student is investigating the maximum mass of sodium chloride that can be dissolved in 100 cm^3 water at room temperature.

The student has been given 1.0 g samples of solid sodium chloride to dissolve in the water.

Which row of the table shows the correct formula of sodium chloride and of water?

(1)

	sodium chloride	water
☒ **A**	$NaCl_2$	H_2O
☒ **B**	$NaCl_2$	HO_2
☒ **C**	NaCl	H^2O
☒ **D**	NaCl	H_2O

(Total for question = 1 mark)