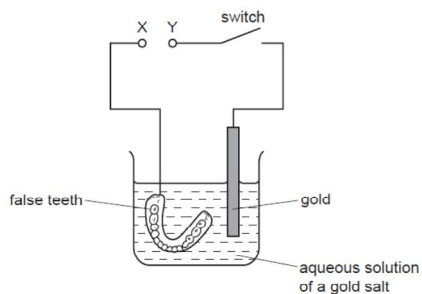


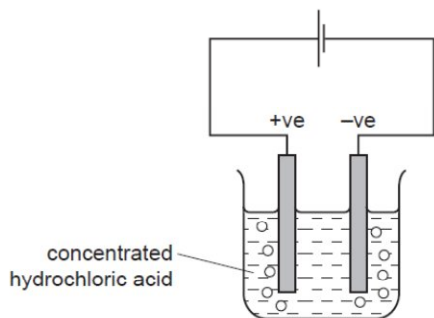
1 Winston Churchill, a British Prime Minister, had his false teeth electroplated with gold. The teeth were coated with a thin layer of carbon and were then placed in the apparatus shown.



Which row is correct?

	terminal X is	the carbon powder could be
A	negative	diamond
B	negative	graphite
C	positive	diamond
D	positive	graphite

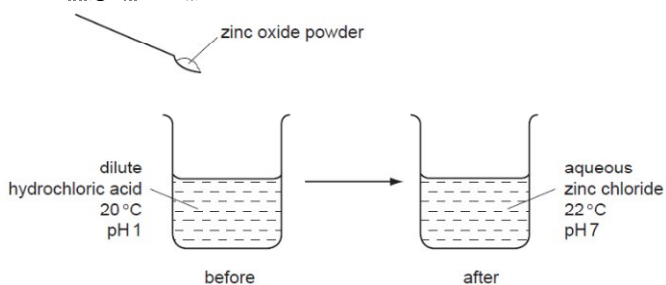
2 The diagram shows that two gases are formed when concentrated hydrochloric acid is electrolysed using inert electrodes.



Which row correctly describes the colours of the gases at the electrodes?

	anode (+ve)	cathode (-ve)
A	colourless	colourless
B	colourless	yellow-green
C	yellow-green	colourless
D	yellow-green	yellow-green

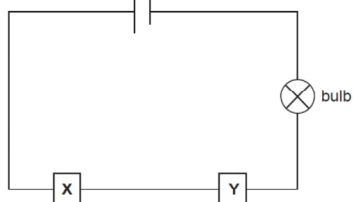
3 The diagram shows the reaction between zinc oxide and dilute hydrochloric acid.



Which terms describe the reaction?

	endothermic	neutralisation
A	✓	✓
B	✓	x
C	x	✓
D	x	x

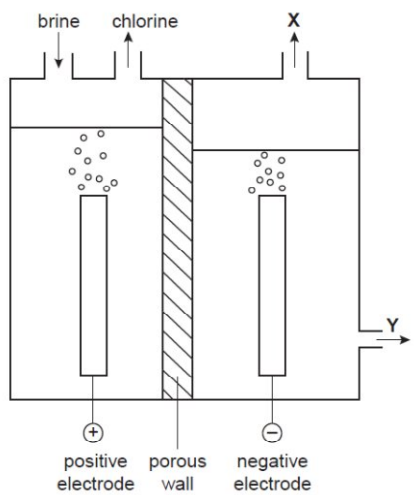
4 The diagram shows an electric circuit



For which two substances at X and Y does the bulb light up?

	X	Y
A	copper	graphite
B	copper	poly(ethene)
C	rubber	graphite
D	rubber	poly(ethene)

5 The diagram represents the electrolysis of brine (aqueous sodium chloride).



What are products X and Y?

	X	Y
A	hydrogen	aqueous sodium hydroxide
B	hydrogen	hydrochloric acid
C	oxygen	aqueous sodium hydroxide
D	oxygen	hydrochloric acid

6 Which statement about the electrical conductivity of non-metals and the charge on their ions is correct?

	electrical conductivity	charge on ions
A	good	positive
B	good	negative
C	poor	positive
D	poor	negative

7 Which metal produces a solution of a metal hydroxide when added to water?

- A** calcium
- B** copper
- C** iron
- D** zinc

8 A highly reactive metal is likely to

- A** form negative ions,
- B** occur naturally as an element,
- C** occur only as an oxide,
- D** oxidise rapidly in air.

9 A student writes the following statements.

- 1 Aluminium is used in the manufacture of aircraft bodies.
- 2 Aluminium is used to make stainless steel.
- 3 Mild steel is used in the manufacture of car bodies.

Which statements are correct?

- A** 1 and 2 only
- B** 1 and 3 only
- C** 2 and 3 only
- D** 1, 2 and 3

10 Metals could be extracted from their molten chlorides using electrolysis. Which substances are formed at each electrode?

	anode	cathode
A	chlorine	hydrogen
B	chlorine	metal
C	hydrogen	metal
D	metal	chlorine

11 Concentrated aqueous potassium bromide solution is electrolysed using inert electrodes. The ions present in the solution are K^+ , Br^- , H^+ and OH^- .

To which electrodes are the ions attracted during this electrolysis?

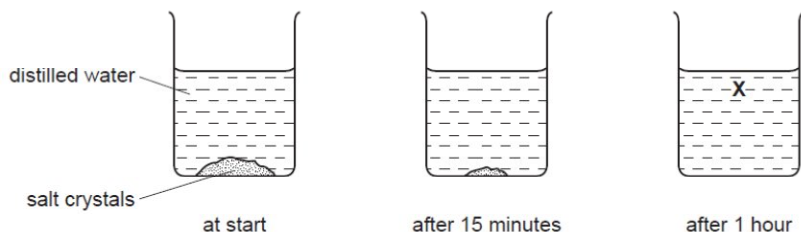
	attracted to anode	attracted to cathode
A	Br^- and K^+	H^+ and OH^-
B	Br^- and OH^-	H^+ and K^+
C	H^+ and K^+	Br^- and OH^-
D	H^+ and OH^-	Br^- and K^+

12 An alloy contains copper and zinc. Some of the zinc has become oxidised to zinc oxide.

What is the result of adding an excess of dilute sulfuric acid to the alloy?

- A A blue solution and a white solid remains.
- B A colourless solution and a pink / brown solid remains.
- C The alloy dissolves completely to give a blue solution.
- D The alloy dissolves completely to give a colourless solution.

13 A student placed some crystals of salt at the bottom of a beaker of distilled water. She left the contents of the beaker to stand for one hour. The diagram below shows her observations.



After one hour, all the salt had disappeared but the solution at point X tasted salty.

(a) Use the kinetic particle theory to explain these observations.

.....
.....
.....
.....
..... [4]

(b) Salt is sodium chloride, NaCl.

(i) Which one of the following statements about bond formation in sodium chloride is true?

Tick **one** box.

A sodium atom shares one electron with a chlorine atom.

A sodium atom loses its outermost electron and a chlorine atom gains an electron.

A sodium atom shares two electrons with a chlorine atom.

A sodium atom gains an electron and a chlorine atom loses its outermost electrons.

[1]

(ii) Explain why solid sodium chloride does not conduct electricity but molten sodium chloride does conduct.

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

(iii) State the name of the product formed at each electrode when a concentrated aqueous solution of sodium chloride is electrolysed using graphite electrodes.

at the positive electrode

at the negative electrode [2]

(iv) What is the name of the negative electrode?

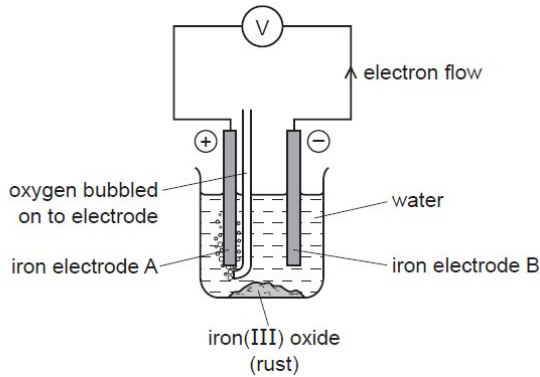
Put a ring around the correct answer.

Anion anode cation cathode electrolyte

[1]

(v) Suggest why graphite is a suitable material for an electrode. [1] [Total: 11]

14 Iron and steel rust when exposed to water and oxygen. Rust is hydrated iron(III) oxide.
 (a) The following cell can be used to investigate rusting.



(i) What is a cell?

..... [2]

(ii) Which electrode will be oxidised and become smaller? Explain your choice.

..... [3]

(iii) What measurements would you need make to find the rate of rusting of the electrode you have chosen in (ii)?

..... [2]

(iv) Suggest an explanation why the addition of salt to the water increases the rate of rusting.

..... [1]

(b) A sample of rust had the following composition:

51.85g of iron 22.22 g of oxygen 16.67 g of water.

Calculate the following and then write the formula for this sample of rust.

number of moles of iron atoms, Fe = [1]

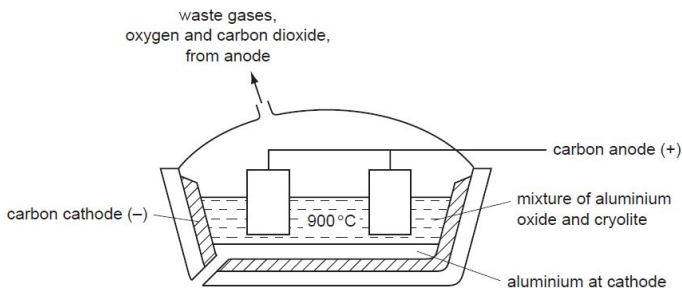
number of moles of oxygen atoms, O = [1]

number of moles of water molecules, H₂O = [1]

simplest mole ratio Fe : O : H₂O is : :

formula for this sample of rust is [1] [Total: 12]

15 Aluminium is extracted by the electrolysis of a molten mixture of alumina, which is aluminium oxide, and cryolite.



(a) (i) Alumina is obtained from the main ore of aluminium. Name this ore.

..... [1]

(ii) Explain why it is necessary to use a mixture, alumina and cryolite, rather than just alumina.

..... [2]

(iii) Copper can be extracted by the electrolysis of an aqueous solution. Suggest why the electrolysis of an aqueous solution cannot be used to extract aluminium.

..... [2]

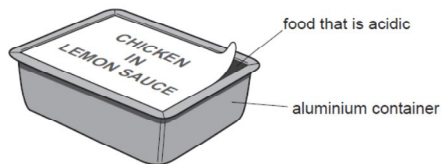
(b) The ions which are involved in the electrolysis are Al^{3+} and O_2^- . The products of this electrolysis are given on the diagram.

Explain how they are formed. Use equations where appropriate.

..... [4]

(c) The uses of a metal are determined by its properties.

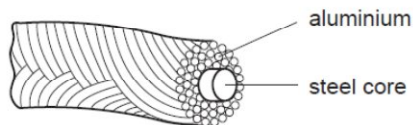
(i) Foods which are acidic can be supplied in aluminium containers.



Explain why the acid in the food does not react with the aluminium.

..... [1]

(ii) Explain why overhead electrical power cables are made from aluminium with a steel core



..... [3]

[Total: 13]

16 (a) Copper has the structure of a typical metal. It has a lattice of positive ions and a “sea” of mobile electrons. The lattice can accommodate ions of a different metal. Give a different use of copper that depends on each of the following.

(i) the ability of the ions in the lattice to move past each other

..... [1]

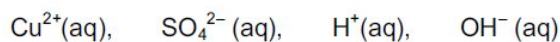
(ii) the presence of mobile electrons

..... [1]

(iii) the ability to accommodate ions of a different metal in the lattice

..... [1]

(b) Aqueous copper(II) sulphate solution can be electrolysed using carbon electrodes. The ions present in the solution are as follows.



(i) Write an ionic equation for the reaction at the negative electrode (cathode).

..... [1]

(ii) A colourless gas was given off at the positive electrode (anode) and the solution changes from blue to colourless.

Explain these observations.

..... [2]

(c) Aqueous copper(II) sulphate can be electrolysed using copper electrodes. The reaction at the negative electrode is the same but the positive electrode becomes smaller and the solution remains blue.

(i) Write a word equation for the reaction at the positive electrode.

..... [1]

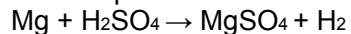
(ii) Explain why the colour of the solution does not change.

..... [2]

(iii) What is the large scale use of this electrolysis?

..... [1] TOTAL = [10]

1 The equation for the reaction between magnesium and dilute sulfuric acid is shown.



M_r of MgSO_4 is 120

Which mass of magnesium sulfate will be formed if 12 g of magnesium are reacted with sulphuric acid?

A 5 g B 10 g C 60 g D 120 g

2 A gas is escaping from a pipe in a chemical plant.

A chemist tests this gas and finds that it is alkaline.

What is this gas?

A ammonia

B chlorine

C hydrogen

D sulfur dioxide

3 The results of three tests on a solution of compound X are shown in the table.

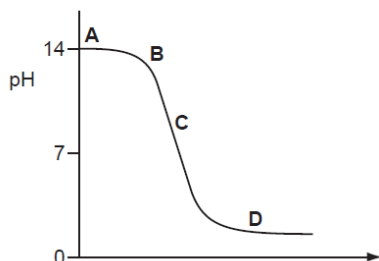
test	result
aqueous sodium hydroxide added	white precipitate formed, soluble in excess
aqueous ammonia added	white precipitate formed, insoluble in excess
acidified silver nitrate added	white precipitate formed

What is compound X?

A aluminium bromide

- B aluminium chloride
- C zinc bromide
- D zinc chloride

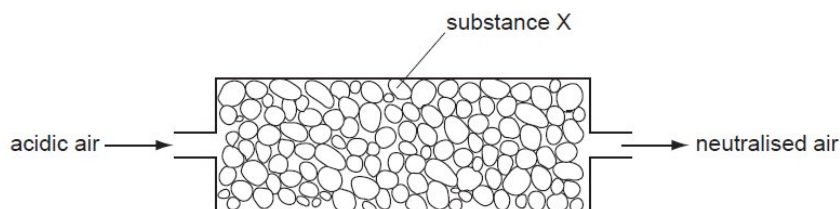
4 The graph shows how the pH changes as an acid is added to an alkali. acid + alkali → salt + water
Which letter represents the area of the graph where both acid and salt are present?



5 Dilute hydrochloric acid is added to a solid, S. A flammable gas, G, is formed. Gas G is less dense than air. What are S and G?

	solid S	gas G
A	copper	hydrogen
B	copper carbonate	carbon dioxide
C	zinc	hydrogen
D	zinc carbonate	carbon dioxide

6 Air containing an acidic impurity was neutralised by passing it through a column containing substance X.



- What is substance X?
- A calcium oxide
 - B sand
 - C sodium chloride
 - D concentrated sulfuric acid

7 Which type of reaction always forms a salt and water?

- A exothermic
- B neutralisation
- C oxidation
- D polymerisation

8 Which property is not characteristic of a base?

- A It reacts with a carbonate to form carbon dioxide.
- B It reacts with an acid to form a salt.
- C It reacts with an ammonium salt to form ammonia.

D It turns universal indicator paper blue.

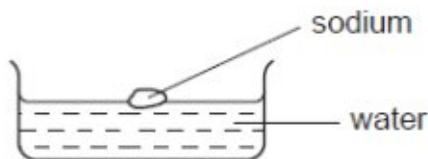
9 The results of three tests on a solution of compound X are shown

test	result
aqueous sodium hydroxide added	white precipitate formed, soluble in excess
aqueous ammonia added	white precipitate formed, soluble in excess
dilute hydrochloric acid added	bubbles of gas

What is compound X?

- A aluminium carbonate
- B aluminium chloride
- C zinc carbonate
- D zinc chloride

10 When sodium reacts with water, a solution and a gas are produced.



The solution is tested with litmus paper and the gas is tested with a splint. What happens to the litmus paper and to the splint?

	litmus paper	splint
A	blue to red	glowing splint relights
B	blue to red	lighted splint 'pops'
C	red to blue	glowing splint relights
D	red to blue	lighted splint 'pops'

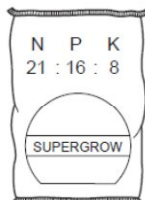
11 A chemical engineer plans to produce hydrochloric acid. Which metal is best for the reaction container?

- A copper
- B iron
- C magnesium
- D zinc

12 A liquid turns white anhydrous copper sulfate blue and has a boiling point of 103°C. Which could be the identity of the liquid?

- A alcohol
- B petrol
- C salt solution
- D pure water

13 Which combination of chemical compounds could be used to produce the fertiliser shown?



- A NH_4NO_3 , $\text{Ca}_3(\text{PO}_4)_2$
- B NH_4NO_3 , $\text{CO}(\text{NH}_2)_2$
- C NH_4NO_3 , K_2SO_4 , $(\text{NH}_4)_2\text{SO}_4$
- D $(\text{NH}_4)_3\text{PO}_4$, KCl

14 Alkalis are soluble bases.

(a) Which **one** of the following is alkaline? Put a ring around the correct answer.

distilled water

hydrochloric acid

sodium chloride solution

sodium hydroxide solution

[1]

(b) Suggest a pH value for a solution which is alkaline.

[1]

(c) Describe how you would find the pH of a solution.

[2]

(d) When excess fertilisers are put on the soil, the soil may become acidic.

(i) Why is it important to farmers that the soil does not become too acidic?

[1]

(ii) Calcium carbonate is used to decrease the acidity of the soil. Explain how calcium carbonate decreases soil acidity.

[2] [Total: 7]

15 This question is concerned with the following oxides.

- sulfur dioxide
- carbon monoxide
- lithium oxide
- aluminium oxide
- nitrogen dioxide
- strontium oxide

(a) (i) Which of the above oxides will react with hydrochloric acid but not with aqueous sodium hydroxide?

[1]

(ii) Which of the above oxides will react with aqueous sodium hydroxide but not with hydrochloric acid?

[1]

(iii) Which of the above oxides will react with both hydrochloric acid and aqueous sodium hydroxide?

[1]

(iv) Which of the above oxides will not react with hydrochloric acid or with aqueous sodium hydroxide?

[1]

(b) Two of the oxides are responsible for acid rain. Identify the **two** oxides and explain their presence in the atmosphere.

.....
.....
.....
..... [5]

16 Soluble salts can be made by the neutralisation of an acid by a base. Insoluble salts can be made by precipitation.

(a) The following is a brief description of the preparation of the soluble salt, nickel(II) chloride-6-water, from the insoluble base nickel(II) carbonate. Nickel(II) carbonate is added in small amounts to hot dilute hydrochloric acid until it is in excess. The mixture is filtered. The filtrate is partially evaporated and then allowed to cool until crystals of nickel(II) chloride-6-water form.

(i) Why is it necessary to use excess carbonate?

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

(ii) Explain why it is necessary to filter.

..... [1]

(iii) Why partially evaporate rather than evaporate to dryness?

..... [1]

(iv) What additional steps are needed to obtain dry crystals?

..... [2]

(b) Potassium chloride can be made from hydrochloric acid and potassium carbonate.

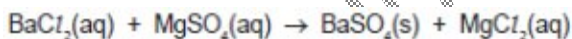
(i) Why must a different experimental method be used for this preparation?

..... [1]

(ii) Give a description of the different method used for this salt preparation.

.....
.....
..... [4]

(c) Insoluble salts are made by precipitation. An equation for the preparation of barium sulfate is given below.



This reaction can be used to find x in the formula for hydrated magnesium sulphate $\text{MgSO}_4 \cdot x\text{H}_2\text{O}$.

A known mass of hydrated magnesium sulfate, $\text{MgSO}_4 \cdot x\text{H}_2\text{O}$, was dissolved in water. Excess aqueous barium chloride was added. The precipitate of barium sulfate was filtered, washed and dried. Finally it was weighed.

Mass of hydrated magnesium sulfate = 1.476 g

Mass of barium sulfate formed = 1.398 g

The mass of one mole of BaSO_4 = 233 g

The number of moles of BaSO_4 formed = [1]

The number of moles of $\text{MgSO}_4 \cdot x\text{H}_2\text{O}$ = [1]

The mass of one mole of $\text{MgSO}_4 \cdot x\text{H}_2\text{O}$ =g [1]

The mass of one mole of MgSO_4 = 120 g

The mass of $x\text{H}_2\text{O}$ in one mole of $\text{MgSO}_4 \cdot x\text{H}_2\text{O}$ = [1]

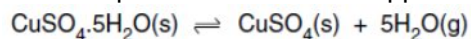
x = [1]

[Total: 15]

17 Potassium nitrate is a salt and dissolves in water in an endothermic process. What happens to the temperature and pH of the water as the salt dissolves?

	temperature increases	pH falls
A	✓	✓
B	✓	x
C	x	✓
D	x	x

18 The equation shows what happens when hydrated copper(II) sulphate is heated.



What can be deduced from the equation?

- A The hydrated copper(II) sulphate is oxidised.
- B The hydrated copper(II) sulphate is reduced.
- C The reaction is reversible.
- D There is no colour change.

19 Which two processes are involved in the preparation of magnesium sulphate crystals from dilute sulphuric acid and an excess of magnesium oxide?

- A decomposition and filtration
- B decomposition and oxidation
- C neutralisation and filtration
- D neutralisation and oxidation

20 An NPK fertiliser contains three elements required for plant growth.

Which two compounds, when mixed, provide the three elements?

- A ammonium phosphate + potassium nitrate
- B ammonium sulphate + potassium nitrate
- C ammonium sulphate + sodium nitrate
- D sodium phosphate + potassium chloride

21 Two processes are listed.

1 treating acidic soil with slaked lime

2 using limestone to extract iron

In which of these processes is carbon dioxide produced?

	1	2
A	✓	✓
B	✓	x
C	x	✓
D	x	x

22 The table gives the solubility of four substances in ethanol and in water.

A mixture containing all four substances is added to ethanol, stirred and filtered.

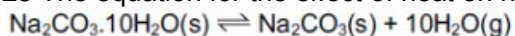
The solid residue is added to water, stirred and filtered.

The filtrate is evaporated to dryness, leaving a white solid.

Which is the white solid?

	solubility in	
	ethanol	water
A	insoluble	insoluble
B	insoluble	soluble
C	soluble	insoluble
D	soluble	soluble

23 The equation for the effect of heat on hydrated sodium carbonate is as shown.



Statements made by four students about the reaction are given.

P Anhydrous sodium carbonate is formed.

Q Steam is formed.

R There is a colour change from blue to white.

S The reaction is reversible.

Which students' statements are correct?

A P, Q and R only

B P, Q and S only

C Q, R and S only

D P, Q, R and S

24 Carbon dioxide is an acidic oxide that reacts with aqueous calcium hydroxide.

Which type of reaction takes place?

A decomposition

B fermentation

C neutralisation

D oxidation

25 Which is not a typical property of an acid?

A They react with alkalis producing water.

B They react with all metals producing hydrogen.

C They react with carbonates producing carbon dioxide.

D They turn litmus paper red.

26 A solution contains barium ions and silver ions.

What could the anion be?

A chloride only

B nitrate only

C sulfate only

D chloride or nitrate or sulphate

27 A mixture containing two anions was tested and the results are shown below.

test	result
dilute nitric acid added	effervescence of a gas which turned limewater milky
dilute nitric acid added, followed by aqueous silver nitrate	yellow precipitate formed

Which anions were present?

A carbonate and chloride

B carbonate and iodide

C sulfate and chloride

D sulfate and iodide

28 Which two substances, when reacted together, would form a salt that contains two of the essential elements provided by fertilisers?

A potassium hydroxide and nitric acid

B potassium hydroxide and sulfuric acid

C sodium hydroxide and nitric acid

D sodium hydroxide and sulfuric acid

For All these Question for 1 to 11 Write Complete Symbols equations and also balance them.

1. metal oxide + acid →

2. metal hydroxide + acid →

3. acid + metal carbonate →

4. acid + metal hydrogen carbonate →

2 A gas is escaping from a pipe in a chemical plant. A chemist tests this gas and finds that it is alkaline. What is this gas?

- A ammonia
- B chlorine
- C hydrogen
- D sulfur dioxide

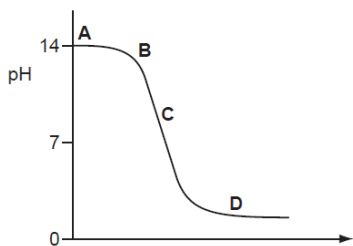
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- A aluminium bromide
- B aluminium chloride
- C zinc bromide
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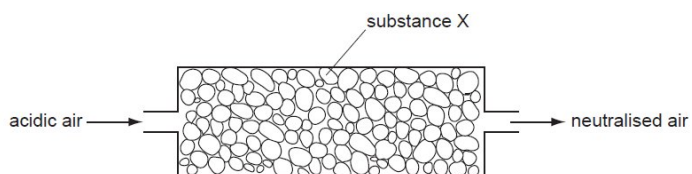
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What is substance X?

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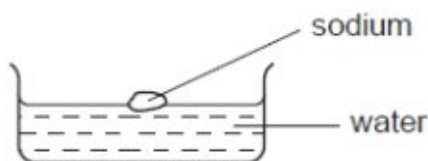
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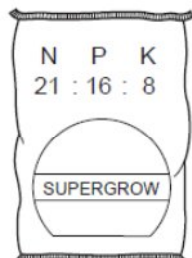
- A copper
- B iron
- C magnesium

D zinc

12 A liquid turns white anhydrous copper sulfate blue and has a boiling point of 103°C. Which could be the identity of the liquid?

- A alcohol
- B petrol
- C salt solution
- D pure water

13 Which combination of chemical compounds could be used to produce the fertiliser shown?



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- B NH_4NO_3 , $\text{CO}(\text{NH}_2)_2$
- C NH_4NO_3 , K_2SO_4 , $(\text{NH}_4)_2\text{SO}_4$
- D $(\text{NH}_4)_3\text{PO}_4$, KCl

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sodium hydroxide solution

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(b) Suggest a pH value for a solution which is alkaline.

[1]

(c) Describe how you would find the pH of a solution.

[2]

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(i) Why is it important to farmers that the soil does not become too acidic?

[1]

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[2] [Total: 7]

Total Marks:-----

Obtained Marks:-----

Date:-----