Name……Stream……..

545/2
CHEMISTRY
Paper 2
2 Hours

Uganda Certificate of Education

RESOURCEFULL EXAMINATION, 2022

CHEMISTRY

Paper 2

2 Hours

INSTRUCTIONS TO CANDIDATES:

Section **A** consists of 10 structured questions. Attempt **all** questions in this section. Answers to section must be written in the spaces provided.

Section **B** consists of 4 semi-structured questions. Attempt any **TWO** questions from this section. Answers to this section must be written in the answer booklet provided

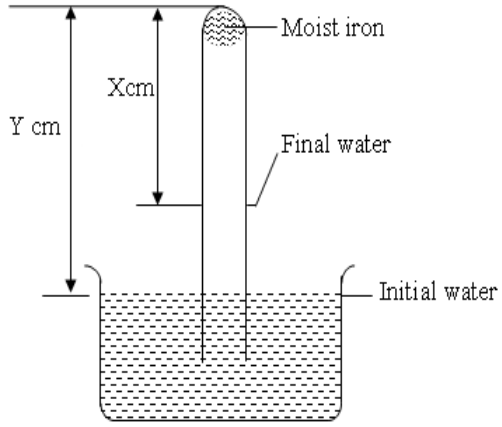
In both sections **all** working **MUST** be clearly shown.

For Examiner's Use Only														
1	2	3	4	5	6	7	8	9	10	1	12	13	14	Total

SECTION A [50MARKS]

(Attempt all questions in this section)

1. Some moist iron wool was placed in a test tube and the tube was inverted and placed in a beaker of water. When the apparatus was left for one week, it was observed the iron wool had rusted and the level of water had risen.



a) Explain whether rusting is a chemical or physical change. (1mark)

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b) Write equation to show the rusting of iron. (1½ marks)

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……..

c) Write an expression for an approximate percentage of air used up. (1mark)

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……

d) State the similarities between rusting and combustion. (1½ marks)

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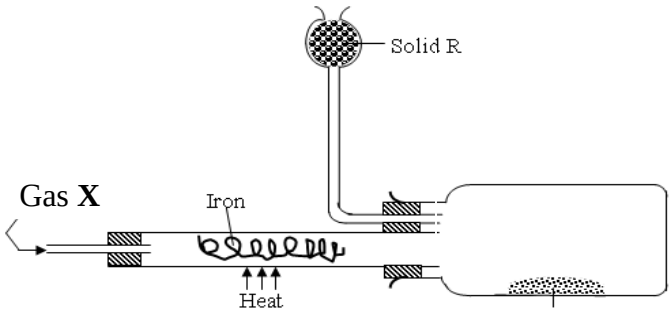
2. Anhydrous Iron (III) chloride was prepared using the setup of the apparatus shown in the figure below



Iron (III) chloride

a) Identify;

i) Gas X……(½ mark)

ii) Solid **R**……(1mark)

b) Write equation for the reaction leading to formation of iron (III) chloride. (1½ marks)

……

……

c) i) State what would be observed if iron (III) chloride is exposed to air. (1mark)

……

……

ii) Give a reason for your answer in (c) (i) above. (1mark)

……

……

3. a) State what is observed when a mixture of iron and sulphur is warmed with

i) dilute sulphuric acid. (2marks)

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……

……

ii) carbon disulphide (1mark)

……

……..

b) i) Write equation for the reaction that took place in a) i) above. (1½ marks)

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ii) State how you test for the gaseous product in b) i) (½ mark)

……

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4. When lead (II) nitrate solution was added to solution of compound **H**, a white precipitate F was formed, dissolved on heating and recrystallized on cooling.

a) i) Identify the anion in H. (½ mark)

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ii) Write ionic equation for the formation of the white precipitate **F**. (1½ marks)

……

……

b) i) Name the reagent used to confirm the anion in **H**. (½ mark)

……

……

ii) State what would be observed when the named reagent in b) i) is added to a solution of H. (1mark)

……

……

iii) Write ionic equation for the formation of what is observed in b) ii). (1½ marks)

……

……

5. a) What is allotropes? (1½ marks)

……

……

……

b) Name two crystalline allotropes of carbon. (1mark)

……

……

c) State two differences between the two allotropes named above. (1marks)

……

……

d) Name the allotropes that conduct electricity. Explain your answer. (1½ marks)

……

……

6. Hydrogen peroxide was added to manganese (IV) oxide.

a) State:

i) what was observed. (1mark)

……

……

ii) the role of manganese(IV) oxide. (1mark)

……

……

b) Write an equation for the reaction between

i) Hydrogen peroxide and manganese (IV) oxide. (1½ marks)

……

……

ii) Sodium and the product in b) i) (1½ marks)

……

……

7. The element Rubidium (Rb) is an element immediately below potassium with atomic number 19 in group I of the Periodic Table.

a) i) State how you would store Rubidium. (½ mark)

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……

ii) A small piece of Rubidium was cut and added to water. State what would be observed? (½ mark)

……

……

iii) Write equation for the reaction that took place in (a) (ii) (1½ marks)

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……

b) Write the formula of:

i) Rubidium nitrate. (½ mark)

……

……

ii) Rubidium sulphate. (½ mark)

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c) Write equation of reaction of Rubidium oxide (Rb_2O) with water. (1½ marks)

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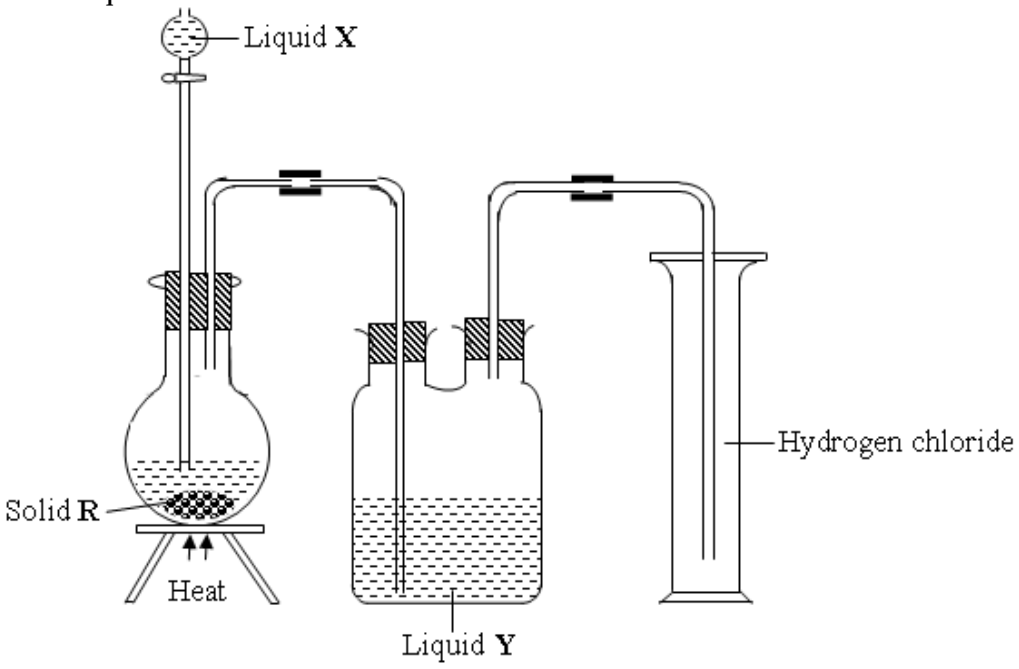
8. The diagram below shows laboratory preparation of hydrogen chloride gas. Study it and answer the questions that follow



a) Identify:

i) liquid **X** (½ mark)

……..

ii) solid **R** (½ mark)

……..

iii) liquid Y (½ mark)

……

b) Write equation for the formation of hydrogen chloride. (1½ marks)

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……

c) i) Name the reagent that can be used to test for hydrogen chloride. (1mark)

……

……

ii) State what is observed when the reagent named in c) i) is treated with hydrogen chloride. (1mark)

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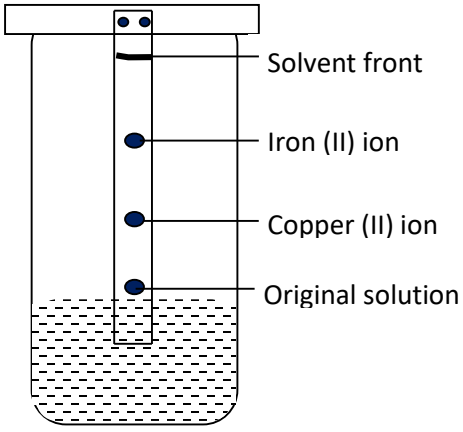
9. A mixture of copper (II) ions, iron (II) ion and zinc ions was separated as shown in the figure below.



a) Name the method used to separate the mixture. (1mark)

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b) i) State the colours of copper(II) ions and iron(II) ions in the mixture.

Copper (II) ions …… (½ mark)

Iron (II) ions …….. (½ mark)

ii) Explain why zinc ions are not observed in the experiment. (½ mark)

……

……..

c) Write ionic equation for the reaction when dry chlorine is bubbled through the solution of iron(II) ions. (1½ mark)

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……

d) State two other mixtures that can be separated by the method named above. (1mark)

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10. a) Chlorine water was filled in a long tube. The tube was inverted in a beaker having the same solution and this was exposed to bright sunlight for some time.

i) State what is observed after sometime. (1½ marks)

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……

ii) Write equation of reaction to explain what is observed in a) i) (1½ marks)

……

……

b) Chlorine gas was bubbled through a solution of sodium bromide containing a small amount of tetrachloromethane.

i) State what is observed. (½ marks)

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ii) Write ionic equation for the reaction that took place. (1½ marks)

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SECTION B [30 MARKS]

(Attempt any **two** questions from this section)

11. a) i) Name three fundamental particles in an atom. (1½ marks)

ii) With the aid of a labelled diagram, describe how the particles are located in an atom. (4marks)

b) The full symbol of the atom of an element is $^{32}_{16}H$. State what 16 and 32 stands for. (2marks)

c) If the full symbol of another element is $^{34}_{16}P$. State the

i) similarities and differences between the atoms H and P. (1mark)

ii) name given to the atoms H and P. (1mark)

d) The atomic number of elements E, F and G are 6, 12 and 17 respectively.

i) Write the electronic configuration of elements E, F and G. (1½ marks)

ii) Using the outermost energy electrons only, draw a diagram to show how **E** and **G** form a compound. (1mark)

iii) State the type of bond form between E and G and F and G. (2marks)

iv) Identify the element that exists as diatomic molecules. (1mark)

12. a) Describe how a pure dry sample of chlorine can be prepared in the laboratory from potassium manganate(VII) crystals. (Your answer should include a well-labelled diagram and equation for the reaction) (6marks)

b) State what is observed if chlorine is bubbled through a:

i) blue litmus solution. (1mark)

ii) potassium bromide solution. (1mark)

iii) solution of iron(II) ions. (1mark)

c) Write equation for the reaction in (b) (ii) and (iii) (3marks)

d) Write equation for the reaction between chlorine and:

i) heated iron. (1½ marks)

ii) cold dilute sodium hydroxide solution. (1½ marks)

13. a) A piece of clean iron metal was left exposed to damp air over night for a number of days and it became coated with a reddish-brown solid.

i) Write the chemical name and formula of the reddish brown coating. (2marks)

ii) With the aid of a labelled diagram describe an experiment to show that the presence of moisture is necessary for the formation of reddish-brown coating on iron. (5marks)

b) State three ways in which rusting of iron is similar to burning. (3marks)

c) i) State any three ways in which rusting of iron can be prevented. (3marks)

ii) Suggest one way in which rusting of moving parts of machinery and cutlery can be prevented. (1mark)

d) State one effect of rusting of iron on the metal. (1mark)

14. a) Oxygen can be prepared in the laboratory by decomposition of potassium chlorate.

i) Name one other solid substance from which oxygen can be prepared in the

laboratory. (1mark)

ii) Describe how oxygen can be prepared from the substance named in a) i) (No diagram is required) (3½ marks)

b) What would be observed and write the equation for the reaction that takes place when the following were plunged into a jar of oxygen.

i) Burning magnesium. (2½marks)

ii) Burning sulphur (2½ marks)

c) Write an equation for the decomposition of iron (II) carbonate when strongly heated in air. (1½ marks)

d) During the manufacture of oxygen on large scale from air, water vapour and carbon dioxide are removed before the process of isolating oxygen from the air.

i) What name is given to this process? (1mark)

ii) Explain why water vapour and carbon dioxide are removed from air. (1mark)

iii) State principle of isolation of oxygen from air. (1mark)

iv) Give two practical applications of the process in d) i) (1mark)

SUGGESTED MARKING GUIDE

Chemistry 545/2

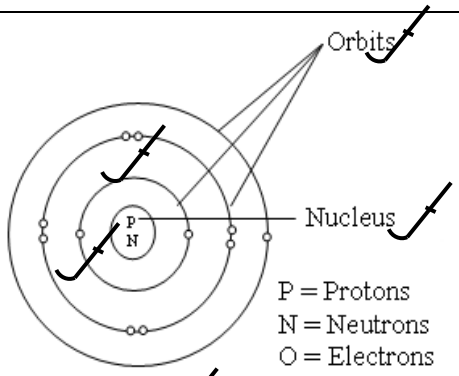
RESOURCEFULL EXAMINATION, 2022

	SECTION A [50MARKS]	
1.	a) Rusting is chemical change. This is because a new substance is formed.	1mark
	b) $4Fe_{(s)} + 3O_{2(g)} + nH_2O_{(l)} \longrightarrow 2Fe_2O_3.nH_2O_{(s)}$	1½mark
	c) $\frac{Y-X}{Y} \times 100\%$	1mark
	d) Both rusting and combustion requires oxygen. Both rusting and combustion are chemical changes. Both rusting and combustion releases heat energy. In both processes of rusting and combustion there is a change in mass.	1½mark
	Total	5marks
2.	a) i) X is Chlorine gas.	½ mark
	ii) R is Anhydrous calcium chloride.	1mark
	b) $2Fe_{(s)} + 3Cl_{2(g)} \longrightarrow 2FeCl_{3(s)}$	1½mark
	c) i) iron(III) chloride absorbs moisture from the atmosphere and dissolves in it and forms a brown solution.	1mark
	ii) This is because iron (III) chloride is a deliquescent substance.	1mark
	Total	5marks
3.	a) i) Effervescence occurs giving out a colourless gas and yellow suspension forms in a green solution.	2marks
	ii) Sulphur dissolves forming a yellow solution with grey suspension in the solution.	1mark
	b) i) $Fe_{(s)} + H_2SO_{4(aq)} \longrightarrow FeSO_{4(aq)} + H_{2(g)}$	1½mark
	ii) Buy using a burning splint.	½ mark
	Total	5marks
4.	a) i) Chloride ion.	½ mark
	ii) $Pb^{2+}_{(aq)} + 2Cl^-_{(aq)} \longrightarrow PbCl_{2(s)}$	1½mark
	b) i) acidified silver nitrate solution.	1mark

	ii) When acidified silver nitrate solution is added to a solution containing silver ion, a white precipitate is formed insoluble in the acid. iii) $Ag^{+}_{(aq)} + Cl^{-}_{(aq)} \longrightarrow AgCl_{(s)}$	1½mark 1½mark
	Total	5marks
5.	a) Allotropes are different atoms of an element in the same state. b) The crystalline allotropes of carbon are Diamond Graphite. c) Diamond is colourless crystalline transparent solid while graphite a dark grey-black opaque solid. Diamond is very hard while graphite is fleaky and soft slippery substance. Diamond does not conduct electricity while graphite is a good conductor of electricity. Diamond has a density of $3.5gcm^{-3}$ while graphite has a density of $2.3gcm^{-3}$. d) Graphite conducts electricity This is because in graphite structure of the four valency electrons, only three are used for the bond formation. The fourth electron is delocalized in the layer of graphite. It is these delocalized electrons that are responsible for electrical conductivity in graphite.	1½mark 1mark 1mmark 1½mark
	Total	5marks
6.	a) i) Effervescence occurs giving out a colourless gas. ii) Manganese (IV) oxide acts as a catalyst. b) i) $2H_2O_{2\,(aq)} \xrightarrow{MnO_2} I_2O_{(l)} + O_{2\,(g)}$ ii) $4Na_{(s)} + O_{2\,(g)} \longrightarrow 2Na_2O_{(s)}$	1mark 1mark 1½mark 1½mark
	Total	5marks
7.	a) i) Rubidium is stored under oil. ii) It reacts explosively with water. iii) $2Rb_{(s)} + 2H_2O_{(l)} \longrightarrow 2RbOH_{(aq)} + H_{2\,(g)}$ b) i) $RbNO_3$ ii) Rb_2SO_4	½ mark ½ mark 1½mark ½ mark ½ mark

Tr. Felix Js Rubangakene Geofrey Jr

	c) $Rb_2O_{(s)} + H_2O_{(l)} \longrightarrow 2RbOH_{(aq)}$	1½mark
	Total	5marks
8.	a) i) X is concentrated sulphuric acid. ii) R is sodium chloride. iii) Y is concentrated sulphuric acid. b) $NaCl_{(s)} + H_2SO_{4(l)} \longrightarrow NaHSO_{4(aq)} + HCl_{(g)}$ c) i) Concentrated ammonia. ii) Dense white fumes is formed.	½ mark ½ mark ½ mark 1½mark 1mark 1mark
	Total	5marks
9.	a) Chromatography. b) i) Blue. Green. ii) Zinc ions is colourless. c) $2Fe^{2+}_{(aq)} + 3Cl_{2(g)} \longrightarrow 2Fe^{3+}_{(aq)} + 6Cl^-_{(aq)}$ d) Black ink. Green pigment from chlorophyll.	1mark 1mark ½ mark 1½mark 1mark
	Total	5marks
10.	a) i) Yellowish green solution gradually looses it colour and become colourless and a colourless gas collects at the top the tube. ii) $2H_2O_{(l)} + 2Cl_{2(g)} \longrightarrow 4HCl_{(aq)} + O_{2(g)}$ b) i) Red colouration forms. ii) $Cl_{2(g)} + 2Br^-_{(aq)} \longrightarrow 2Cl^-_{(aq)} + Br_{2(aq)}$	1½mark 1½mark ½ mark 1½mark
	Total	5marks
	SECTION B [30MARKS]	
11.	a) i) Proton Neutron Electron ii) The particles are located in an atom as shown in the diagram below	½ mark ½ mark ½ mark



2mark

The protons and neutrons are located in the nucleus found in the centre of the atom.

2mark

The electrons are located and revolve in the orbits or energy level around the nucleus.

2marks

b) 16 stand for atomic number of the atom, Q.
32 stand for mass number of the atom.

1mark

c) i) Atoms Q and R have the same atomic number but different mass numbers.

1mark

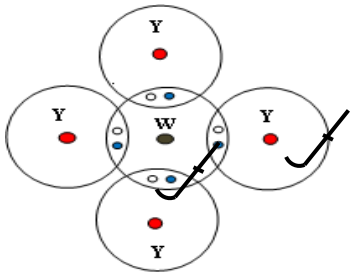
ii) Isotopes

½ mark

d) i) W: 2:4
X: 2:8:2
Y: 2:8:7

½ mark
½ mark
½ mark

ii)



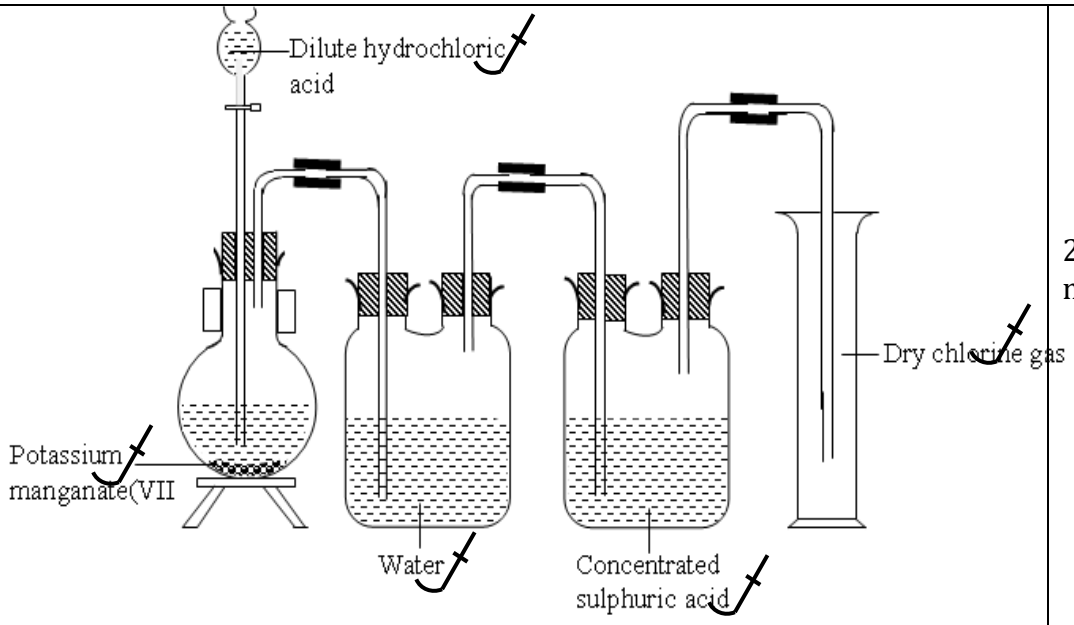
1mark

iii) **X** and **Y** from ionic bond.
Or **X** and **Y** form electrovalent bond.
W and **Y** form covalent bond.

2mark
1mark

iv) Element **Y**

	Total	15marks
12.	a) Chlorine is prepared in the laboratory by reacting dilute hydrochloric with potassium manganate(VII). Potassium manganate(VII) is placed in a round bottom flask and the apparatus is arranged as shown in the diagram below.	1mark



2½ marks

Dilute hydrochloric acid is added to the potassium manganite (VII) in flask through a thistle funnel.
The reaction takes place with effervescence at room temperature and a greenish yellow gas is given out.

$2KMnO_{4\,(s)} + 16HCl_{(aq)} \longrightarrow 2KCl_{(aq)} + 2MnCl_{2\,(aq)} + 8H_2O_{(l)} + 5Cl_{2\,(g)}$

The gas produced is passed a wash bottle containing water to remove sprays of hydrogen chloride gas. It then passed through another wash bottle containing concentrated sulphuric acid to dry the gas. The gas is the collected by down ward delivery method.

1mark

b) i) The blue litmus solution turns colourless. 1mark

ii) The solution turns from colourless to brown solution. 1mark

iii) The solution turns from green solution to brown solution. 1½mark

c) $2KBr_{(aq)} + Cl_{2\,(g)} \longrightarrow 2KCl_{(aq)} + Br_{2\,(aq)}$ 1½mark

$2Fe^{2+}{}_{(aq)} + 3Cl_{2\,(g)} \longrightarrow 2Fe^{3+}{}_{(aq)} + 6Cl^-{}_{(aq)}$ 1½mark

d) i) $2Fe_{(s)} + 3Cl_{2\,(g)} \longrightarrow 2FeCl_{3\,(g)}$ 1½mark

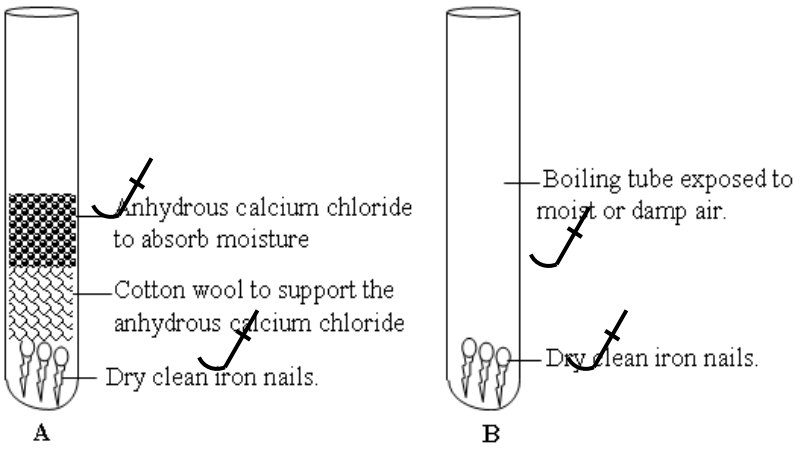
ii) $NaOH_{(aq)} + Cl_{2\,(g)} \longrightarrow NaOCl_{(aq)} + NaCl_{(aq)} + H_2O_{(l)}$ 1½ marks

	Total	15marks
13.	a) i) Hydrated iron(III) oxide $Fe_2O_3.nH_2O$	1mark 1mark
	ii) **Experiment to show that moisture is necessary for rusting.**	

Clean iron nails are placed in a boiling tube. Cotton wool is put to cover the iron nails. Anhydrous calcium chloride is placed on the cotton wool. This set up is labelled **A**.

Other iron nails are placed in another boiling tube which is left open to moist air or damp air. This set up labelled **B**. The set ups are then arranged as shown in the diagram below and left to stand for some few days.

5marks



Observation:

After a few days, it would be found out that the reddish brown coating has not formed on nails in boiling tube **A**. But reddish brown coating formed on the iron nails in boiling tube **B**.

Conclusion:

It can therefore be concluded that moisture is necessary for the formation of reddish brown coating on iron nails/ moisture is necessary for rusting.

1mark

b) **Similarities between rusting and burning.**

Both rusting and combustion requires oxygen. 1mark

Both rusting and combustion are chemical changes. 1mark

Both rusting and combustion releases heat energy.

In both processes of rusting and combustion there is a change in mass.

c) i) **Methods of prevention of rusting**

Painting

Oiling/greasing.

Electroplating

Galvanization.

Chromium/nickel plating.

Use of stainless steel.

Enameling

ii) Moving parts of machine is prevented from rusting by oiling or greasing.

The cutlery can be prevented from rusting by use of stainless steel.

	c) Rusting weakens metals/iron, loses their illustrious appearances. Millions of shillings is being spent annually in the prevention of rusting.	
	Total	15marks
14.	a) i) Sodium peroxide. ii) Sodium peroxide is placed a round bottom flask. Cold water added to it drop by drop through a thistle funnel. Effervescence immediately occurs and a colourless (oxygen) is given out. The gas is then passed through a wash bottle containing concentrated sulphuric acid. It is then collected by upward delivery method. $2Na_2O_{2\,(s)} + 2H_2O_{2\,(l)} \longrightarrow 4NaOH_{(aq)} + O_{2\,(g)}$ b) i) It burns with an intense brilliant white flame forming white solid. $2Mg_{(s)} + O_{2\,(g)} \longrightarrow 2MgO_{(s)}$ ii) It burns with a blue flame forming a colourless gas. $S_{(s)} + O_{2\,(g)} \longrightarrow SO_{2\,(g)}$ c) $4FeCO_{3\,(s)} + O_{2\,(g)} \longrightarrow 2Fe_2O_{3\,(g)} + 4CO_{2\,(g)}$ d) i) Fractional distillation of liquid air. ii) Carbon dioxide and water vapour have high freezing point. iii) The difference in boiling point. iv) Refining of petroleum. Concentration of alcohol in whisky production .i.e. in distilleries.	1mark 3½ marks 2½ marks 2½ marks 1½ marks 1mark 1maark 1mark 1mark
	Total	15marks