UCE CHEMISTRY, PAPER 2

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CLICK HERE TO SEE FREQUENTLY ASKED QUESTIONS.

Typed and Designed by Rahmi Tüfenk | kecan44@mynet.com | Nov-Dec2005

545/2 CHEMISTRY PAPER 2 Oct./Nov. 1987 2 hours	UGANDA NATIONAL EXAMINATION BOARD Uganda Certificate of Education CHEMISTRY Paper 2 Time: 2 hours

INSTRUCTIONS TO CANDIDATES

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

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

In both sections all working must be clearly shown.

SECTION A

Attempt all question in this section.

1. **(a)** 5.0 g of calcium carbonate was heated strongly until there was no further change.
(i) Write equation for the reaction.
(ii) Calculate the mass of the solid left.
(b) The residue in (a) was shaken with water and the product tested with blue litmus paper. State what was observed. (Ca=40, C=12, O=16)

2. Hydrogen chloride reacts with silver ions according to the equation
$HCl_{(g)} + Ag^{+}_{(aq)} \rightarrow AgCl_{(s)} + H^{+}_{(aq)}$.
1.2 litres of hydrogen chloride was carefully bubbled through 500 cm^3 of 1.0 M solution of silver ions at room temperature.
Calculate
(a) the number of moles of silver ions that reacted.
(b) the number of moles of hydrogen chloride bubbled. (1 mole of a gas occupies 24 litres at room temperature).
(c) the mass in grams of silver chloride formed (Cl=35.5, Ag=108).

3. The structure of an organic substance A is shown below

***

(a) Name A.
(b) A reacts with excess concentrated sulphuric acid at 170°C to form an organic product B.
(i) Name B.
(ii) Write the structure of B.
(iii) Name **one** reagent that could be used to detect the presence of B.
(iv) State what would be observed if the reagent named in (iii) was used.

4. A concentrated solution of sodium chloride was electrolysed using platinum electrodes.
(a) State what was observed
(i) At the anode.
(ii) At the cathode.
(b) Explain your observation in (a) (i).
(c) Litmus paper was dipped into the solution after the electrolysis. State what was observed.

5. The result of a paper chromatography experiment is shown in the diagram below.

***

A and B are different mixtures of some of the pure substances, P, Q, R, S and T.

(a) Identify the substances in the
  (i) mixture A.
  (ii) mixture B.

(b) Which substances are present in both mixtures?

(c) Which substances are present in mixture A only?

6. (a) Explain what is meant by the terms
  (i) 'mass number'.
  (ii) 'atomic number'

(b) An atom of an element is represented by the symbol $^{80}_{35}X$
  (i) State the mass number of the atom.
  (ii) What is the atomic number of the atom?
  (iii) How many neutrons are present in the atom?

7. **(a)** A given mass of magnesium strips was reacted with dilute hydrochloric acid at room temperature. The volume of the gas produced was measured at various intervals.
  (i) Write equation for the reaction.
  (ii) Sketch a graph to show variations of the volume of the gas produced with time.

***

(b) State what would be observed if the same mass of magnesium powder was used instead of the strips. Give one reason for your answer.

8. Nitric acid is manufactured by catalytic oxidation of ammonia.

(a) Name
  (i) two raw materials, other than ammonia that are used in the manufacture of nitric acid.
  (ii) the catalyst used.

(b) Write equation for the reaction between nitric acid and ammonia.

(c) State **one** use of the product in (b).

9. The positions of the elements A, B, C, D, E and F are shown in the Periodic Table below. The se are not the usual symbols for the elements.

***

(a) State the type of bonding in the compound formed between
  (i) B and D.
  (ii) E and C.

(b) (i) Which one of the elements A and B reacts vigorously with cold water?
  (ii) Write equation for the reaction between water and the element you have named in (b) (i).

(c) From the table select **two** elements that can oxidise F.

10. A circuit was connected as shown in the diagram below and a steady current of 0.20 amperes was passed for 20 minutes. (1 Faraday= 96500 $Cmol^{-1}$; Cu=64)

***

(a) Write equation for the reaction that took place at the cathode.

(b) Calculate
  (i) the number of coulombs of electricity used.
  (ii) the number of moles of electricity.
  (iii) the mass of the substance formed at the cathode.

SECTION B

*Attempt any **two** questions in this section.*

11. **(a)** Define *'allotropy'*.

(b) Give **one** example of an element other than carbon which shows allotropy and name allotropes.

(c) (i) Describe briefly the structure of graphite.

(ii) State the properties of graphite.

(d) Describe how you would show by a chemical test that graphite is made up of carbon atoms.

12. **(a)** In sewage treatment, the sewage is brought into contact with appropriate bacteria under controlled conditions.

(i) Explain what is meant by the term 'Sewage'.

(ii) Explain the role of bacteria in sewage treatment.

(iii) State the conditions under which bacteria will be active during the treatment of sewage.

(b) Distinguish between a 'sludge' and an 'effluent' in relation to sewage treatment.

(c) State **two** uses of sewage sludge.

13. The diagram below shows the apparatus which can be used to prepare anhydrous iron (III) chloride.

***

(a) (i) Name the gas A.

(ii) State the conditions for the reaction between iron filling and gas A.

(iii) Describe what would be observed during the reaction.

(iv) Write equation for the reaction.

(b) Describe how you would prepare pure crystals of iron (II) chloride in the laboratory.

14. Carbondioxide gas can be prepared in the laboratory by reacting an acid with a carbonate.

(a) Write an ionic equation for the reaction.

(b) Draw a labelled diagram of the apparatus that can be used in the laboratory to prepare and collect a sample of carbondioxide.

(c) Write equations to show how carbondioxide reacts with each of the following and state what would be observed in each case.

(i) Sodium hydroxide solution.

(ii) Calcium hydroxide solution.

(iii) Magnesium metal.

(d) Name one process in each case by which the concentration of carbondioxide in the atmosphere is

(i) Increased.

(ii) Decreased.

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545/2
CHEMISTRY
PAPER 2
Oct./Nov. 1988
2 **hours**

UGANDA NATIONAL EXAMINATION BOARD
Uganda Certificate of Education
CHEMISTRY
Paper 2
Time: 2 hours

INSTRUCTIONS TO CANDIDATES

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In both sections all working must be clearly shown.

(C=12; H=1; Na=23; O=16; S=32; N=14)

SECTION A

*Attempt **all** question in this section.*

1. (a) Name
(i) two major components of air
(ii) the process by which the components of air are separated.
(b) Explain why the process you have named in a (ii) can be used to separate the components of air
(c) Which one of the components of air are useful as a plant nutrient?

2. Glucose, $C_6H_{12}O_6$, can be converted to ethanol by a catalytic reaction caused by an enzyme produced from yeast.
(a) Name
(i) the reaction in which yeast converts glucose into alcohol.
(ii) the enzyme produced by yeast during the reaction.
(b) Write the equation for the reaction that leads to the formation of ethanol.
(c) Briefly describe how the ethanol produced can be concentrated.

3. The electronic structure of an element X is 2:8:6.
(a) Write the formula of the most common ion of X.
(b) To which group pf the Periodic Table does X belong?
(c) Element X reacts with an element M (atomic number=12)
(i) Write the electronic structure of M.
(ii) State the type of bond that exists in the compound between M and X.

4. **(a)** An apparatus to investigate the reaction of bromine with zinc was set up as shown in this diagram below.

***

(i) State what was observed in the combustion tube.
(ii) Write an equation for the reaction that took place in the combustion tube.
(b) The product was dissolved in water and aqueous ammonia added dropwise to the solution until it was in excess. State what was observed.

5. **(a)** Write one equation in each case for the reaction in which sulphuric acid behaves as

(i) an acid.
(ii) an oxidising agent.

(b) State the conditions for each of the reactions in (a).

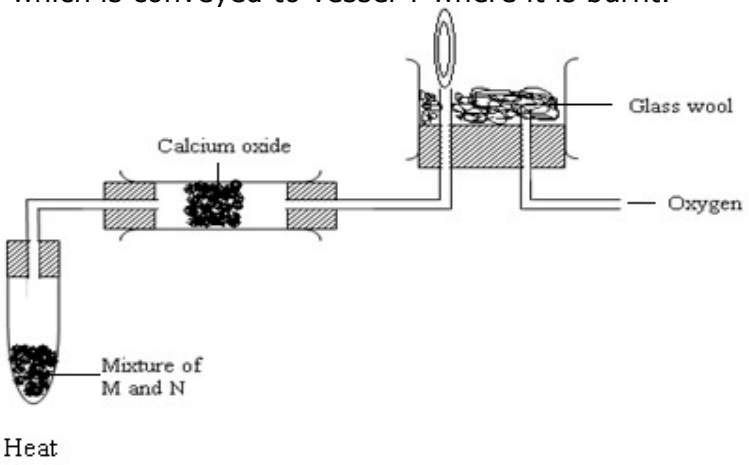
6. **(a)** A compound, X, of molecular mass 28, contains 87.5% carbon and 14.3% hydrogen. Calculate the simplest formula of X.

(b) (i) Determine the molecular formula of X.
(ii) Write the structural formula of X.

(c) State what is observed if X is reacted with bromine.

(d) Write an equation for the reaction in (c).

7. In the apparatus shown in the diagram below, compounds M and N are reacted to produce ammonia which is conveyed to vessel T where it is burnt.



(a) Name the substance
(i) M.
(ii) N.

(b) State the role of
(i) the glass wool.
(ii) calcium oxide.

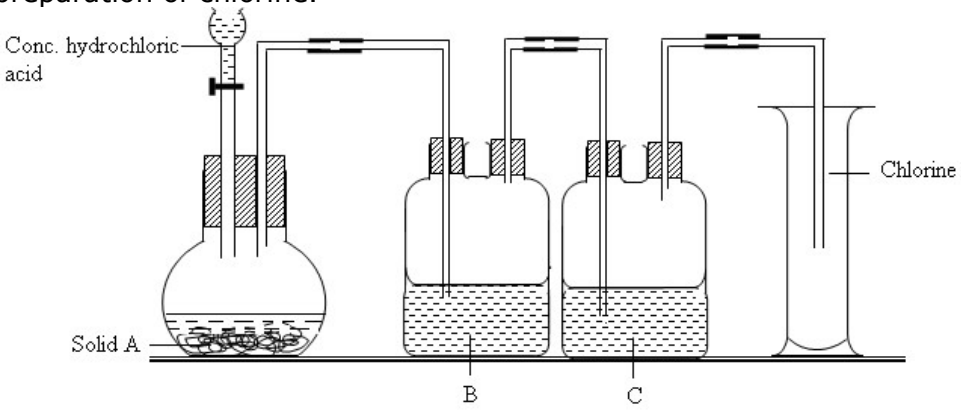
(c) Write an equation for the combustion of ammonia.

8. A steady current of 0.65 A was passed for 35 minutes through acidified water to electrolyse it using carbon electrodes.

(a) State the electrode at which oxygen was liberated.

(b) Calculate the mass of oxygen liberated. (1 Faraday = 96500 coulombs)

9. **(a)** The diagram below shows an arrangement of the apparatus for the laboratory preparation of chlorine.



(i) Identify liquids
P

Q

(ii) What is the function of liquid R?

(iii) Why is chlorine collected as shown?

(b) Write an equation for the reaction between chlorine and aqueous iron (II) chloride.

(c) State one use of chloride.

10. 7.5 g of methane, CH_4, was completely burnt in air. Methane burns in air according to the following equation:

$CH_{4(g)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(g)}$ $\Delta H = -890$ kJ mol^{-1}.

Calculate

(i) the mass of carbondioxide formed.

(ii) the heat evolved.

SECTION B

*Attempt any **two** questions in this section.*

11. **(a)** Explain what is meant by the terms

(i) solubility of a salt.

(ii) saturated solution.

(b) 75 g of a saturated solution contains 30 g of salt.

Calculate

(i) the solubility of the salt.

(ii) the percentage of the salt in the saturated solution.

(c) (i) Briefly describe how a dry sample of copper (II) sulphate crystals can be obtained from copper (II) oxide in the laboratory.

(ii) Write an equation for the reaction.

12. **(a)** (i) Name one ore of each of the following metals: sodium and iron.

(ii) Briefly describe how sodium and iron are extracted from their ores. Write equation for the reaction in each case.

13. **(a)** Describe briefly how you would prepare a pure sample of lead (II) bromide.

(b) Molten lead (II) bromide conducts electricity whereas solid lead (II) bromide does not. Explain this observation.

(c) (i) Describe and explain what would be observed when molten lead (II) bromide is electrolysed between carbon electrodes.
Write equations for the reactions that take place at the electrodes.

(ii) Calculate the mass of lead deposited when 1930 coulombs was passed through molten lead (II) bromide. (1 mole of electrons=96500 coulombs)

14. **(a)** (i) Explain what is meant by the term *polymerisation.*

(ii) Name **two** naturally occurring polymers and **one** synthetic polymer.

(b) The structure of a polymer is shown below.

***

Write down the structural formula of a monomer of the polymer.

(c) Distinguish between a *thermoplastic* and a *thermosetting* plastic.

(d) Explain the term *cracking*.
Draw a fully labelled diagram of the apparatus that can be used to crack liquid paraffin in the laboratory.

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545/2 CHEMISTRY PAPER 2 Nov./Dec. 1989 2 hours	UGANDA NATIONAL EXAMINATION BOARD Uganda Certificate of Education CHEMISTRY Paper 2 Time: 2 hours

INSTRUCTIONS TO CANDIDATES

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In both sections all working must be clearly shown.

(C=12; H=1; Na=23; O=16; S=32; N=14)
1 mole of gas occupies 22.4 l at s.t.p.

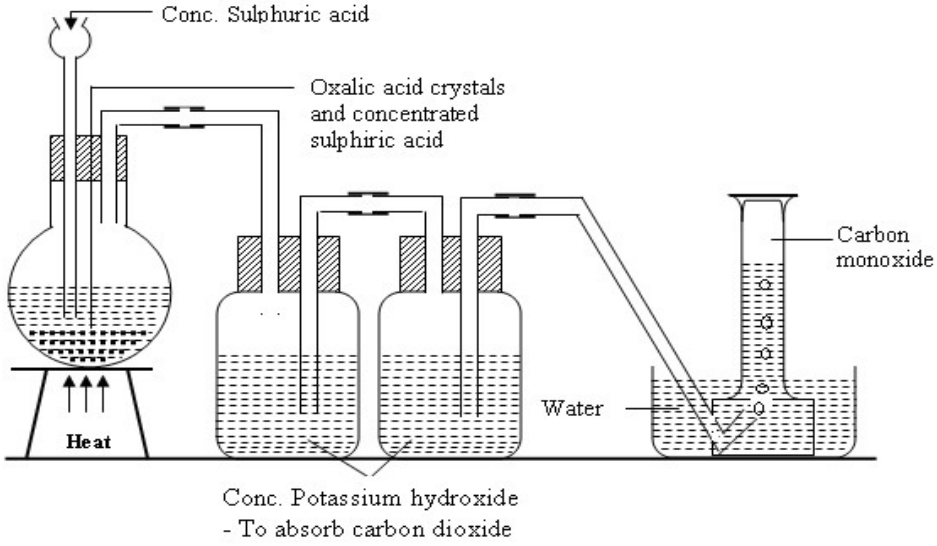
SECTION A

*Attempt **all** question in this section.*

1. Carbondioxide is prepared in the laboratory using marble chips and an acid. Choose one acid which is more suitable for preparing carbondioxide from each of the following pairs of acids. In each case explain your answer.

(a) 1 M hydrochloric acid and 1 M sulphuric acid.
(b) 1 M ethanoic acid and 1 M nitric acid.

2. The apparatus shown in the diagram in figure 1 was used to prepare carbon monoxide in the laboratory.



(a) Name the substance in the flask that reacts with sulphuric acid.
(b) State the conditions necessary for the reaction.
(c) Write an equation for the reaction.
(d) Identify Z and state its role.

3. A gaseous hydrocarbon, X, contains 20% hydrogen by mass. 7.5 g of X occupy 5.6 dm^3 at STP.

(a) Calculate

(i) the empirical formula of X.

(ii) the molar mass of X.

(iii) the molecular formula of X.

(b) Write

(i) the name of the hydrocarbon, X.

(ii) the structural formula of X.

4. Excess lead (II) oxide was added to warm dilute nitric acid and the mixture was stirred. After filtering, the mixture was filtered and a solution of sodium chloride was added to the filtrate.

(a) Write an equation for the reaction between lead (II) oxide and nitric acid.

(b) State what was observed when sodium chloride solution was added to the filtrate.

(c) Write an equation for the reaction in (b).

(d) Describe what happens when the mixture in (b) is heated.

5. When 6.5 g of zinc powder were added to 250 cm^3 of a 0.1 M copper (II) sulphate solution in a plastic cup, 5.45 kJ of heat was liberated.

(a) Explain why a plastic cup was used instead of a metallic cup.

(b) Write an equation for the re action between zinc powder and copper (II) sulphate.

(c) Calculate

(i) the number of moles of zinc in 6.5 g of zinc powder.

(ii) the number of moles of zinc which reacted with copper (II) sulphate.

(iii) the heat energy produced when 1 mole of zinc reacts with 1 mole of copper (II) sulphate.

6. **(a)** A clean sample of steel wool was placed in a test tube containing some water and the test tube was inverted in a trough of water. After three days the volume of air in the test tube changed from 20 cm^3 to 16 cm^3 and a brown layer formed on the steel wool.

(i) Write the formula of the brown solid.

(ii) Calculate the percentage decrease in the volume of air in the tube.

(b) A little of the brown layer was dissolved in dilute nitric acid and dilute sodium hydroxide was added dropwise until in excess.

(i) State what was observed.

(ii) Write an ionic equation for the reaction.

7. Figure 2 shows the diagram of an apparatus for the electrolysis of dilute sulphuric acid.

***

(a) Name all the ions present in dilute sulphuric acid.

(b) Write

(i) Equations for the reaction at each electrode.

Reaction at anode

Reaction at cathode

(ii) the equation for the overall reaction.

8. Table 1 shows some tests which were carried out on a green solid, P and the observations that were made.

Table I

Test	Observations
(i) P was heated until there was no further change	A colourless liquid condensed on the cooler part of the test tube. A colourless gas which turned aqueous potassium dichromate (VI) green was given out and a reddish brown residue R was left.
(ii) Chlorine gas was bubbled through an aqueous solution of P	solution turned from green to yellow.

(a) Identify substances P and R.
P
R

(b) Name a substance that could be used to test for colourless liquid.

(c) Write an equation for the reaction that took place in test (i).

(d) Explain the reactions that took place in test (ii).

9. Table II shows results obtained when soap solution was added to 10 cm^3 of water samples P, Q and R in separate containers.

Table II

	Before boiling			**After boiling**		
Sample of water	P	Q	R	P	Q	R
Volume of soap solution required to form permanent lather (cm^3)	2	8	5	2	8	3

(a) Identify which sample was, rain water, temporary hard water and permanent hard water. Give reasons for your answer.
(i) Rain water
Reason
(ii) Temporary hard water
Reason
(iii) Permanent hard water
Reason

(b) Name one substance which can cause permanent hardness in water.

10. The number of protons and neutrons of atoms A, B, C and D are shown in table III.

Table III

Atoms	Number of protons	Number of neutrons
A	6	6
B	12	12
C	6	8
D	17	20

(a) Which of these atoms are isotopes?
Give a reason for your answer.

(b) Which one of the atoms is of an element in group II of the Periodic Table/ Give a reason for your answer.

(c) Name the type of bond which is formed when B and D reacts.

SECTION B

Attempt any **two** questions in this section.

11. **(a)** Explain what is meant by the terms
(i) 'miscible liquids'
(ii) 'immiscible liquids'
Give an example in each case.

(b) Describe how mixtures of
(i) immiscible liquids
(ii) miscible liquids
can be separated. In each case draw labelled diagrams to illustrate your answer.

12. **(a)** (i) Draw a labelled diagram to show how a sample of dry hydrogen can be prepared. Your diagram should include apparatus and reagents used.
(ii) Write an equation for the reaction that takes place.

(b) Calcium' lead' potassium and zinc form part of the metal activity series.
(i) Arrange the metals in order of reactivity starting with the most reactive metal.
(ii) Describe how each metal reacts with cold water. Write equations for the reactions that take place.

(c) Iron reacts with steam according to the equation:

$$3Fe_{(s)} + 4H_2O_{(g)} \rightarrow Fe_3O_{4(s)} + 4H_{2(g)}.$$

Calculate the mass of iron required to produce 2.24 l of hydrogen at STP.

13. **(a)** Name one reagent that can be used to differentiate between each of the following pairs of cations. In each case state what would be observed if each cation is reacted with the reagent.
(i) $Al^{3+}_{(aq)}$ and $Pb^{2+}_{(aq)}$.
(ii) $Cu^{2+}_{(aq)}$ and $Zn^{2+}_{(aq)}$.
(iii) $NH^{+}_{4\,(aq)}$ and $Ca^{2+}_{(aq)}$.

(b) Name one reagent that reacts with $CO^{2-}_{3\,(aq)}$ and $SO^{2-}_{4\,(aq)}$ to show similar observation and another one which can be used to distinguish the two anions. In each case state the observation.

14. **(a)** Sodium metal is extracted by the electrolysis of molten sodium chloride to which calcium chloride has been added.
(i) Give a reason for the addition of calcium chloride.
(ii) Name a material that can be used as the cathode and another that can be used as the anode.
(iii) Write equations for the reactions that take place at each electrode.
(iv) Describe how the product at the cathode is collected.
(v) Name one other element that can be extracted by a similar method.

(b) Name a place in Uganda where a plant for the extraction of sodium could be constructed. Give a reason for your answer.

(c) Describe what would be observed if a small piece of sodium metal was heated and quickly plunged into a gas jar of oxygen. Write an equation for the reaction that takes place.

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545/2 CHEMISTRY PAPER 2 Nov./Dec. 1990 2 hours	UGANDA NATIONAL EXAMINATION BOARD Uganda Certificate of Education CHEMISTRY Paper 2 Time: 2 hours

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(C=12; H=1; Na=23; O=16; S=32; N=14)
1 mole of gas occupies 22.4 l at s.t.p.

SECTION A

*Attempt **all** questions in this section.*

1. Oxygen can be prepared in the laboratory using hydrogen peroxide and a substance X.

(a) Name X.

(b) Write equation leading to the formation of oxygen.

(c) State

(i) the role of X.

(ii) the conditions for the reaction.

(d) Name one process that increases the amount of oxygen in the atmosphere.

2. **(a)** A compound Q contains 14.38 hydrogen, the rest being carbon. Calculate the empirical formula of Q.

(b) The relative molecular mass of Q is 28. Determine the molecular formula of Q.

(c) Write equation for the reaction between Q and hydrogen in the presence of a catalyst.

3. **(a)** When methane burns in oxygen, heat is produced. Write equation for the combustion of methane in excess oxygen.

(b) The heat of combustion of methane is –890 kJ mol^{-1}.
Calculate the volume of methane gas at s.t.p. that when burned in excess oxygen would raise the temperature of 178 g of water by 10°C.
(Specific heat capacity of water= 4.2 J/g/°C.

4. Part of the Periodic Table indicating the positions of elements W, X and Z is shown below.

	I	II	III	IV	V	VI	VII	VIII
1								
2	W		X				Z	
3								
4								

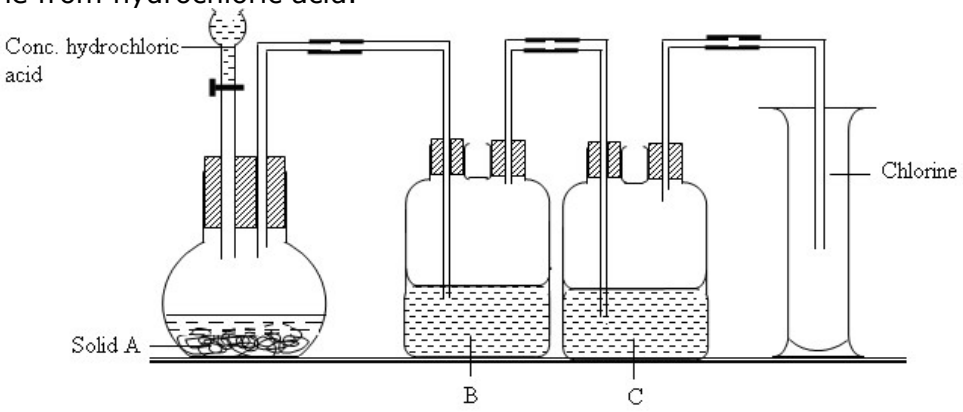
(a) (i) Write the formula of the oxide of W.

(ii) The oxide of W was dissolved in water.
Sate whether the resultant solution is acidic, neutral or alkaline. Explain your answer.

(b) Write the formula of the compound formed between X and Z.

(c) Which one of the atoms W, X and Z has the largest atomic radius?

5. The diagram in Fig.1 shows a set-up of the apparatus for the laboratory preparation of dry chlorine from hydrochloric acid.



(a) (i) Name substances A, B and C.
A.
B.
C.

(ii) State the role of substance B.

(b) State the conditions for the reaction.

(c) Write equation for the reaction.

6. **(a)** Smoke was put in a glass-cell and viewed under a microscope.
(i) State what was observed.
(ii) Explain the observation in (i).

(b) One piece of cotton wool was soaked in concentrated ammonia and another in concentrated hydrochloric acid. The two pieces of cotton wool were placed in a glass tube as shown in figure 2.

***

(i) Write the formula of the substance that formed the white ring.
(ii) Explain why the white ring is formed in position A and not in the middle of the tube.

7. The number of electrons' protons and neutrons in atoms A, B, C and D are shown in the table below.

Atom	Electrons	Protons	Neutrons
A	8	8	8
B	16	16	16
C	13	13	14
D	x	3	4

(a) Determine
(i) the value of x
(ii) the approximate relative atomic mass of C.

(b) Write the electronic configurations of the following atoms and ions:
(i) A
(ii) A^{2-}
(iii) C
(iv) C^{3+}

(c) State two atoms that are of elements in the same group of the Periodic Table.

8. The circuit shown in the diagram in figure 3 was used in an experiment to study the effect of electricity on lead (II) bromide.

(a) State what was observed.
(i) before lead (II) bromide had melted.
(ii) after lead (II) bromide had completely melted.
(b) Explain your answer in (a).
(c) Write equation for the reaction that took place at
(i) P
(ii) Q

9. When 0.107 g of ammonium chloride was heated with excess calcium hydroxide, a gas was evolved.
(a) Write equation for the reaction.
(b) Calculate the volume of gas that was evolved at room temperature.
(1 mole of gas occupies 24 dm^3 at room temperature)

10. State what would be observed and write ionic equation(s) for the reaction(s) that takes place when
(i) a solution of silver nitrate is added to potassium chloride solution.
(ii) sodium hydroxide solution is added dropwise until in excess to a solution of aluminium sulphate.

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545/2 **CHEMISTRY** **PAPER** 2 **Nov./Dec. 1991** 2 **hours**	**UGANDA NATIONAL EXAMINATION BOARD** **Uganda Certificate of Education** **CHEMISTRY** **Paper 2** **Time: 2 hours**

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In both sections all working must be clearly shown.

(C=12; H=1; Na=23; O=16; S=32; N=14)
Faraday's constant = 96,500 C
1 mole of gas occupies 24 l at room temperature.
1 mole of gas occupies 22.4 l at s.t.p.

SECTION A

*Attempt **all** questions from this section.*

1. The atomic number of element Q is 13.
- **(a)** Write the electronic configuration of an atom of Q.
- **(b)** To which group in the Periodic Table does Q belong?
- **(c)** State whether Q would conduct electricity or not.
- **(d)** (i) Write the formula of the oxide of Q.
  (ii) State the type of bonding in the oxide of Q.

2. 2.5 g of zinc carbonate was heated strongly until there was no further change.
- **(a)** State what was observed.
- **(b)** Write an equation for the reaction.
- **(c)** Calculate the mass of the residue.

3.
- **(a)** Write the structural formula of ethene.
- **(b)** Ethene can be prepared by reacting ethanol with sulphuric acid.
  State the conditions for the reaction.
- **(c)** (i) State what would be observed when ethene is reacted with bromine.
  (ii) Write an equation for the reaction.

4. Figure 1 shows a diagram of an electrochemical cell.

***

- **(a)** (i) Write an equation for the overall cell reaction.
  (ii) State what would be observed if the reaction is allowed to continue for a long time.
- **(b)** The reading on the voltmeter, V, was 1.1 V. Calculate the energy, in kJ, produced.

5. A hydrocarbon, R, contains 80% carbon by mass.
- **(a)** Calculate the empirical formula of R.
- **(b)** If the molecular mass of R is 30, determine its molecular formula.

(c) Write an equation for the complete combustion of R.

6. Part of the Periodic Table is shown below. The letters are not the usual symbols for the elements.

I	II		III	IV	V	VIII VI	VII	
							T	
P	Q				S		U	
							W	V

(a) Which is the least reactive element?
(b) Which one of the elements T, U and W reacts most vigorously with Q?
(c) Write the formula of compound formed between Q and S.
(d) The compound formed between P and W was dissolved in water.
State whether the resultant solution was acidic, basic or neutral.
(e) Which two elements represented in the table can react as reducing agents?

7. Substances A and B were obtained from a reaction between ammonia gas and copper oxide using the apparatus shown in the diagram in figure 2.

***

(a) Name substance
(i) A
(ii) B
(iii) X
(b) Write an equation for the reaction that takes place in the combustion tube.
(c) State why it is not possible to collect excess ammonia in the gas jar.
(d) Name one other oxide that can be used instead of copper (II) oxide.

8. In an experiment to measure the volume of carbon dioxide evolved when excess hydrochloric acid reacts with a known mass of sodium carbonate, a small amount of the carbonate is added to the acid before adding the weighed mass of the carbonate.
(a) State the purpose of adding a small amount of sodium carbonate before adding a known mass of the carbonate.
(b) Write an equation for the reaction.
(c) Calculate the mass of sodium carbonate that would be required to liberate 120 cm^3 carbon dioxide at room temperature.

9. Copper (II) sulphate-5-water decomposes when heated.
(a) State what would be observed when copper (II) sulphate-5-water is strongly heated.
(b) Write an equation for the reaction.
(c) Name one reagent that can be used to convert the residue back to copper (II) sulphate.

10. The diagram in figure 3 shows a setup of the apparatus which was used to prepare hydrogen and to show that it burns to form a liquid, Y.
The hydrogen produced was allowed to pass through the apparatus for some time before it was lit.

***

(a) (i) Name liquid Y
(ii) Describe one chemical test that can be used to identify liquid Y.
(iii) Explain why hydrogen was allowed to pass through the apparatus for some time before being lit.
(b) Write an ionic equation for the reaction between zinc and dilute sulphuric acid.

SECTION B

*Attempt any **two** questions in this section.*

11. **(a)** Describe how sulphur is extracted by the Frasch process.

(b) Write equations to show how fuming sulphuric acid can be obtained from sulphur.

(c) State what would be observed if concentrated sulphuric acid is added to sugar.

12. **(a)** Describe how you would prepare pure crystals of lead (II) nitrate in the laboratory starting from lead (II) oxide. Write an equation for the reaction that takes place.

(b) State what happens when lead (II) nitrate is strongly heated.

(c) State what is observed if ammonia solution in gradually added to a solution of lead (II0 nitrate until the alkali is in excess. Write an equation for the reaction that takes place.

(d) Lead (II) ions react with iodine ions according to the following equation:

$$Pb^{2+}_{(aq)} + 2I^{-}_{(aq)} \rightarrow PbI_{2(s)}.$$

400 cm^3 of a 1 M solution of iodine ions was added to a solution containing excess lead (II) ions. Calculate the mass, in grams, of lead (II) iodine formed.

13. **(a)** Explain each of the following observations. Write equations to illustrate your answers.

(i) When zinc dust is put into a solution of copper (II) sulphate, the blue colour of the solution fades and the solution becomes hot.

(ii) When a test tube filled with chlorine water is inverted into a tough 2 of water and the set up exposed to sunlight, a gas which relights a glowing splint is produced I the test tube.

(b) 25.0 cm^3 of 0.1 M sulphuric acid had a pH less than 7. A solution of sodium hydroxide was gradually added and pH gradually increased. After 20.0 cm^3 of the sodium hydroxide solution had been added the resultant solution had a pH of 7.

(i) Explain why the pH of the acid increased when sodium hydroxide solution was added.

(ii) Calculate the concentration of the sodium hydroxide solution in moles per litre.

14. **(a)** Draw a well-labelled diagram to show how a sample of dry hydrogen chloride can be prepared.

(b) Dry hydrogen chloride gas was passed over heated iron fillings. Write an equation for the reaction that took place.

(c) The solid product in (b) was dissolved in water and aqueous sodium chloride added to the resultant solution dropwise until in excess.

(i) State what was observed.

(ii) Write equation for the reaction.

(d) Chlorine gas was passed through a solution of the product in (b).

(i) State what was observed.

(ii) Write an ionic equation for the reaction.

(e) Name one reagent that can be used to test for

(i) the cation formed in (d).

(ii) the anion formed in (d).

In each cases state what is observed when the reagent you have named is used.

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545/2 CHEMISTRY PAPER 2 Nov./Dec. 1992 2 hours	UGANDA NATIONAL EXAMINATION BOARD Uganda Certificate of Education CHEMISTRY Paper 2 Time: 2 hours

SECTION A

*Attempt **all** questions in this section.*

1. **(a)** A mixture consists of sulphur and iron fillings.
Explain briefly how a sample of sulphur can be obtained from the mixture.
(b) A sample of the mixture in (a) was heatedin the porcelain dish.

2. When hydrogen gas was passed over *x* g of strongly heated copper (II) oxide until there was no further change, 4 g of a solid was formed.
(a) State what was observed.
(b) Write equation for the reaction.
(c) Determine the value of x.

3. **(a)** What is meant by the term electroplating?
(b) Draw a labelled diagram of an apparatus that can be used in the laboratory to copper plate an object.

4. Carbondioxide was bubbled into a fairly concentrated solution of sodium hydroxide and no visible change was observed at first. On further bubbling, a white precipitate was formed.
(a) Explain the observation.
(b) Write equations for the reaction.

5. When a steady current was passed through the circuit shown in the diagram figure 1, 0.02 mole of a substance was deposited at P.

***

(a) State what was observed at R.
(b) Write equation(s) that took place at
(i) P
(ii) S
(c) Calculate the number of moles of the gaseous substance formed at S.

6. The following pairs of compounds were reacted together and the maximum temperature rise recorded for each reaction.
A. 100 cm^3 of 1 M sodium hydroxide and 100 cm^3 of 1 M ethanoic acid.
B. 100 cm^3 of 1 M ammonia solution and 100 cm^3 of 1 M ethanoic acid.
C. 100 cm^3 of 1 M sodium hydroxide and 100 cm^3 of 1 M hydrochloric acid.
(a) State the pair which showed.
(i) the highest temperature rise.
(ii) the lowest temperature rise.

(b) Explain your answers in (a).

hardness in water.

(ii) State the principle on which it works.

SECTION B

*Attempt **two** questions from this section. Start each question on a fresh page.*

11. **(a)** Draw a labelled diagram to show how a dry sample of sulphurdioxide can be prepared in the laboratory.

(b) Write equation for the reaction that takes place in (a).

(c) Describe a test that can be carried out to confirm the presence of sulphurdioxide.

(d) Excess sulphurdioxide was bubbled through a solution of sodium hydroxide. Write equation for the reaction that took place.

(e) 25.0 cm^3 of 0.1 M sodium hydrogen carbonate solution reacted completely with 27.8 cm^3 of sulphuric acid. Calculate the concentration of sulphuric acid in moles per litre.

12. **(a)** Name one reagent that can be used to distinguish between each of the following pairs of species.
In each case what would be observed if each member of the pair is treated with the reagent and write equation for the reaction that takes place.

(i) Lead (II) ions and zinc ions.

(ii) Carbonate ions and chloride ions.

(iii) Ethane and ethene.

(b) Write equation to show how polythene is formed from ethene.

13. **(a)** Sodium, aluminium and sulphur can combine with oxygen to form oxides.
Copy and complete the following table to show the formula of, class of, and bond in the oxide of each of these elements.

Element	Formula of oxide	Class of oxide	Type of bond in oxide
Sodium			
Aluminium			
Sulphur			

(b) The oxides of sodium and sulphur were separately treated with water. Write equation to show what took place in each case.

(c) Describe how a dry sample of sodium chloride can be prepared in the laboratory.

(d) To a solution of aluminium sulphate was added ammonia solution dropwise until in excess.

(i) State what was observed.

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

14. **(a)** Describe the industrial preparation of nitric acid from ammonia (Diagram of the plant is not required). Your description should include equations for the reactions that occur.

(b) Explain what happens when concentrated nitric acid is added to copper.

(c) Describe on chemical test that can be used to confirm the presence of nitrate.

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545/2 CHEMISTRY PAPER 2 Nov./Dec. 1993 2 hours	UGANDA NATIONAL EXAMINATION BOARD Uganda Certificate of Education CHEMISTRY Paper 2 Time: 2 hours

INSTRUCTIONS TO CANDIDATES

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

In both sections all working must be clearly shown.

(C=12; H=1; Na=23; O=16; S=32; N=14)
1 mole of gas occupies 24 l at room temperature.
1 mole of gas occupies 22.4 l at s.t.p.

SECTION B

*Attempt **all** question in this section.*

1. **(a)** Name the process by which ammonia is obtained on a large-scale.

(b) One of the main uses of ammonia is the production of fertilizers. Two such fertilizers are ammonium sulphate, $(NH_4)_2SO_4$ and urea, $CO(NH_2)_2$.
Calculate the percentage of nitrogen in
(i) ammonium sulphate.
(ii) urea.

(c) Which one of the fertilizers in (b) is a better fertilizer?

2. Elements X and Y with atomic numbers 12 and 8 respectively react to form a compound W.

(a) Write the electronic configuration of
(i) X.
(ii) Y.

(b) State whether W is
(i) a gas, liquid or solid at room temperature.
(ii) covalent or ionic.

3. Soap can be prepared by boiling a vegetable oil with sodium hydroxide solution and adding a solution of sodium chloride to the reaction mixture.

(a) What name is given to the reaction leading to the formation of soap?

(b) Name one crop from which oil for making soap can be obtained.

(c) Why is sodium chloride added to the reaction mixture?

(d) State one advantage and one disadvantage of using detergents instead of soap.
Advantage.
Disadvantage.

4. Copper (II) sulphate solution was electrolysed using carbon electrodes.

(a) State what was observed at the
(i) anode.
(ii) cathode.

(b) Explain your answer in (a) (ii).

(c) Write equation(s) for the reaction(s) which took place at the anode.

5. **(a)** The graph below shows the change in temperature when 0.5 M sodium hydroxide solution was added to 20 cm^3 of hydrochloric acid.

***

(i) What does point S represent?
(ii) Determine the molarity of the hydrochloric acid.
(iii) Why does the temperature rise from R to S?

(b) The experiment was repeated using 0.5 M ammonia solution instead of 0.5 M sodium hydroxide.
State whether the maximum temperature was greater than, less than or equal to that in (a).

6. When compound P is heated with concentrated sulphuric acid, a gas which forms dense white fumes with ammonia is liberated.

(a) Identify the anon in P.

(b) Write an ionic equation for the reaction between a solution of P and silver nitrate solution.

(c) State what would be observed if lead (II) nitrate solution was added to a solution of P and the mixture heated.

7. Lead (II) nitrate was heated strongly in the apparatus shown in the diagram in figure 1.

***

(a) Identify
liquid X.
gas Y.
(b) State what was observed in the test tube during the heating.
(c) Write an equation for the reaction that took place.

8. An alkane X, of formula mass 30, consists of 80% carbon.
(a) Calculate the empirical formula of X.
(b) Determine the molecular formula of X.
(c) Write the structural formula of X.

9. The graphs below show the effect of temperature on the rate of the reaction between marble chips of the same mass and excess 2 M hydrochloric acid.

***

(a) If curve B is for reaction at 40°C, which curve shows the reaction taking place at
(i) 20°C?
(ii) 60 °C?
(b) Explain why the curves eventually end at the same level.
(c) State one other method that can be used to measure the rate of the reaction between marble chips and hydrochloric acid.

10. The enthalpy of combustion of carbon is –398 kJ mol^{-1}.
(a) Write an equation for the complete combustion of carbon.
(b) 80 g of charcoal costs 4000/=. Calculate the cost of charcoal required to produce 16375 kJ.

SECTION B

*Attempt **two** questions from this section. Start each question on a fresh page.*

11. In the extraction of iron ore, coke and limestone are fed into a blast furnace and hot air is blown into the mixture.

(a) Name and give the formula of one ore of iron.

(b) Why is limestone added to the mixture?

(c) Write equations for the reactions that lead to the formation of iron.

(d) Describe what happens when

(i) dilute hydrochloric acid is added to iron fillings.

(ii) steam is passed over heated iron fillings.

Write equation for the reaction that takes place in each case.

12. **(a)** Draw a labelled diagram of the apparatus that can be used to prepare ammonia in the laboratory.

(b) Describe an experiment that can be used to prepare ammonia in the laboratory.

(c) A copper coil was heated strongly and held over a concentrated solution of ammonia in a beaker.
Oxygen was then bubbled into the ammonia solution.

(i) State what was observed.

(ii) Explain the observations in (i).

(d) Ammonia reacts with lead (II) oxide according to the equation.

$2NH_{3(g)} + 3PbO_{(s)} \rightarrow N_{2(g)} + 3Pb_{(s)} + 3H_2O_{(l)}$.

Calculate the volume of ammonia at room temperature that would be required to completely react with 2.5 g of lead (II) oxide.

13. **(a)** State what is observed when

(i) crystals of iron (II) sulphate, $FeSO_4.7H_2O$, are heated strongly. Write equation(s) for the reaction(s) that occur(s).

(ii) concentrated nitric acid is added to the solution of iron (II) sulphate.

(b) Describe one test in each case that can be carried out to show that iron (II) sulphate crystals contain

(i) water of crystallisation,

(ii) iron (II) ions,

(iii) sulphate ions.

14. **(a)** (i) State two properties which show that air is a mixture.

(ii) Name two gases, other than oxygen, that are constituent of air and give their approximate percentages in air.

(b) Describe an experiment to determine the percentage of oxygen in air. Show how the percentage can be calculated from the results.

(c) (i) State what is observed when burning sulphur is lowered into a jar of oxygen.

(ii) Write the name and formula of the product of the reaction between sulphur and oxygen.

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INSTRUCTIONS TO CANDIDATES

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

In both sections all working must be clearly shown.

(C=12; H=1; Na=23; O=16; S=32; N=14)
1 mole of gas occupies 24 l at room temperature.
1 mole of gas occupies 22.4 l at s.t.p.

SECTION A

*Attempt **all** questions in this section.*

1. **(a)** Draw a diagram of the setup of the apparatus that can be used to show that iron does not rust in the absence of moisture.
(b) State one other conditions necessary for rusting to take place.
(c) Name two methods for preventing rusting.

2. A mixture of phenolphthalein and methyl orange was separated as shown in the diagram in figure 1.

***

(a) Name the method used in the separation of the mixture.
(b) (i) State the colour of methyl orange in this experiment.
(ii) Phenolphthalein is usually colourless. Explain why it is purple in this experiment.
(c) Give one other mixture that can be separated by the method you have named in (a).

3. A compound, X, consists of carbon 40.0%, hydrogen 6.7% and oxygen 53.3%.
(a) Calculate the empirical formula of X.
(b) If the formula mass of X is 60, determine its molecular formula.

4. A circuit for the electrolysis of lead (II) bromide was set up as shown in figure 2.

***

(a) State what was observed when
(i) the switch was turned on.
(ii) lead (II) bromide was melted and the switch turned on.
(b) Explain your observations in (a)(i) and (ii).

5. The atomic numbers of carbon and chlorine are 6 and 17respectively.
(a) Draw a diagram to show the electronic structure of
(i) carbon.
(ii) chlorine.

(b) Write the structural formula of the compound that can be formed between carbon and chlorine.

(c) Would you expect the compound in (b) to conduct electricity? Give a reason for your answer.

6. Figure 3 shows the setup of an apparatus used to identify the products of a burning candle.

***

(a) Name substance
P.
Q.
R.

(b) State the role of P.

(c) State what is observed in the test tube.

7. **(a)** Ethanol can be separated by fermentation of sugars.
Write an equation to show how ethanol can be prepared from glucose, $C_6H_{12}O_{16}$.

(b) When ethanol is heated with concentrated sulphuric acid at 170^{o}C , a substance W is formed.
(i) Name W.
(ii) Write the structural formula of W.
(iii) Name one reagent that can be used to identify W.

8. **(a)** A piece of burning magnesium was introduced into a jar of nitrogen.
(i) State what was observed.
(ii) Write an equation for the reaction that took place.

(b) Water was added to product of the reaction in (a) and the resultant mixture tested with litmus.
State what was observed.

(c) Name one other metal that reacts with nitrogen in a similar way to magnesium.

9. **(a)** Name two raw materials used in the manufacture of soap.

(b) Describe how soap is obtained from the materials you have named in (a).

(c) Detergents are commonly used in laundry instead of soap.
State one advantage of detergents over soap.

10. The table below shows the Solubilities of a salt P in water at different temperatures.

Temperature (^{o}C)	10	20	30	40	50	60
Solubility (g/100 g) of water	18	20	24	30	38	50

(a) Plot a graph of solubility of P against temperature.

(b) Use your graph to determine the solubility of P at 25^{o}C.

(c) Calculate the mass of P that would dissolve in 45 g of water at 25^{o}C.

SECTION B

*Attempt **two** questions from this section. Start each question on a fresh page.*

11. **(a)** Copper (II)) carbonate was heated strongly until there was no further change.

(i) State what was observed.

(ii) Write an equation for the reaction.

(iii) Name one reagent which can be used to identify the gaseous product.

(b) Excess dilute sulphuric acid was added to the residue in (a) and the mixture warmed.

(i) State what was observed.

(ii) Write an equation for the reaction.

(c) To the product in (b) was added dilute sodium hydroxide solution dropwise until in excess.

(i) State what was observed.

(ii) Write an equation for the reaction.

(d) 25.0 cm^3 of a 0.1 M hydrochloric acid required 10.0 cm^3 of sodium carbonate for complete neutralisation.

(i) Write an equation for the reaction which took place between sodium carbonate and hydrochloric acid.

(ii) Calculate the concentration of the sodium carbonate in mol dm^{-3}.

12. Figure 4 represents a flow chart for the manufacture of fertilizer. A, B, C, D, E and F are some of the important parts of the plant.

***

(a) (i) Name catalyst X.

(ii) Write an equation to show how the product at B is formed.

(iii) State the three conditions for the reaction C.

(iv) Identify the product at C.

(v) Write an equation to show how the product at D is formed.

(vi) Name the product at E.

(vii) What is the use of the water at E?

(viii) Write an equation to show the reaction that takes place at F.

(ix) Name the fertilizer formed at F.

(b) Calculate the percentage of nitrogen in ammonium phosphate, $(NH_4)_3PO_4$.

13. **(a)** Chlorine can be prepared in the laboratory from hydrochloric acid.

(i) Name the other reagent used in the preparation of chlorine.

(ii) State the conditions for the reaction.

(iii) Write an equation for the reaction which takes place between hydrochloric acid and the reagent you have named in (i).

(b) (i) Draw a labelled diagram to show the preparation of iron (II) chloride using chlorine.

(ii) State what would be observed during the reaction.

(iii) Write an equation leading to the formation of iron (III) chloride.

(c) (i) State what would be observed if aqueous ammonia was added to a solution of iron (III) chloride.

(ii) Write an ionic equation for the reaction in (c)(i).

14. **(a)** Describe an experiment that can be carried out to determine the heat of combustion of ethanol. Draw a diagram to illustrate your answer.

(b) Would you expect the heat of combustion as determined in the experiment in (a) to be greater than, lower than or equal to the theoretical value? Give a reason.

(c) When 0.382 g of ethanol was burnt, the heat evolved raised the temperature of 100 g of water from 16.5^{o}C to 43.5^{o}C.

Calculate the heat of combustion of ethanol.

(Heat capacity of water is 4.2 J g^{-1})

(d) Name two products, other than water, of incomplete combustion of ethanol.

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INSTRUCTIONS TO CANDIDATES

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

In both sections all working must be clearly shown.

(C=12; H=1; Na=23; O=16; S=32; N=14)
1 mole of gas occupies 24 l at room temperature.
1 mole of gas occupies 22.4 l at s.t.p.

SECTION A

*Answer **all** the questions in this section.*

1. **(a)** State the approximate percentage of oxygen in the atmosphere.

(b) Name the process by which oxygen is

(i) used up from the atmosphere.

(ii) replaced in the atmosphere.

(c) State what would be observed if a piece of burning phosphorus is lowered into a jar of oxygen.

2. **(a)** 50 cm^3 of 2 M hydrochloric acid and 50 cm^3 of 2 M sodium hydroxide, both at 22^oC, were mixed in a plastic beaker. The mixture was stirred and its maximum temperature was 35 ^oC.

(Specific heat capacity of the solution = 4.2 kJ $g^{-1}/^oC$.

Density of the solution = 1 g cm^{-3})

(i) Write an ionic equation for the reaction which took place.

(ii) Calculate the heat of the reaction.

(b) 50 cm^3 of 2 M ammonia solution was used instead of the sodium hydroxide in (a). State whether the heat of the reaction was greater than, smaller than or equal to the value you have calculated in (a)(ii). Give a reason for your answer.

3. **(a)** A clean nail was dipped into a solution of copper (II) sulphate and was left to stand.

(i) State what was observed.

(ii) Write an equation for the reaction that took place.

(b) (i) State what would be observed if the iron nail was replaced by a silver nail.

(ii) Give a reason for your answer in (i).

4. The diagram in figure 1 shows the apparatus which can be used to prepare nitrogen in the laboratory.

***

(a) Name gas A.

(b) (i) State what would be observed in the combustion tube during the reaction.

(ii) Write an equation for the reaction.

(c) Name

(i) substance X.

(ii) one reagent that can be used to identify X.

5. **(a)** State what is observed if chlorine is passed through

(i) litmus solution.

(ii) aqueous potassium iodide.

(b) Write an equation for the reaction that takes place in (a)(ii).

6. Part of the Periodic Table showing positions of some elements is shown below. The letters are not the usual symbols of the elements.

I	II			III	IV	V	VI	VII	VIII
A					B				
	C							D	
E								F	

(a) State what type of bond in the compound formed between E and F.

(b) Write the formula of the compound formed between B and D.

(c) Which one of the elements reacts most vigorously with

(i) cold water?

(ii) heated zinc?

(d) Write the formula of the ion formed by C.

7. **(a)** Ethanol reacts with sulphuric acid to form ethene.
State the conditions for the reaction.

(b) Write an equation for the reaction between ethene and bromine.

(c) Ethene burns in oxygen according to the equation:

$$C_2H_{4(g)} + 3O_{2(g)} \rightarrow 2CO_{2(g)} + 2H_2O_{(l)}.$$

Calculate the mass of each of the products when 14 g of ethene is completely burnt in oxygen.

8. **(a)** Write equation to show how each of the following salts could be prepared in the laboratory.

(i) lead (II) sulphate.

(ii) sodium sulphate.

(b) State what would be observed if dilute nitric acid followed by a few drops of barium nitrate solution was added to a solution of

(i) sodium sulphate.

(ii) sodium sulphite.

9. In an experiment to study the action of steam on aluminium, a piece of aluminium foil was cleaned and the experiment carried out as shown in the diagram in figure 2.

***

(a) Why was the aluminium foil first cleaned?

(b) State why the glass wool was heated.

(c) State what was observed during the experiment.

(d) Identify gas Z.

10. 20 cm^3 of sodium carbonate solution reacted completely with 25 cm^3 of a 0.8 M hydrochloric acid according to the following equation:

$$Na_2CO_{3(aq)} + 2HCl_{(aq)} \rightarrow 2NaCl_{(aq)} + CO_{2(g)} + H_2O_{(l)}.$$

Calculate the concentration of the sodium carbonate solution in grams per litre.

SECTION B

*Attempt **two** questions from this section. Start each question on a fresh page.*

11. **(a)** (i) Draw a labelled diagram of the set-up the apparatus that can be used to prepare a dry sample of carbondioxide in the laboratory.

(ii) Write an equation that leads to the formation of carbondioxide.

(b) Burning magnesium was lowered into a jar of carbondioxide.

(i) State what was observed.

(ii) Explain the observations in (b)(i).

(c) Water was added to the product in (b) and the resultant mixture tested with litmus.

State what was observed.

(d) When a solution of sodium hydroxide was exposed to air, a white solid was formed on the surface.

(i) Name the white solid.

(ii) Write equations to show how the white solid is formed.

12. **(a)** Explain what is meant by the term *saturated solution*.

(b) Describe how the solubility of potassium chloride can be determined in the laboratory.

(c) The table below shows the solubilities of potassium chloride and potassium nitrate at various temperatures.

Temperature (^{o}C)	0	20	40	60
Solubility of potassium chloride (g)	28.2	33.5	38.8	44.7
Solubility of potassium nitrate (g)	12.9	31.8	61.2	108.2

(i) On the same axes, plot graphs of solubilities of potassium chloride and potassium nitrate against temperature.

(ii) Determine the temperature at which the concentrations of the two salts are equal.

(iii) Which of the two salts dissolves more rapidly with increase in temperature?

(iv) State what would happen if a saturated solution of potassium chloride at 40^{o}C was cooled to 30^{o}C.

(d) Of what industrial application is the study of solubility of salts.

13. **(a)** Sulphuric acid is a strong dibasic acid.

(i) Explain the terms *strong acid* and *basicity*.

(ii) Write an equation to show how sulphuric acid ionises in water.

(b) Sulphuric acid reacts with potassium hydrogen carbonate according to the equation:

$$H_2SO_4(aq) + 2KHCO_3(s) \rightarrow K_2SO_4(aq) + 2CO_2(q) + 2H_2O(l).$$

Calculate the volume of carbondioxide produced at s.t.p. when 20 cm^3 of 0.5 M sulphuric acid is reacted with excess potassium hydrogen carbonate.

(c) (i) State the conditions under which sulphuric acid reacts with potassium nitrate.

(ii) State what is observed and write an equation for the reaction.

(d) Explain what happens when a mixture of sulphur and concentrated nitric acid is heated.

14. **(a)** Name one ore from which sodium can be extracted.

(b) Describe how sodium is extracted from the ore you have named in (a).

Your answer should include the following:

(i) names of the materials used as the electrodes.

(ii) equations for the reactions that take place at the electrodes.

(iii) method of collecting the sodium produced.

(A diagram is **not** required.)

(c) A piece of sodium was heated and plunged into a jar of chlorine.

(i) State what was observed.

(ii) Write the equation for the reaction which took place.

(e) When aqueous silver nitrate was added to a solution of the product in (d), a white precipitate was formed.

Write an ionic equation for the reaction that took place.

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545/2 CHEMISTRY PAPER 2 Nov./Dec. 1996 2 hours	UGANDA NATIONAL EXAMINATION BOARD Uganda Certificate of Education CHEMISTRY Paper 2 Time: 2 hours

INSTRUCTIONS TO CANDIDATES

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In both sections all working must be clearly shown.

(C=12; H=1; Na=23; O=16; S=32; N=14)
1 mole of gas occupies 24 l at room temperature.
1 mole of gas occupies 22.4 l at s.t.p.

SECTION A

*Attempt **all** questions in this section.*

1. Sodium is manufactured by electrolysis of sodium chloride as shown in the diagram below.

***

(a) Name the material of which the cathode is made.

(b) Write an equation for the reaction that takes place at

(i) the cathode,

(ii) the anode.

(c) What is the purpose of calcium chloride?

(d) State why sodium is collected under dry nitrogen.

2. A certain mass of zinc powder was reacted with hydrochloric acid at room temperature.

(a) (i) Write an equation for the reaction.

(ii) Draw a graph to show how the volume of the gaseous product varied with time.

(b) What would be the effect of

(i) adding copper (II) sulphate solution to the reaction mixture at room temperature,

(ii) using the same mass of zinc granules instead of the zinc powder?

(c) Give a reason for your answer in (b)(ii).

3. A compound, Y consists of 92.31% carbon and 7.69% hydrogen. The formula of Y is 26.

(a) Calculate the empirical formula of Y.

(b) determine the molecular formula of Y.

(c) Write the structural formula of Y.

4. Dilute sulphuric acid reacts with sodium sulphite to produce a colourless gas X. X turns acidified aqueous potassium dichromate (VI) green.

(a) (i) Identify X.

(ii) Write an ionic equation to show the formula of X.

(b) 25.0 cm^3 of a 0.02 M sodium hydroxide solution reacted with v cm^3 of an aqueous solution containing 0.025 mol dm^{-3} of X.

Calculate the value of v. (2 moles of sodium hydroxide react with 1 mole of X).

5. **(a)** Write an equation to show how ethanol can be prepared from glucose.

(b) State how a sample of ethanol obtained from the product of the reaction in (a) can be purified.

(c) When 23 g of ethanol completely burnt, 13600 kJ of heat was produced.

Calculate the molar heat of combustion of ethanol (C=12; H=1; O=16).

6.

***

The diagram in figure 2 shows a set up of apparatus for the electrolysis of dilute sulphuric acid.

(a) State what was observed after about 5 minutes.

(b) Explain your observation in (a).

7. A test tube filled with a solution of chlorine in water was inverted over water and exposed to sunlight. After a few days, a gas formed in the test tube.

(a) Name the gas.

(b) Describe a simple test to identify the gas.

(c) Explain the reaction which leads to the formation of the gas.

8. Part of the Periodic Table is shown below.

I	II			III	IV	V	VI	VII	VIII
A									
						C	D		
B	F						E		

(a) State the type of bonding in the compound formed between

(i) C and D.

(ii) E and F.

(b) (i) Which one of the elements A and B reacts more vigorously with **water**?

(ii) Write an equation for the reaction between water and the element you have identified in (i).

9. **(a)** Name the element present in pure charcoal.

(b) Explain why it is dangerous use charcoal stove in a poorly ventilated room.

(c) Write an equation for the reaction between charcoal and heated iron (III) oxide.

10. An experiment was set up as shown in the diagram below to investigate conditions under which iron rusts.

***

(a) What is the purpose of the layer of oil in the experiment?

(b) Why was boiled water used?

(c) State what was observed after some days.

(d) Give one method which can be used to prevent rusting.

SECTION B

*Attempt **two** questions from this section. Start each question on a fresh page.*

11. **(a)** Sodium carbonate contains water of crystallisation and it is efflorescent. Explain the terms *water of crystallisation* and *efflorescence*.

(b) Aqueous sodium carbonate was added separately to

(i) a solution of zinc sulphate and

(ii) ethanoic acid.

State what was observed and write an ionic equation for the reaction in each case.

(c) When 3.22 g of hydrated sodium sulphate, $Na_2SO_4.nH_2O$, was heated until there was no further change, 1.42 g of the residue remained.

(i) Write an equation for the reaction.

(ii) Determine the value of n.

12. **(a)** 20.0 dm^3 of sodium hydroxide solution required 46.0 cm^3 of 0.1 M hydrochloric acid for complete neutralisation.

Calculate

(i) the concentration of the sodium hydroxide in mol dm^{-3}.

(ii) the mass of sodium chloride formed.

(b) (i) Name **one** reagent that can be used to test for the presence of chloride ions in solution.

(ii) State what is observed when the reagent is added to the solution.

(iii) Write an ionic equation for the reaction.

(c) (i) Name one chloride, other that sodium chloride, that can be prepared by neutralisation.

(ii) Briefly describe how a dry sample of the salt you have named in (c)(i) can be obtained.

13. The following flow chart shows the steps in the manufacture of sulphuric acid by the Contact process.

***

(a) Write an equation for the reaction that takes place in step I.

(b) Why is step II necessary?

(c) Name

(i) the drying agent in step II.

(ii) the catalyst in step III.

(d) Describe the process that takes place in step V.

(e) Sulphurdioxide combines with air to form sulphur trioxide according to the equation:

$$2SO_{2(g)} + O_{2(g)} \rightarrow 2SO_{3(g)} \qquad \Delta H = -200 \text{ kJ mol}^{-1}.$$

(f) Give **one** use of sulphuric acid.

(g) Concentrated sulphuric acid is 18 M. Calculate the volume of concentrated sulphuric acid required to make 2 l of 2 M sulphuric acid.

14. **(a)** (i) Draw a labelled diagram of the set up apparatus that can be used to prepare dry ammonia in the laboratory.

(ii) Write an equation for the reaction.

(b) Aqueous ammonia was added dropwise until in excess to a solution of copper (II) nitrate.

(i) State what was observed.

(ii) Explain the observations you have stated in (i).

(c) Explain what happens when heated platinum foils is introduced into a gas jar containing a mixture of ammonia and oxygen.

(d) Ammonium sulphate, when heated, decomposes according to the following equation:

$(NH_4)_2SO_{4(s)} \rightarrow 2NH_{3(g)} + H_2SO_{4(aq)}$.

Calculate the volume of ammonia at room temperature, produced when 1.32 g of ammonium sulphate is strongly heated.

****

545/2 **CHEMISTRY** **PAPER** 2 **Nov./Dec. 1997** 2 **hours**	**UGANDA NATIONAL EXAMINATION BOARD** **Uganda Certificate of Education** **CHEMISTRY** **Paper 2** **Time: 2 hours**

INSTRUCTIONS TO CANDIDATES

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

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

In both sections all working must be clearly shown.

(C=12; H=1; Na=23; O=16; S=32; N=14)
1 mole of gas occupies 24 l at room temperature.
1 mole of gas occupies 22.4 l at s.t.p.

SECTION A

*Attempt **all** questions in this section.*

1. Zinc powder was added to a solution of copper sulphate in a test tube. A brown solid and a colourless solution were formed.

(a) (i) Identify the brown solid.

(ii) Write an equation for the formation of the brown solid.

(b) (i) Identify the colourless solution.

(ii) Write an equation for the formation of the colourless solution.

(iii) Write an overall equation for the reaction between zinc powder and copper sulphate.

(iv) What reaction has taken place?

2. During the preparation of chlorine in the laboratory, the gas may be passed through water and concentrated sulphuric acid before collection.

(a) State the use of

- Water.
- Concentrated sulphuric acid.

(b) Chlorine is a bleaching agent when in the presence of water.

(i) Write an equation for the reaction between chlorine and water.

(ii) Using equations explain the bleaching action of chlorine.

(c) (i) State what would be observed if chlorine was bubbled through a solution of iron (II) sulphate solution.

Write an ionic equation for the reaction between chlorine and iron (II) ions.

3. **(a)** Molten lead (II) bromide was electrolysed between carbon electrodes.

(i) State what was observed at the

- cathode,

- anode.

(ii) Write an equation that took place at each electrode.

(b) Calculate the mass of the product formed at the cathode when a current of 2 amps is passed for 1 hour and 30 minutes.

(Pb=207; Br=80; IF=96500 coulombs)

4. Soap forms scum when mixed with certain types of water.

(a) What is the chemical nature of scum?

(b) Outline a physical method used to obtained water free from hardness.

(c) Give **two** advantages of hard water.

5. Figure 1 shows part of the Periodic Table. The letters used are not the correct symbols of the elements.

I							VIII
	II	III	IV	V	VI	VII	
			P		T	R	
S							Q

Which of the elements are metals?

(b) Suppose element P reacts with element T,

(i) Write the formula of the compound formed between P and T.

(ii) What would be the type of bond formed between P and T?

(c) (i) Which element in the table is least reactive?

(ii) Explain your answer in (c)(i).

(d) (i) Suggest a compound formed between any two elements shown, which would conduct electricity.

(ii) Give a reason for your answer in (d)(i).

6. Figure 2 shows a setup of apparatus to investigate the reaction between metals and steam.

***

(a) Suggest a suitable metal that could be used in the experiment.

(b) (i) What would be observed in the glass tube?

(ii) Write the equation for the reaction in the glass tube.

(c) (i) Suggest the gas that is being burnt at the end of the tube.

(ii) Write the equation for the combustion of the gas in (c)(i).

7. 18.75 cm^3 of 0.2 M sodium hydroxide solution neutralised 25 cm^3 of a 0.05 M solution of an acid.

Calculate

(a) the number of moles of sodium hydroxide that reacted.

(b) the number of moles of acid that reacted.

(c) the molar ratios of alkali to acid for the reaction.

8. **(a)** Explain what is meant by **polymerisation**.

(b) Name **one** neutral polymer and **one** synthetic polymer and state one use of each of the polymers named.

Natural polymer.

Use.

Synthetic polymer.

Use.

9. **(a)** Define **oxidation** in terms of electrons.

(b) Write the equations of the following half reactions and in each case state whether the reaction is a reduction or an oxidation reaction.

(i) The conversion of hydrogen ions (H^+) to hydrogen molecules (H_2).

(ii) The conversion of iron (II) ions (Fe^{2+}) to iron (III) ions (Fe^{3+}).

(iii) The conversion of chlorine molecules (Cl_2) to chloride ions (Cl^-).

10. Use the data in the table below to answer the questions that follow.

Substance	M.P.°C	B.P.°C	Solubility in water	Electrical conductance		Density at room temp.
				Solid form	Molten form	
A	714	1418	V	none	good	2.3 g/cm^3
B	-95	56	V	none	none	0.8 g/cm^3
C	1083	2580	I	good	good	8.9 g/cm^3
D	-101	-34	V	none	none	2.55 g/l
E	-23	77	I	none	none	1.6 g/cm^3
F	-219	-183	S	none	none	1.33 g/l

V= very soluble; S= slightly soluble; I=insoluble.

(a) (i) Name **two** substances that are liquid at room temperature.

(ii) Which of the two is more volatile?

(b) Which substance(s) would dissolve in water and could be separated from the solution by

(i) fractional distillation.

(ii) by evaporation of the water?

(c) Which of the substances A to F,

(i) has the structure consisting of ions?

(ii) is a metal?

(iii) is a liquid which would form separate layer with water?

(iv) would the water be above or below?

(d) Which substance is a gas which

(i) would **not** be collected efficiently over water.

(ii) would be collected efficiently over water.

SECTION B

*Answer **two** questions from this section, start each question on a fresh page.*

11. **(a)** With the aid of diagram describe an experiment you would carry out to show that rusting requires both oxygen and water in order to occur.

(b) Describe **four** ways of preventing rusting.

12. **(a)** Describe briefly how copper (II) sulphate crystals can be prepared from copper (II) oxide.

(b) What would be observed if

i) sodium hydroxide solution was gradually added to a solution of copper (II) sulphate until the alkali was in excess? Write the equation for the reaction that took place.

(ii) hydrated crystals of copper sulphate were heated strongly?

(c) Copper (() carbonate reacts with dilute hydrochloric acid according to the equation:

$$CuCO_{3(s)} + 2HCl_{(aq)} \rightarrow CuCl_{2(aq)} + CO_{2(g)} + H_2O_{(l)}.$$

What volume of carbondioxide would be evolved at s.t.p. when 6.2 g of copper (II) carbonate is reacted with excess dilute hydrochloric acid.

(H=1; C=12; Cu=64; one mole of gas occupies 22.4 dm^3 at s.t.p.)

13. **(a)** Draw a labelled diagram of the apparatus you would use to prepare chlorine in the laboratory, using potassium permanganate.

(b) State what is observed when

(i) a piece of yellow phosphorus is lowered in a jar of chlorine.

(ii) burning turpentine ($C_{10}H_{16}$) is lowered in a jar of chlorine.

(iii) chlorine is bubbled in a solution of potassium bromide.

14. **(a)** Draw a diagram of a Daniel cell consisting of a zinc rod dipped in zinc sulphate and a copper rod dipped in copper sulphate solution; the solutions separated by the porous wall; and the rods connected by a wire.

(b) Indicate

(i) the charges on each electrode,

(ii) the direction of electron movement in the wire.

(c) Write,

(i) equations for reactions at each electrode.

(ii) an equation for the overall reaction.

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545/2 CHEMISTRY PAPER 2 Nov./Dec. 1998 2 hours	UGANDA NATIONAL EXAMINATION BOARD Uganda Certificate of Education CHEMISTRY Paper 2 Time: 2 hours

INSTRUCTIONS TO CANDIDATES

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

In both sections all working must be clearly shown.

(C=12; H=1; Na=23; O=16; S=32; N=14)
1 mole of gas occupies 24 l at room temperature.
1 mole of gas occupies 22.4 l at s.t.p.

SECTION A

Answer all the questions in this section.

1. An atom X of an element, atomic mass 31 contains 15 protons.

(a) (i) State the number of neutrons in X.

(ii) Write the electronic configuration of X.

(b) State the group in the Periodic Table the element belongs.

(c) (i) Write the formula of a compound that can be formed between X and chlorine.

(ii) State the bon type in the compound in (c)(i).

(d) An atom Y contains 17 neutrons and 15 protons. What word is used to describe the relationship between X and Y?

2. **(a)** write an equation to show how hydrogen gas can be prepared from zinc and dilute sulphuric acid.

(b) Hydrogen was reacted with copper (II) oxide. State

(i) the conditions for the reaction.

(ii) what was observed.

3. A crystal of potassium manganese (VII) was placed at the corner in a trough of water as shown in figure 1 below and the experiment was allowed to stand for about 30 minutes.

***

(a) State what was observed after 30 minutes.

(b) Name the process that occurred.

(c) State the purpose of the experiment.

4. Ammonium chloride dissolves in water to form an acidic solution according to the equation below:

$$NH_4Cl_{(s)} + H_2O_{(l)} \rightarrow NH_4OH_{(aq)} + HCl_{(aq)}.$$

(a) Explain why the solution is acidic.

(b) A solid mixture contains ammonium chloride and sodium chloride. Name **one** method that can be used to obtain pure ammonium chloride from the mixture.

(c) Write an equation for the reaction that takes place when ammonium chloride is heated with sodium hydroxide.

5. Figure 2 below shows a simple voltaic cell.

***

(a) (i) Write equations for the reaction taking place at the

cathode.

anode.

(ii) Write the overall equation of the cell reaction.

(b) Draw an arrow on the diagram to show the direction of flow of electrons.

6. When hydrogen peroxide was exposed to sunlight, a gas was formed.

(a) (i) Name the gas.

(ii) State how the gas could be identified.

(iii) Write an equation for the reaction leading to the formation of the gas.

(b) Name **one** reagent that can be used to speed up the rate of formation of the gas.

7. 5.00 g of zinc was heated to constant mass.

(a) State what was observed.

(b) Write an ionic equation for the reaction that took place.

(c) Calculate the apparent loss in mass. (C=12; O=16; Zn=65)

8. The molecular mass of a gas X is 28 and its empirical formula is CH_2. (H=1; C=12).

(a) Determine the molecular formula of X.

(b) Write

(i) the structural formula of X.

(ii) the equation for the reaction between X and bromine.

(c) (i) Name **one** other reagent that could be used to identify X.

(ii) State what would be observed if the reagent named in (c)(i) was reacted with X.

9. **(a)** When 17 g of hydrogen peroxide was exposed to sunlight, 6dm^3 of a gas was evolved at room temperature.

(i) Write equation for the reaction that took place.

(ii) Calculate the volume of the gas evolved at room temperature.
(H=1; O=16; 1 mole of a gas occupies 24 dm^3 at room temperature.)

(b) Manganese (IV) oxide is added to 17 g of hydrogen peroxide and the mixture exposed to sunlight at room temperature.

(i) Determine the volume of the liquid evolved at room temperature.

(ii) Give a reason for your answer.

10. **(a)** State the conditions necessary for rusting to occur.

(b) During an investigation to show the conditions under which an iron nail may rust, an experiment was set up as shown in figure 3 below:

***

State the conditions which was eliminated.

(c) State **one** disadvantage of rusting.

(d) (i) What is galvanised iron?

(ii) State **one** use of galvanised iron.

SECTION B

*Attempt **two** questions from this section. Start each question on a fresh page.*

11. **(a)** Describe how a dry sample of hydrogen chloride can be prepared from a named chloride. (No diagram is required). Your answer should include the following:

- Conditions for the reaction.
- Name of the drying agent.
- Method of collection.
- Equation for the reaction.

(b) Name the substance that is formed when hydrogen chloride is passed through water.

(c) (i) Name **one** reagent that can be used to test for the presence of chloride ions in solution.

(ii) State what would be observed if the reagent was added to chloride solution.

(d) Write an ionic equation to show the reaction between aqueous hydrogen chloride and calcium hydrogen carbonate solution.

(e) 25.0 cm^3 of a 0.2 M lead (II) nitrate solution was shaken with excess aqueous hydrogen chloride. Lead (II) ions react with chloride ions according to the following equation:

$$Pb^{2+}_{(aq)} + 2\ Cl^{-}_{(aq)} \rightarrow PbCl_{2(s)}.$$

Calculate the mass of lead (II) chloride formed.

12. **(a)** (i) state the difference between fats and oils.

(ii) Give **one** example of each.

(b) Briefly describe how soap can be prepared.

(c) State what would be observed if soap solution was shaken with a solution containing magnesium hydrogen carbonate.

(d) Explain your answer in (c).

(e) State what would be observed if a solution of soapless detergent was used instead of soap solution.

(f) Give **one** disadvantage of soapless detergents.

13. **(a)** (i) Draw a labelled diagram to show how carbondioxide can be prepared in the laboratory.

(ii) Write an ionic equation for the reaction leading to the formation of carbondioxide.

(b) Carbondioxide was passed through calcium hydroxide solution. Describe and explain the reaction that took place.

(c) (i) State what would be observed if burning magnesium ribbon was lowered into a jar of carbondioxide.

(ii) Write equation for the reaction that takes place in (c)(i).

14. **(a)** "Extraction of metals is essentially a reduction process". Explain the statement using extraction of iron as an example. Write an equation to illustrate you're a answer.

(b) State the conditions under which iron may react with

(i) oxygen.

(ii) water.

(iii) chlorine.

(c) Write an equation for the reactions in (b)(ii) and (iii).

(d) Steel is an alloy of iron.

(i) Explain what is meant by the **alloy**.

(ii) Name the elements which are used in making stainless steel.

(iii) State **one** use of stainless steel.

(iv) Suggest a reason why the use of stainless steel is preferred to that of pure iron.

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545/2 CHEMISTRY PAPER 2 Nov./Dec. 1999 2 hours	UGANDA NATIONAL EXAMINATION BOARD Uganda Certificate of Education CHEMISTRY Paper 2 Time: 2 hours

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In both sections all working must be clearly shown.

(C=12; H=1; Na=23; O=16; S=32; N=14)
1 mole of gas occupies 24 l at room temperature.
1 mole of gas occupies 22.4 l at s.t.p.

SECTION A

*Attempt **all** questions in this section.*

1. **(a)** Write equation for the complete combustion of methane.

(b) A litre of methane gas costs 600/=. Calculate the cost of methane required to produce 1746 x 10^3 J of heat. (1 mole of a gas occupies 24 litres at room temperature, the heat of combustion of methane is –822 kJ mol^{-1}).

2. **(a)** State the factors that can affect the rate of a chemical reaction.

(b) A mixture of a known mass of magnesium and a certain volume of 2M hydrochloric acid was put in a conical flask and the mass of the mixture was recorded at various intervals. The result of the experiment is shown in the graph below.

***

On the same axes, draw a graph that would be obtained when same mass of magnesium was reacted with the same volume of 1 M hydrochloric acid.

(c) 5.0 g of calcium carbonate was reacted with 20 cm^3 of 2 M hydrochloric acid.

(i) Write the equation for the reaction between hydrochloric acid and calcium carbonate.

(ii) Calculate the mass of calcium carbonate that was left.
(Ca=40; O=16; C=12)

3. **(a)** Define the term **electrolyte**.

(b) (i) Draw a labelled diagram of the apparatus that can be used to electroplate iron with zinc.

(ii) State one advantage of using zinc coated iron.

4. Figure 1 is a set up of apparatus for the preparation of hydrogen.

***

(a) Identify:

(i) X.

(ii) Y.

(b) Write an ionic equation for the formation of hydrogen.

(c) Hydrogen was passed over heated copper (II) oxide.

(i) State what was observed.

(ii) Write equation for the reaction.

5. Nitrogen reacts with hydrogen to produce ammonia according to the following equation:

$N_{2(g)} + 3H_{2(g)} \Leftrightarrow NH_3 + Heat.$

The table below shows the percentage yield of ammonia at various temperature and pressures.

Temperature ^oC	Pressure (atmosphere)		
	10	200	1000
250	30%	75%	96%
500	1%	18%	60%
1000	0%	0.1%	1%

(a) (i) State how the percentage yield of ammonia varies with pressure at constant temperature.

(ii) State the temperature and pressure which gives maximum yield of ammonia.

(b) Calculate the volume of ammonia produced at s.t.p. when 18.5 g of hydrogen gas is reacted with excess nitrogen.

(H=1; N=14; 1 mole of a gas occupies 22.4 litres at s.t.p.)

6. The solubility of hydrated copper (II) sulphate, $CuSO_4 \bullet 5H_2O$ in moles per litre at various temperature is shown in the figure 2 below.

***

(a) Determine the solubility of hydrated copper (II) sulphate 80 ^oC.

(b) Calculate the solubility of hydrated copper (II) sulphate in g/100 g of water at 80 ^oC. (H=1; O=16; S=32; C=64)

7. **(a)** State what would be observed if concentrated sulphuric acid is added to sugar. Explain your answer.

(b) Dilute sulphuric acid was added to zinc carbonate. State what was observed and write equation for the reaction.

(c) State the conditions under which sulphuric acid reacts with copper and write equation for the reaction.

(d) Describe a test that can be carried out to identify the sulphate ion in sulphuric acid.

(e) State **one** use of sulphuric acid.

8. **(a)** (i) State how you would separate a mixture of sulphur and iron fillings using a physical method.

(ii) Explain the principle behind the method you have given in your answer in (i) above.

(b) A mixture of sulphur and iron fillings was strongly heated.

(i) State what was observed.

(ii) Write the equation for the reaction.

9. **(a)** The table below shows the results of tests carried out on an aqueous solution of a salt. Study the table and answer the questions that follow.

Tests	**Observation**
(i) With dilute sodium hydroxide solution.	White precipitate in excess alkali.
(ii) With aqueous ammonia.	A white precipitate insoluble in excess ammonia.
(iii) With aqueous potassium iodine.	A bright yellow precipitate.

(i) Identify the cation.

(ii) Write an ionic equation for the reaction in test (ii) in the table.

(iii) Explain the observation in test (ii).

10. **(a)** (i) Define the term **allotropes**.

(ii) Name **one** example of an element that shows allotropy other than carbon.

(b) (i) Give the allotropes of carbon.

(ii) State **two** properties of one of the allotropes of carbon you named in (i).

(iii) Explain how the allotrope is used due to its properties named in (b)(ii) above.

SECTION B

*Attempt **two** questions from this section. Start each question on a fresh page.*

11. **(a)** (i) What is the rate of reaction?

(ii) How does particle size affect rate of reaction? Explain your answer.

(b) The table of results below shows the time taken for Sulphur to form when various concentrations of sodium thiosulphate were used.

M

Concentration of $S_2O_3^{2-}$ (M)	0.2	0.6	0.8	1.2	1.6
Time for sulphur to form (Sec)	60	20	15	10	7.5
1/t (Sec^{-1})	0.017	0.05	0.07	0.10	0.13

Plot the graph of 1/t (sec^{-1}) vertical against concentration of thiosulphate.

(c) (i) Explain the relationship between a rate of the reaction and 1/t.

(ii) Deduce from the graph, how the rate of reaction various with the concentration of thiosulphate.

(d) Name **one** reagent that you would use to test for sulphur dioxide and state what would be observed if the reagent was used.

12. In an experiment to determine the rate of reaction between zinc and sulphuric acid, dilute sulphuric acid was reacted with zinc granules to which some copper (II) sulphate solution was added. The volumes of hydrogen gas evolved at various times were measured. The results are shown in the table below.

Time in minutes	0	5	10	15	20	25	30
Vol of gas in cm^3	0	10	20	25.5	29.5	32	32

(a) (i) What is the role of copper (II) sulphate solution?

(ii) Write an ionic equation for the solution in the reaction above.

(iii) Explain what would happen to the reaction if zinc granules were replaced with zinc powder.

(b) (i) Plot the graph of volume of hydrogen evolved (vertical) against time.

(ii) Describe how you would determine the rate of the reaction at 12 minutes.

(iii) Compare the rate of reaction at 12 minutes with that of 20 minutes. Give a reason for your answer.

(iv) What happens to the shape of the graph after 25 minutes? Explain your answer.

13. **(a)** (i) Draw a labelled diagram to show how a sample of oxygen can be prepared in laboratory from hydrogen peroxide.

(ii) Write the ionic equation for the reaction that takes place.

(b) State and explain what happens when each of the following substances are lowered in a gas jar of oxygen and water added to the products.

(i) Burning sodium,

(ii) Ignited magnesium,

(iii) Hot iron.

(c) Name **one** natural process by which oxygen can be obtained.

(d) State **two** uses of oxygen to society.

(e) Calculate the volume of oxygen liberated when 16 g of potassium chlorate (V) is heated. (K=39; Cl=35.5; O=16; 1 mole of gas occupies 24000 ml at s.t.p.)

14. **(a)** (i) Describe with the aid of a well-labelled diagram how a dry sample of chlorine can be prepared in the laboratory.

(ii) Write an equation for the reaction that took place.

(iii) State any **three** uses of chlorine.

(b) State with the aid of equations, what would be observed if chlorine was added to

(i) Iron (II) chloride solution,

(ii) Potassium iodine solution.

(c) Burning sodium was plunged into a jar of chlorine.

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545/2 CHEMISTRY PAPER 2 Nov./Dec. 2000 2 hours	UGANDA NATIONAL EXAMINATION BOARD Uganda Certificate of Education CHEMISTRY Paper 2 Time: 2 hours

INSTRUCTIONS TO CANDIDATES

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

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

In both sections all working must be clearly shown.

(C=12; H=1; Na=23; O=16; S=32; N=14)
1 mole of gas occupies 24 l at room temperature.
1 mole of gas occupies 22.4 l at s.t.p.

SECTION A

*Attempt **all** questions in this section.*

1. **(a)** A solution of sodium carbonate was added to a solution of calcium ions.
(i) State what was observed.
(ii) Write equation for the reaction that took place.
(b) Dilute hydrochloric acid was added to the mixture formed in (a) above.
(i) State what was observed.
(ii) Write equation for the reaction.

2. The diagram in figure 1 shows an arrangement of the apparatus used for the purification of copper.

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(a) Name the substance used as:
(i) anode.
(ii) cathode.
(b) Name the electrolyte.
(c) Write equation for the reaction that took place at:
(i) anode.
(ii) cathode.

3. **(a)** Name the ions that cause hardness in water.
(b) Explain how the variation in hardness can be determined in the laboratory.
(c) State the disadvantage of using sodium carbonate to remove hardness in water.
(d) State **two** advantages of hard water.

4. **(a)** (i) What is an **alloy**?
(ii) Give an example of an alloy.
(iii) State the composition of the alloy you named in (a)(ii).
(b) State **two** uses of the alloy in (a)(ii).

5. **(a)** Write the formulae of the oxides of:
(i) sulphur.
(ii) aluminium.

(b) State the type of bond that exists in the oxide of:
(i) sulphur.
(ii) aluminium.

(c) State the class to which the oxides of the following elements belong.
(i) sulphur.
(ii) aluminium.

6. Magnesium can react with both oxygen and nitrogen.
(a) (i) State the conditions for the reaction.
(ii) Write the formulae of the products formed during the reaction.

(b) Identify one of the products in (a) that dissolves in water to form a solution and a gas. Both solution and the gas turn litmus blue.
(i) Identify the product.
(ii) Write equation for the reaction between the product and water.

(c) A clean piece of magnesium ribbon was placed in a solution of copper (II) sulphate.
(i) State what was observed.
(ii) Write an ionic equation for the reaction.

7. **(a)** Write equation for the reaction between sodium hydroxide and sulphuric acid.

(b) 20.0 cm^3 of sodium hydroxide solution reacted completely with 30.0 cm^3 of 1M sulphuric acid. Calculate the molarity of the sodium hydroxide solution.

8. **(a)** Excess sulphurdioxide was bubbled into a solution of sodium hydroxide containing phenolphthalein indicator.
(i) State what was observed.
(ii) Write equation for the reaction.

(b) Sodium hydroxide was added to the resultant solution in (a) above until it was in excess.
(i) State what was observed.
(ii) Write equation for the reaction.

9. A stream of dry hydrogen was passed over 6.85 g of heated lead (II) oxide in a combustion tube. The residue weighted 6.21 g.
(a) State what was observed in the reaction.
(b) Write equation for the reaction.
(c) Calculate the moles of the residue.

10. Sulphuric acid reacts with ethanol to produce a colourless gas that decolourises bromine water.
(a) Name the gas that is produced.
(b) State the conditions for the reaction.
(c) Write equation fort he reaction.
(d) Give **two** large-scale uses of the gas produced.

SECTION B

*Attempt **two** questions from this section. Start each question on a fresh page.*

11. **(a)** (i) Name the raw materials used for the manufacture of ammonia.
(ii) Write equation for the reaction leading to the formation of ammonia.

(b) Explain how formation of ammonia is affected by
(i) Pressure.
(ii) Temperature.

(c) State another factor that affects the formation of ammonia.

(d) Dry ammonia was passed over heated copper (II) oxide until there was further change.

State what was observed and explain your answer.

12. **(a)** (i) What is **polymer**?
(ii) Distinguish between a natural and artificial polymer.
In each case give **two** examples.

(b) Describe the process of vulcanisation of rubber.
In your description include:
(i) the importance of vulcanisation in rubber industry.
(ii) **two** useful items of vulcanised rubber.

13. **(a)** (i) How can calcium oxide (quick lime) be obtained on the large-scale?
(ii) Write equation for the reaction that occurs.
(iii) State **three** uses of calcium oxide.
(iv) What would you observe when water is added to fresh calcium oxide?
(v) Calculate the mass of 0.25 moles of calcium oxide. (Ca=40; O=16)

(b) How would you obtain a nitrogenous fertilizer starting with calcium oxide?

14. Iron forms compounds in which it shows a valency of two and three.

(a) State the general colour of iron compounds in which iron is:
(i) divalent.
(ii) trivalent.

(b) Write a formula and the name of the sulphates of iron in which iron is:
(i) divalent.
(ii) trivalent.

(c) (i) Name a reagent that can be used to distinguish between the sulphates in (b)(i) and (ii).
(ii) State what would be observed if each of the iron sulphate is reacted with the reagent you have named in (c)(i).
(iii) Write equations for the reaction in (c)(ii).

(d) Starting from iron wool, state how the anhydrous chloride of iron (II) can be prepared and write equation to illustrate your answer. (Diagrams not required).

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545/2 CHEMISTRY PAPER 2 Nov./Dec. 2001 2 hours	UGANDA NATIONAL EXAMINATION BOARD Uganda Certificate of Education CHEMISTRY Paper 2 Time: 2 hours

INSTRUCTIONS TO CANDIDATES

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

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

In both sections all working must be clearly shown.

(C=12; H=1; Na=23; O=16; S=32; N=14)
1 mole of gas occupies 24 l at room temperature.
1 mole of gas occupies 22.4 l at s.t.p.

SECTION A

*Attempt **all** questions in this section.*

1. **(a)** Draw and name the structure adopted by the following substances:
(i) diamond.
(ii) sodium chloride.
(b) (i) State the properties of diamond.
(ii) What use is made of diamond as a result of one of the properties you stated above?

2. A compound R, molecular mass 42, contains 85.7% carbon and 14.3% hydrogen (C=12; H=1)
(a) Calculate the empirical formula of R.
(b) Determine the molecular formula of R.

3. Magnesium reacts with steam to give a solid X and a gas Y.
(a) Identify:
(i) solid X.
(ii) gas Y.
(b) State how Y could be tested.
(c) Write equation for the reaction between X and hydrochloric acid.

4. The cell conversion for an electrochemical cell is shown below.
$Zn_{(s)}$ / $Zn^{2+}_{(aq)}$ // $Pb^{2+}_{(aq)}$ / $Pb_{(s)}$.
(a) Name **two** substances that could be used as electrolytes.
(b) State which one of the electrodes is the anode.
(c) Write equation for the reaction.
(i) the anode.
(ii) the cathode.
(d) Write equation for the overall cell reaction.

5. Oxygen can be prepared from hydrogen peroxide in the presence of a catalyst only.
(a) (i) Name the catalyst used.

(ii) Write equation for the formation of oxygen.

(b) (i) What is meant by the rate of formation of oxygen?

(ii) State **three** ways in which the rate of formation of oxygen is increased.

6. **(a)** State **three** ways you can use to show that water is a compound of hydrogen.

(b) A pure sample of iodine crystals can be separated from its mixture with sand by heating.

(i) What would be observed during the heating?

(ii) What property of iodine makes this separation possible?

(iii) Give **one** other mixture which can be separated by the above method.

7. A sample of 0.106 g of pure sodium carbonate was dissolved in water to make a 100 cm^3 solution.

(a) Calculate the mass of sodium carbonate needed to dissolve in one litre of water.

(b) Calculate the molarity of the solution.

8. **(a)** Define the term **enthalpy (heat) of neutralisation**.

(b) When 50 cm^3 of a 0.5 M hydrochloric acid was added to 50 cm^3 of a 0.5 M potassium hydroxide in a calorimeter, there was a temperature rise from 27.5 ^oC to 30.8 ^oC. Calculate the enthalpy of the reaction. (Density of water is 1 g dm^{-3} and its heat capacity is 4.2 Jg^{-1})

9. During the manufacture of sodium hydroxide, a concentrated sodium chloride solution (brine) is electrolysed using a mercury cathode as shown in the diagram in figure 1.

***

(a) Name the substance used as the anode.

(b) Identify the substance

(i) fed in at Q.

(ii) taken out from R, S, T.

(c) Name **one** other substance formed during the manufacture of sodium hydroxide.

(d) Describe briefly how solid sodium hydroxide can be obtained from the product of the electrolysis.

10. An element M has electronic structure 2:8:8:2.

(a) State the group to which this element belongs in the Periodic Table.

(b) Element M was put in warm water.

(i) State what was observed.

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

(c) Name **one** use of element M.

SECTION B

*Attempt **two** questions from this section. Start each question on a fresh page.*

11. **(a)** (i) What is **water pollution**?

(ii) How can you tell that water is polluted? Give **two** ways.

(b) (i) What is **Sewage**?

(ii) How does sewage pollute water?

(iii) Describe how urban sewage is treated?

(iv) How can sewage be useful to the society?

12. **(a)** (i) Describe, with the aid of a well-labelled diagram, how a sample of iron (III) chloride can be prepared in the laboratory from concentrated reaction in your description.

(ii) What happens when water is added to iron (III0 chloride?

(iii) State a confirmatory test for iron (III) ions.

(b) Hydrogen gas was used to reduce 32.5 g of iron (III) chloride.
(i) Write equation for the reaction that took place.
(ii) Calculate the minimum volume of hydrogen required to react completely with the chloride.

13. **(a)** Name the raw materials used in your locality to make an alcohol drink.
(b) Briefly describe how ethanol can be obtained from the materials you have named in (a).
(c) State how ethanol prepared in (b) can be concentrated and suggest one way of determining whether the ethanol is pure or not.
(d) Ethene can be formed from ethanol. Write equation and state the conditions for the reaction leading to the formation of ethene.
(e) Name **two** uses of ethanol apart from the preparation of ethene.

14. **(a)** A substances X reacts with solid sodium chloride to produce hydrogen chloride.
(i) Identify X.
(ii) State the conditions for the reaction.
(iii) Write equation for the reaction.
(b) (i) Name the substance that is formed when hydrogen chloride is dissolved in water.
(ii) Explain why an aqueous solution of hydrogen chloride is an electrolyte whereas the solution of the gas in methylbenzene is an non-electrolyte (Equations not required).
(c) An aqueous solution of hydrogen chloride was added dropwise to 4.2 g of solid sodium hydrogen carbonate until there was no further change. A colourless gas was evolved.
(i) State what was observed.
(ii) Write equation(s) for the reaction between the gas and calcium hydroxide.
(iii) Calculate the volume of the gas, measured at s.t.p. that was evolved.

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545/2 CHEMISTRY PAPER 2 Nov./Dec. 2002 2 hours	UGANDA NATIONAL EXAMINATION BOARD Uganda Certificate of Education CHEMISTRY Paper 2 Time: 2 hours

INSTRUCTIONS TO CANDIDATES

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

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

In both sections all working must be clearly shown.

(C=12; H=1; Na=23; O=16; S=32; N=14)
1 mole of gas occupies 24 l at room temperature.
1 mole of gas occupies 22.4 l at s.t.p.

SECTION A

*Attempt **all** the questions in this section.*

1. **(a)** (i) State the conditions under which magnesium can react with water.
(ii) Write equation for the reaction that takes place in (a)(i).
(b) The product from (a) was shaken with water. State what was observed.
(c) Dilute hydrochloric acid was added to the product in (b). Write an ionic equation for the reaction that took place.

2. **(a)** Define the terms:
(i) a normal salt
(ii) an acid salt
(b) Give one example of
(i) a normal salt.
(ii) an acid salt.

3. Part of the Periodic Table is shown below.

I							VIII
	II	III	IV	V	VI	VII	
			W		V		Z
	Y	T				Q	

(a) State:
(i) the most reactive metal.
(ii) the most reactive –non-metal.
(iii) the atom that forms the largest anion.
(iv) the most non-reactive element.
(b) Write the formula of the compounds formed between the following pairs of elements and in each case state the type of bonding.
(i) W and Q.
(ii) T and Y.

4. ***

The graph in figure 1 shows the change in temperature when sodium hydroxide solution was added to 20cm^3 of 1M sulphuric acid.

(a) Determine the volume of sodium hydroxide required to react completely with hydrochloric acid.

(b) Calculate the concentration of sodium hydroxide in moles per litre.

5. A hydrocarbon, Z of molecular mass 56 consists of 85.7% of carbon by mass.

(a) Define the term **hydrocarbon**.

(b) Calculate the empirical formula of Z.

(c) Determine the molecular formula of Z.

6. **(a)** Lead (II) nitrate was heated until there was no further change.

(i) What was observed?

(ii) Write equation of the reaction that took place.

(b) Dilute hydrochloric acid was added to a solution of lead (II) nitrate and the resultant solution warmed.

(i) State what was observed.

(ii) What can you deduce from your observation?

7. **(a)** Write equation to show the reaction between copper (II) hydroxide and dilute nitric acid.

(b) Aqueous ammonia solution was added dropwise to a sample of copper (II) hydroxide until ammonia was in excess.

(i) State what was observed.

(ii) Write the formula of the final product.

(c) Write equation for the reaction when copper (II) hydroxide is heated.

8. Excess sodium sulphate solution was added to a solution containing 4.14 g of lead (II) nitrate. (Pb=207; Na=23; S=32; N=14; O=16)

(a) What was observed?

(b) Write equation for the reaction that took place.

(c) Calculate the mass of the solid formed.

9. **(a)** Chlorine can be prepared from concentrated hydrochloric acid.

(i) name a substance that can react with hydrochloric acid to produce chlorine.

(ii) Write equation for the reaction.

(b) Chlorine gas was passed through cold dilute sodium hydroxide solution.

(i) State what was observed.

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

10. State **one** reagent that can be used to distinguish between each of the following pairs of ions and in each case, state what would be observed if each ion is treated with the reagent.

(a) $Pb^{2+}_{(aq)}$ and $Al^{3+}_{(aq)}$.

Reagent.

Observation.

(b) $SO_4^{2-}{}_{(aq)}$ and $CO_3^{2-}{}_{(aq)}$.

Reagent.

Observation.

SECTION B

*Attempt **two** questions from this section.*

11. **(a)** (i) Name **one** substance that is reacted with hydrochloric acid to produce Sulphurdioxide in the laboratory.
(ii) State the conditions for the reaction.
(iii) Name a substance that can be used to dry the sulphurdioxide.
(iv) Write equation for the reaction leading to the formation of sulphurdioxide.

(b) State what would be observed and explain what would happen if sulphurdioxide is passed through a solution containing
(i) acidified potassium dichromate.
(ii) a dye.

(c) Briefly describe how sulphurdioxide can be converted to sulphuric acid. Your answer should include equations and conditions for the reaction(s).

12. When a certain volume of 0.1 M hydrochloric acid was reacted at room temperature with excess of iron fillings, 120cm^3 of a gas were produced.

(a) Draw a labelled diagram to show how the rate of reaction was determined.

(b) Write equation for the reaction that took place.

(c) Calculate the:
(i) Volume of 0.1 M hydrochloric acid required to produce 120 cm^3 of the gas.
(ii) mass of iron filling that reacted.

(d) Draw a sketch graph of the volume of the gas against time.

(e) State how the rate of reaction would change if the reaction was carried out at a temperature above room temperature.

13. **(a)** (i) Draw a labelled diagram to show how a dry sample of ammonia can be prepared from ammonium chloride in the laboratory.
(ii) Write equation for the reaction leading to the formation of ammonia.

(b) Dry ammonia gas was passed over-heated lead (II) oxide.
(i) State what was observed.
(ii) Write equation for the reaction that takes place.

(c) Describe how ammonia can be converted to nitric acid. Use equation to illustrate your answer.

14. **(a)** Name **one** ore of iron and write its formula.

(b) During the extraction of iron, limestone and coke are added into the blast furnace.
Explain the role of
(i) coke.
(ii) limestone.
(Use equation(s) to illustrate your answer).

(c) Write equation for the reaction leading to the formation of iron (II) sulphate.

(d) Iron (II) sulphate was heated strongly.
(i) State what was observed.
(ii) Write equation for the reaction.

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545/2 CHEMISTRY PAPER 2 Nov./Dec. 2003 2 hours	UGANDA NATIONAL EXAMINATION BOARD Uganda Certificate of Education CHEMISTRY Paper 2 Time: 2 hours

INSTRUCTIONS TO CANDIDATES

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

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

In both sections all working must be clearly shown.

(C=12; H=1; Na=23; O=16; S=32; N=14)
1 mole of gas occupies 24 l at room temperature.
1 mole of gas occupies 22.4 l at s.t.p.

SECTION A

*Attempt **all** questions in this section.*

1. Excess zinc was added to 100cm^3 of 0.2 M copper (II) sulphate solution.
- **(a)** State what was observed.
- **(b)** Write equation for the reaction.
- **(c)** Calculate the:
  - (i) number of moles of copper (II) ions in the 100cm^3 of solution.
  - (ii) mass of the solid product.

2. During the manufacture of soap, sodium hydroxide was boiled with substance X.
- **(a)** Identify substance X.
- **(b)** What name is given to the process leading to the formation of soap?
- **(c)** Name a substance that can be used to precipitate the soap from the solution.
- **(d)** State what would be observed if soap solution was reacted with aqueous calcium hydrogen carbonate.

3. Concentrated sulphuric acid was heated with charcoal in the apparatus shown in figure 1 below.

***

- **(a)** Name the gas produced during the reaction between concentrated sulphuric acid and charcoal.
- **(b)** (i) State what was observed in the tube containing potassium dichromate.
  (ii) What is the purpose of sodium hydroxide solution?
- **(c)** State **two** uses of one of the gases names in (a).

4.
- **(a)** Write equation for the reaction leading to the formation of ammonia on large-scale.
- **(b)** State any **two** conditions for the reaction.
- **(c)** Write equation for the reaction between ammonia and copper (II) oxide.

5.
- **(a)** Write an ionic equation to show how sulphurdioxide can be formed from sodium sulphate and hydrochloric acid.

(b) (i) Name **one** reagent that can be used to test for sulphurdioxide.
(ii) State what would be observed if sulphurdioxide was reacted with the reagent you have named in (b)(i).

(c) Sulphur dioxide was passed into a beaker containing a red flower and water.
(i) State what was observed.
(ii) Give a reason for your answer in (c)(i).

6. Draw diagrams to show how the following elements use their outermost electrons to form the following compounds. [Atomic numbers: C=6; O=8; Cl=17; Ca=20]

(a) Carbon and hydrogen to form methane.
(b) Hydrogen and oxygen to form water.
(c) Calcium and chlorine to form calcium chloride.

7. Molten lead (II) bromide was electrolysed between two carbon electrodes.

(a) Explain why lead (II) bromide was electrolysed in the molten state and not in the solid state.
(b) State what was observed at the:
(i) Anode.
(ii) Cathode.
(c) Write equation for the reaction that took place at the anode.

8. **(a)** What is meant by the term **enthalpy of neutralisation**?
(b) When 50.0 cm^3 of a 1M sulphuric acid was added to 50.0 cm^3 of a 2M sodium hydroxide, the temperature of the resultant mixture rose by 13.6 ^oC.
(i) Write an ionic equation for the reaction that took place.
(ii) Calculate the enthalpy of neutralisation of sodium hydroxide. [Specific heat capacity of water=4.2 J $g^{-10}C^{-1}$, density of water=1 gcm^{-3}]

9. 2.50 g of an oxide of a metal M, was reduced by hydrogen to 1.98 g of metal.

(a) Calculate the number of moles of atoms of:
(i) M in the oxide (M=64).
(ii) Oxygen in the oxide (O=16).
(b) Determine the molecular formula of the oxide of M.
(c) Name **two** other gases that can be used instead of hydrogen.

10. Some elements in Period 3 of the Periodic Table are shown in the table below.

Group	I	II	III	IV	V	VI	VII	O
Element	E	Y			T	X	Q	Z

(a) Write the formula of the compound formed when
(i) T reacts with Q.
(ii) E reacts with X.
(b) State the type of bonding;
(i) between the atoms of Y.
(ii) when X is reacted with oxygen.
(iii) between Y and Q.

SECTION B

*Attempt **two** questions in this section.*

11. **(a)** What is meant by **rate of a chemical reaction**?

(b) State how the following factors affect the rate of a chemical reaction:

(i) temperature.

(ii) surface of the reactants.

(c) The table below shows the volume of hydrogen collected at various time intervals when magnesium was reached with a 2M hydrochloric acid.

Time (s)	0	1	2	3	4	5	6	7
Volume of hydrogen collected (cm^3)	0	25	45	60	70	75	77	77

(i) Plot a graph of volume of hydrogen versus time.

(ii) Determine the rate of the reaction at 3 seconds.

(iii) Determine the volume of hydrogen evolved at 3.5 seconds.

(d) State how the rate of the reaction at 3 seconds would be affected if a 1M hydrochloric acid was used.

12. **(a)** Write equation to show how hydrogen chloride can be prepared from sodium chloride.

(b) Draw a labelled diagram to show how aqueous hydrogen chloride can be prepared in the laboratory.

(c) State what would be observed and write equation for the reaction that would take place when aqueous hydrogen chloride is reacted with:

(i) solid calcium carbonate.

(ii) silver nitrate solution.

(iii) magnesium.

(d) State why aqueous hydrogen chloride does **not** react with copper.

13. **(a)** The diagram in figure 2 shows an electrolytic cell in which electrolysis of dilute Sulphuric acid occurs.

***

(i) Name the gases X and Y that are evolved during electrolysis.

(ii) Give equation for the reaction occurring at the anode.

(iii) Indicate the direction of electron flow in the circuit.

(iv) Calculate the volume of gas X produced when a current of one ampere flows for 10 minutes though the electrolyte.
[1 Faraday=9.6×10^4 coulombs; 1 mole of a gas occupies 2.4×10^4 cm^3 at room temperature and pressure.]

(v) State **two** industrial applications of electrolysis other than the manufacture of sodium hydroxide.

(b) Sodium hydroxide can be manufactured using a mercury cell. How would this manufacturing process affect the environment?

14. **(a)** Describe how a dry sample of copper (II) sulphate may be prepared from copper (II) oxide.

(b) Crystals of copper (II) sulphate were heated gently and then strongly until there was no further change.
Write equation(s) for the reaction(s) that took place.

(c) (i) Draw a labelled diagram for the electrolysis of copper (II) sulphate using copper electrodes.

(ii) Write equations for the reactions that take place at the electrodes.

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545/2 CHEMISTRY PAPER 2 Nov./Dec. 2004 2 hours	UGANDA NATIONAL EXAMINATION BOARD Uganda Certificate of Education CHEMISTRY Paper 2 Time: 2 hours

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INSTRUCTIONS TO CANDIDATES

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

In both sections all working must be clearly shown.

(C=12; H=1; Na=23; O=16; S=32; N=14)
1 mole of gas occupies 24 l at room temperature.
1 mole of gas occupies 22.4 l at s.t.p.

SECTION A

*Attempt **all** questions in this section.*

1. Name **one** process by which the components of the following mixtures can be separated:
- **(a)** Pigments of green leaf.
- **(b)** Water and ethanol.
- **(c)** Iodine and potassium chloride.
- **(d)** Copper (II) sulphate and sand.

2.
- **(a)** Define the term **acid**.
- **(b)** State what would be observed if an aqueous solution of each of the following substances were tested with blue litmus paper.
  - (i) ammonium chloride.
  - (ii) sodium chloride.
- **(c)** Write the equation for the reaction between potassium oxide and
  - (i) water.
  - (ii) hydrochloric acid.

3. A mixture containing copper (II) sulphate and copper (II) carbonate was shaken with excess water and filtered.
- **(a)** Identify the residue.
- **(b)** The dry residue was heated strongly.
  - (i) State what was observed.
  - (ii) Write an equation for the reaction.
- **(c)**
  - (i) Name a reagent that can be used to identify the anion in the filtrate.
  - (ii) Write an ionic equation for the anion and the reagent you have named in (c)(i).

4. **(a)** The reaction between sodium peroxide and water is used in the preparation of oxygen.
Write an equation for the reaction.

(b) Oxygen was passed over heated zinc.
(i) State what was observed.
(ii) Write an equation for the reaction.

5. State what would be observed and write an ionic equation for the reaction that would take place when aqueous ammonium chloride was:
(a) heated with sodium hydroxide solution.
(i) Observation.
(ii) Equation.
(b) added to silver nitrate solution.
(i) Observation.
(ii) Equation.

6. **(a)** An element X is in Group II of the Periodic Table.
(i) State the type of bond that exists in the chloride of X.
(ii) Write the formula of the ion formed by X.
(b) The nitrate of X was strongly heated.
(i) State what was observed.
(ii) Write an equation for the reaction.

7. A compound Y, of molecular mass=46 consists of 52.2% carbon, 13.0% hydrogen and 34.8% oxygen by mass. [H=1; C=12; O=16]
(a) Calculate the empirical formula of Y.
(b) Determine the molecular formula of Y.
(c) The combustion of Y is highly exothermic. Suggest a possible use of Y.

8. The table below shows some tests that were carried out on a certain substance, Z, and the observations made.

Test	Observation
1. Solid Z was heated.	A colourless gas evolved which turned limewater milky.
2. Aqueous sodium hydroxide was added to aqueous solution of Z.	No apparent change.
3. Dilute hydrochloric acid was added to a solution of Z.	Effervescence and a gas that turned limewater milky evolved.
4. (i) Aqueous magnesium chloride was added to a solution of Z.	No apparent change.
(ii) Resultant solution from 4(i) was heated.	White precipitate formed.

(a) What deduction can you make concerning the solubility of the hydroxide of the metal ion in Z?
(b) State the:
(i) likely anions present in Z.
(ii) anion actually present in Z.
(c) (i) Identify the white precipitate in test 4(ii).
(ii) Write an equation to show the reaction resulting in the formation of the substance you have identified in (c)(i).

9. **(a)** The molecular formula of ethene is C_2H_4. Write the structural formula of ethene.
(b) Bromine water is one of the reagents that can be used to test for the presence of ethene.
(i) State what would be observed if ethene is tested with bromine water and write an equation for the reaction.
Observation.

Equation.

(ii) Name **one** other reagent that can be used to test for the presence of ethene.

(c) Name **one** compound from which ethene can be prepared.

10. Under suitable laboratory conditions, ethene can be converted to a compound with the general formula,

(a) (i) What is the change from ethene to *** called?

(ii) what name is given to compound ***?

(iii) Write an equation for the reaction leading to the formation of ***.

(iv) State **one** possible use of ***.

(b) Name **one** other compound of the category of *** which is **not** manmade.

11. Nitrogen reacts with hydrogen to produce ammonia according to the following equation:

$N_{2(g)} + 3H_{2(g)} \Leftrightarrow NH_{3(g)} + Heat.$

The table below shows the percentage yield of ammonia at various temperature and pressures.

Temperature ^{o}C	Pressure (atmosphere)		
	10	200	1000
250	30%	75%	96%
500	1%	18%	60%
1000	0%	0.1%	1%

(a) (i) state how the percentage of yield of ammonia varies with pressure at constant temperature.

(ii) State the temperature and pressure which given maximum yield of ammonia.

(b) Calculate the volume of ammonia produced at s.t.p. when 18.5 g of hydrogen gas is reacted with excess nitrogen.
(H=1; N=14; 1 mole of a gas occupies 22.4 litres at s.t.p.)

13. **(a)** (i) State **one** word, which means "formation of soap".

(ii) Name **two** sources of vegetable oils that can be used to make soap.

(b) Briefly describe how soap can be prepared.

(c) Explain the following observations.

(i) Water containing calcium hydrogen carbonate will **not** lather easily with soap unless the water is boiled prior to using soap.

(ii) Water containing magnesium sulphate will **not** lather with soap even after boiling the water.

(d) State:

(i) the advantage of using a detergent instead of soap for laundry work.

(ii) **one** disadvantage of using a detergent.

14. **(a)** (i) Describe how would obtain a sample of sugar crystals from sugarcane.

(ii) State **two** uses of sugar in the world of the sick.

(b) Concentrated sulphuric acid was added to sugar.

(i) What was observed?

(ii) What name is given to this process?

(iii) How would you convert sugar to alcohol (ethanol)?

(iv) Why is ethanol important to society?

(c) A mass of 3.10 g of an organic compound that contains carbon, hydrogen and oxygen atoms only, produced 4.40 g of carbondioxide and 2.70 g of water on complete combustion.
Calculate the empirical formula of the organic compound. [C=12; O=16; H=1]

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545/2 CHEMISTRY PAPER 2 Nov./Dec. 2005 2 hours	UGANDA NATIONAL EXAMINATION BOARD Uganda Certificate of Education CHEMISTRY Paper 2 Time: 2 hours

INSTRUCTIONS TO CANDIDATES

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

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

In both sections all working must be clearly shown.

(C=12; H=1; Na=23; O=16; S=32; N=14)
1 mole of gas occupies 24 l at room temperature.
1 mole of gas occupies 22.4 l at s.t.p.

SECTION A

Attempt **all** questions in this section.

1. Although nitrogen is generally un-reactive, it readily reacts with a burning magnesium ribbon.
- **(a)** Give a reason why nitrogen is generally inert.
- **(b)** Burning magnesium reacts with nitrogen.
  - (i) Give a reason for the reaction.
  - (ii) Write an equation for the reaction.
- **(c)** Water was added to the product in (b). Write an equation for the reaction.

2. An atom of element X contains 15 electrons and 16 neutrons.
- **(a)** (i) State the mass number of X.
  - (ii) Write the electronic structure of X.
- **(b)** (i) Write the formula of a chloride of X.
  - (ii) State the type of bond that exists in the chloride of X.
- **(c)** Suggest how an aqueous solution of the oxide of X would affect litmus paper.

3. **(a)** State what would be observed if sodium carbonate solution was added to:
- (i) aqueous calcium hydroxide.
- (ii) dilute sulphuric acid.

(b) Write ionic equations for the reactions in (a)(i) and (a)(ii).

4. **(a)** Name two crystalline allotropes of carbon.
(b) State two differences between the allotropes you have named in (a).
(c) Give one use of each of the allotropes.

5. Dilute copper (II) sulphate solution was electrolysed using carbon electrodes.
- **(a)** State what was observed at
  - (i) the anode.
  - (ii) the cathode.
- **(b)** Write an equation for the reaction at the anode.

(c) Dilute copper (II) sulphate was electrolysed using copper electrodes. State what was observed at the anode.

6. **(a)** (i) Name two substances which can react to produce hydrogen chloride.
(ii) Write an equation for the reaction leading to the formation of hydrogen chloride.

(b) Hydrogen chloride reacts with lead (II) nitrate to form lead (II) chloride according to the following equation.

$$Pb(NO_3)_{2(aq)} + 2HCl_{(g)} \rightarrow 2HNO_{3(aq)} + PbCl_{2(s)}.$$

Calculate the volume of hydrogen chloride measured at s.t.p. that would be required to form 5.53 g of lead (II) chloride.
[$PbCl_2$=227; 1 mole of a gas at s.t.p. occupies 22.4 dm^3]

7. **(a)** Determine the number of moles of hydrogen ions that are contained in 1dm^3 of a 0.1 M sulphuric acid solution.

(b) 100.0 cm^3 of a 0.1 M sulphuric acid solution was transferred to a 250 cm^3 volumetric flask. The acid was then diluted with water until the volume of the solution was exactly 250.0 cm^3. Calculate:
(i) the number of moles of sulphuric acid in the diluted solution.
(ii) the concentration of the diluted solution in moles per dm^3.

8. **(a)** A compound Q, molecular mass=30 consists of 80.0% carbon and 20.0% hydrogen. (H=1; C=12)
(i) Calculate the empirical formula of Q.
(ii) Determine the molecular formula of Q.
(iii) Write the structural formula of Q.

(b) The enthalpy of combustion of Q is 84.7 kJ mol^{-1}. Calculate the enthalpy change when 2.5 g of Q is completely burnt in oxygen.

9. **(a)** Write an equation for the formation of sulphurdioxide from sulphuric acid and sodium sulphate.

(b) Sulphur dioxide was bubbled through an acidified solution of potassium dichromate.
(i) State what was observed.
(ii) Briefly explain your observation in (b)(i).

10. **(a)** Sodium carbonate was dissolved in water to form sodium hydroxide and carbonic acid as shown in the equation below:

$$Na_2CO_{3(s)} + H_2O_{(l)} \rightarrow 2NaOH_{(aq)} + H_2CO_{3(aq)}.$$

The solution was tested with litmus paper.
(i) State what was observed.
(ii) Give reasons for your answer in (a)(i).

(b) Write an equation for the reaction between aqueous sodium carbonate and magnesium sulphate solution.

SECTION B

*Attempt any **two** questions from this section.*

11. **(a)** Describe how a dry sample of ammonia can be prepared in the laboratory. (Diagram **not** required.)

(b) Name a reagent that can be used to test for ammonia and state what would be observed if ammonia is testes with the reagent.

(c) (i) Draw a labelled diagram of the set up of the apparatus that can be used to show that ammonia can burn in oxygen.
(ii) Write an equation for the combustion of ammonia in oxygen.

(d) Dry ammonia was passed over heated copper (II) oxide.

(i) State what was observed.
(ii) Write an equation for the reaction.

12. In the extraction of cast iron using a blast furnace, spathic iron ore, which contains some impurities, is first roasted in air. It is then mixed with some other substances and finally introduced into the blast furnace. Cast iron can be obtained from iron (II) carbonate ore.

(a) Name the major impurity in the iron ore.

(b) (i) Give the chemical name of the spathic iron ore.
(ii) Write an equation for the reaction which takes place when iron (II) carbonate is roasted in air.

(c) Name the substances that are fed into the blast furnace:
(i) from the top.
(ii) from the bottom.

(d) Outline the reactions leading to:
(i) the formation of cast iron.
(ii) the removal of the major impurity you have named in (a).

(e) State the major components of steel.

13. **(a)** Describe an experiment to show how surface area can affect the rate of the reaction between calcium carbonate and 2M hydrochloric acid. Your answer **must** include:
- a labelled diagram of the apparatus.
- sketch of expected graphs.
- mention of how the graphs can be used to react conclusions.

(b) Briefly explain why, when a 4M hydrochloric acid was used instead of 2M acid, the rate of the reaction was faster. Explain the observation.

(c) State **one** factor other than those mentioned above that can affect the rate of the reaction between hydrochloric acid and calcium chloride.

14. Explain the following observations:

(a) 2M nitric acid reacts with magnesium more vigorously than a 2M ethanoic acid does.

(b) A pinkish precipitate is observed when a magnesium ribbon is added to a copper (II) sulphate solution.

(c) An aqueous solution of hydrogen chloride reacts with sodium carbonate whereas a solution of hydrogen chloride in methylbenzene does not.

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545/2 CHEMISTRY PAPER 2 Nov./Dec. 2006 2 hours	UGANDA NATIONAL EXAMINATION BOARD Uganda Certificate of Education CHEMISTRY Paper 2 Time: 2 hours

INSTRUCTIONS TO CANDIDATES

*Section **A** consists of 10 structure questions. Answer **all** questions in this section.*

*Answers to the questions **must** be written in the spaces provided.*

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

In both sections all working must be clearly shown.

[H = 1; C = 12; N = 14; O = 16; Na = 23; S = 32; Cl = 35.5]

1 mole of a gas occupies 24 *l* at room temperature.

1 mole of a gas occupies 22.4*l* at s.t.p.

For Examiners Use Only														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total

SECTION A : (50 MARKS)

1. Ammonium chloride was placed in a dry test tube and heated while holding at the mouth of the test tube a glass rode containing a drop of lead (II) nitrate solution.
   (a) State what was observed:
      (i) In the test tube.
      ……
      ……
      (ii) On the glass rode
      ……
   (b) Write an ionic equation for the reaction that took place at the glass rod.
      ……...……
   (c) (i) Name a reagent that can be used to test for the second product which was not tested for when lead (II) nitrate was used,
      ……
      ……
      (ii) State what would be observed if the reagent named in (c)(i) was used.
      ……
      ……
      ……

2. (a) Lead (II) nitrate solution was added to an aqueous solution of sodium iodide .
      (i) State what was observed.
      ……
      (ii) Write an ionic equation for the reaction that took place.
      ……
   (b) When lead (II) nitrate is heated strongly, it decomposes according to the following equation:
      $2Pb(NO_3)_2(s) \rightarrow 2PbO(s) + 4NO_2(g) + O_{2(g)}$
      If 3.31g of lead II nitrate was heated strongly, calculate the total volume of gaseous products at room temperature.
      ……
      ……

3. (a) When dilute hydrochloric acid was added to iron II sulphide , a gas was evolved.
      Write an equation for the reaction that took place.
      ……
   (b) State;
   (i) How the gas was identified.
      ……
      (ii) Why the gas is normally prepared in a fume cupboard or outside the laboratory.
      ……
   (c) The gas was reacted with sulphur dioxide.
      (i) State what was observed.
      ……G
      ive a reason for your answer in © (i).
      ……

4. Acidified water was electrolysed using a platinum electrode.
   (a) Write an equation for the reaction that took place at the;
      (i) Anode…….
      (ii) Cathode……
   (b) Name one other substance that can be used as electrodes in the electrolysis of acidified water.

5. When 7.2g of sodium carbonate, $Na_2CO_3.n\ H_2O$, was strongly heated, the mass of the residue was 2.7g .

Calculate;

(a) The number of moles of water of crystallisation.

……

……

(b) Percentage of water of crystallisation

……

……

6. (a) Name one compound that when reacted with dilute hydrochloric acid can produce carbon dioxide .

……

(b) Excess carbon dioxide was passed through ice cold sodium hydroxide solution.

(i) State what was observed

……

(ii) Write equations for the reaction that took place.

……

7. (a) Give a reason why ;

(i) Graphite conducts electric current where as diamond does not.

……

(ii) Diamond is used as a cutting tool where as graphite is used in pencil

……

(b) Concentrated sulphuric acid reacts with graphite according to the equation;

$C(s) + 2H_2SO_4\ (l) \rightarrow CO_2\ (g) + 2SO_2\ (g) + 2H_2O\ (l)$.

Calculate the mass of carbon that can react completely with a solution containing 19.6 g of sulphuric acid.

……

……

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

(a) State;

(i) What was observed?

……

……

(ii) The role of manganese (IV) oxide.

……

……

(b) Write an equation for the reaction between:

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

……

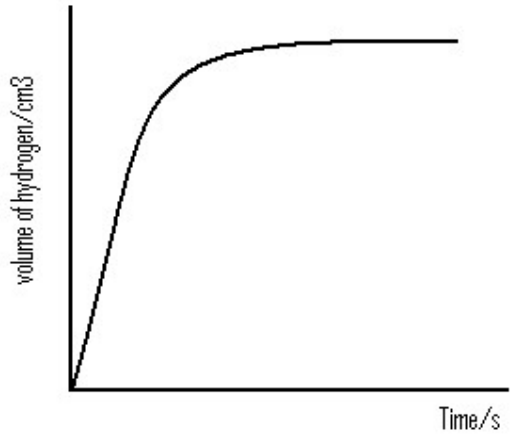
……

(ii) Sodium and the product in (b) (i).

……

……

9. The graph in figure 1 shows the variation of volume of hydrogen evolved with time when magnesium was added to $100.0cm^3$ of 1.0M sulphuric acid at room temperature.



(a) Calculate the number of moles of hydrogen ions that is contained in 100.0 of :

(i) a 0.5M H_2SO_4

……..

(ii) A 1.0M H_2SO_4.

…….

(b) Sketch on the same axes of the graph in figure 1, the graph that would be obtained if the same mass of magnesium was added to 100.0 cm^3 of 0,5M sulphuric acid at room temperature.

(i) Mark on the same graphs the times when the two reactions reach completion.

(ii) Compare the time the reaction took to reach completion when 0.5M sulphuric acid was used to that when 1.0M sulphuric acid was used.

……

10. A mixture containing 3.90g of silver nitrate and silver chloride was shaken with excess water, filtered and the residue dried .

(a) Identify the anion that was present in the; `

(i) Residue.

……

(ii) Filtrate.

……

(b) State the test that can be carried to confirm the anion in the filtrate.

.....

.....

(c) The mass of the dried residue was 1.80 g. calculate the number of moles of silver ions that were contained in the filtrate.

……

……

……

SECTION B

11. (a) (i) State the condition under which sulphuric acid reacts with ethanol to form ethene.

(ii) Write an equation for the formation of ethene from ethanol and sulphuric acid.

(iii) State the property of sulphuric acid shown in the reaction (a) (ii).

a. Name one reagent, apart from bromine, that can be used to distinguish between ethene and ethane; and in each case state what will be observed if the reagent is separately treated with ethane and ethene.

b. A hydrocarbon T, molecular mass 42, contains 85.7% carbon.

(i) Calculate the empirical formula of T.

(ii) Determine the molecular formula of T.

(iii) Write the structure of T.

c. T was reacted with bromine. State what was observed and write an equation for the reaction.

12. (a) State the difference between;

(i) an acid and a base.

(ii) Abase and an alkali.

(b) Explain the following observation.

Aluminium oxide reacts with both dilute hydrochloric acid and sodium hydroxide solution.

(c) Briefly describe how a pure sample of calcium carbonate can be prepared.(Diagrams not required)

13. (a) The atomic number of the elements M, X and Q are 6,11and 17 respectively.

(i) Explain what is meant by the term atomic number.

(ii) Write the electronic structures of Q,M and X.

(b) Q and M can combine with X to form compound

(i) Use the valency electrons to explain briefly how the atoms M and Q, Q and X form compounds.

(ii) Write the structural formula of the compounds formed when Q combines with X.

(c) State two properties of the compounds formed between:

(i) M and X

(ii) Q and X

14. (a) Define the terms

(i) Solute.

(ii) Saturated solution.

(b) The solubilities of potassium chloride and potassium nitrate at certain temperatures are shown in the able below.

Temperature / ^{0}C	0	11	1	530	40	50	57

Solubility of potassium chloride per 100g of water	27.9	31.0	32.0	36.6	40	43	45.0
Solubility of potassium nitrate Per 100g of water.	14	21.5	25	43	63	84	102

(i) Plot on the same axes, a graph of solubility against temperature for the solubilities of potassium chloride and potassium nitrate.

(ii) State which one of the two salts has a solubility which increases less rapidly with increase in temperature.

(iii) Determine the temperature at which the solubilities of the two salts are equal.

(iv) (c) a saturated solution of potassium nitrate at 30^0C was cooled to 5^0C

Calculate the number of moles of potassium nitrate crystal formed.

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545/2 CHEMISTRY PAPER 2 Nov./Dec. 2007 2 hours	UGANDA NATIONAL EXAMINATION BOARD Uganda Certificate of Education CHEMISTRY Paper 2 Time: 2 hours

INSTRUCTIONS TO CANDIDATES

*Section **A** consists of 10 structure questions. Answer **all** questions in this section.*
*Answers to the questions **must** be written in the spaces provided.*
*Section **B** consists of 4 semi-structured questions. Attempt any **two** questions from this section. Answers to the questions must be written in the answer booklets provided.*

In both sections all working must be clearly shown.

[H = 1; C = 12; N = 14; O = 16; Na = 23; S = 32; Cl = 35.5]
1 mole of a gas occupies 24 *l* at room temperature.
1 mole of a gas occupies 22.4*l* at s.t.p.

For Examiners Use Only														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total

SECTION A: (50 MARKS)

Answer all questions in this section.

1. During an experiment, a beam of light was passed through a dark room and dust particles were seen moving in all directions.
   (a) State: (i) why the dust particles moved in all directions
   (ii) what the experiment indicated.
   (b) The temperature of the room was increased.
   (i) state what was observed.
   (ii) Give a reason for your in (b) (i) above.

2. (a) Calcium was burnt in air. Write equation for the reaction that took place.
   (b) Few drops of water were added to the product in (a).
   (i) State what was observed.
   (ii) Write equation for the reaction that took place.
   (c) Name **one** compound which when heated forms the same product as that in (a) above.

3. When excess carbon monoxide was passed over 4.0 g of a heated oxide of iron, **Y**, 2.8 g of iron was formed.
   (a) Determine the molecular formula of **Y**.
   (O = 16; Fe = 56; Y = 160)
   (b) Write equation for the reaction between Y and carbon monoxide.

4. (a) Write the structural formula of ethene.
   (b) (i) Name two compounds that can be used to prepare ethane in the laboratory.
   (ii) State the conditions for the formation of ethene from the compounds you have named in (b) (i) above.
   (c) Ethene was bubbled through acidified potassium manganate (VII) solution. State what was observed.

5. The number of particles (protons, electrons and neutrons) in atoms; Q, T; W; X and Y are shown in the table below.

Atom	Number of particles		
	Protons	**Electrons**	**Neutrons**
Q	1	1	0
T	8	8	8
W	12	12	12
X	16	16	16
Y	1	1	1

   (a) State the: (i) atomic number of Y
   (ii) mass number of Q.
   (iii) atoms which are isotopes.
   (b) Identify the atoms that belong to elements in the same group of the periodic table.
   (c) Write the structural formula of the compound that can be formed when Q combines with T.
   (d) (i) State **one** property of the compound formed between **T** and **W**.
   (ii) Give a reason for your answer in (d) (i) above.

6. (a) (i) State the conditions under which sulphuric acid can react with sodium nitrate to form nitric acid.
   (ii) Write equation for the reaction in (a) (i) above.
   (b) Sulphur was warmed with concentrated nitric acid.
   (i) State what was observed.

(ii) Write equation for the reaction.

7. 4.3 litres of hydrogen bromide was bubbled through 700 cm^3 of 1.0 M silver nitrate solution at room temperature. Calculate
   (a) the number of moles of silver nitrate in the solution.
   (b) the number of moles of hydrogen bromide bubbled.
   (1 mole of a gas occupies 24 litres at room temperature)
   (c) the mass in grams of silver bromide formed. (Ag = 108; Br = 80)

8. (a) (i) Name two allotropes of carbon other than charcoal.
   (ii) State one use of each of the allotropes you have named in (a) (i) above.
   (b) (i) State the condition under which sulphuric acid can react with sugar $C_{12}H_{22}O_{11}$ to form carbon.
   (ii) Write equation for the reaction.

9. (a) Sodium carbonate solution was added to an aqueous solution of hydrogen chloride.
   (i) State what was observed.
   (ii) Write equation for the reaction that took place.
   (b) 2-3 drops of lead (II) nitrate was added to the resultant solution in (a).
   (i) State what was observed.
   (ii) Write equation for the reaction that took place.

10. (a) Sulphur dioxide can be prepared by roasting zinc sulphide in air according to the following equation:

$$2\ ZnS_{(s)} + 3\ O_{2(g)} \rightarrow 2\ SO_{2(g)} + 2\ ZnO_{(s)}$$

Calculate the volume of sulphur dioxide evolved at room temperature when 9.7 g of zinc sulphide is reacted with excess oxygen.
(Zn = 65, S = 32; 1 mole of gas occupies 24 dm3 at room temperature.)
   (b) During the manufacture of sulphuric acid by the contact process, sulphur dioxide is heated with oxygen in the presence of a catalyst.
   (i) Name the catalyst.
   (ii) Write the equation for the reaction between sulphur dioxide and oxygen.

SECTION B: (30 MARKS)

Answer two questions from this section.

11. (a) With the help of equations, outline how a dry sample of ammonia can be prepared in the laboratory starting from ammonium chloride. *(Diagram **not** required).*
   (b) Draw a labelled diagram of the set up of the apparatus to show that ammonia is very soluble in water.
   (c) Using equations where possible, explain why when dry ammonia is passed over a strongly heated lead (II) oxide, a colourless liquid is formed and a grey solid residue obtained.
   (d) Ammonium nitrate dissolves in water according to the following equation:

$$NH_4NO_{3(s)} + H_2O_{(l)} \rightarrow NH_4OH_{(aq)} + HNO_{3(aq)}.$$

Explain using equations, why extensive use of ammonium nitrate as a fertilizer can make the soil become acidic.

12. Explain the following, illustrating your answers with equations where applicable.
   (a) When ammonia solution is added drop-wise until in excess to copper (II) sulphate solution, a blue precipitate is formed. The precipitate dissolves in excess ammonia solution to form a deep blue solution.
   (b) Hydrogen gas cannot be prepared using calcium turnings and dilute sulphuric acid.
   (c) Zinc bromide conducts electricity in both molten and aqueous states but not in the solid state.

(d) When magnesium is burnt in air and the residue dissolved in water, a gas that turns moist red litmus paper blue is evolved.

13. (a) Define the term rate of reaction.
(b) The table below shows the variation in volume of hydrogen evolved with time when dilute hydrochloric acid was added to excess zinc.

Volume of hydrogen (cm^3)	0	20	35	46	56	72	79	79
Time (s)	0	10	20	30	40	60	80	90

Plot a graph of volume of hydrogen evolved against time.
(c) Using the graph determine the time taken to collect 60 cm^3 of hydrogen gas.
(d) (i) Draw tangents on your graph at points when the time is 20 and 60 seconds and determine the gradient of each tangent.
(ii) Compare the rate of reaction at 20 seconds and 60 seconds. Explain your answer.
(e) Comment on the rate of the reaction after 20 seconds and 60 seconds. Explain your answer.

14. (a) State the difference between **fats** and **oils**.
(b) Fats and oils can be used to make soap.
(i) Define the term **soap**.
(ii) Briefly describe how soap can be prepared.
(c) (i) Name **two** substances which when present in water can cause permanent hardness of water.
(ii) State **one** chemical method of removing permanent hardness of water.
(iii) Write equation for the reaction involved in (c) (ii) above.
(d) Soap was used for washing in hard water.
(i) State what was observed.
(ii) Write equation for the reaction.
(e) A detergent can be used for washing instead of soap. State **one** advantage and **one** disadvantage of using a detergent.

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545/2 CHEMISTRY PAPER 2 Nov./Dec. 2008 2 hours	UGANDA NATIONAL EXAMINATION BOARD Uganda Certificate of Education CHEMISTRY Paper 2 Time: 2 hours

INSTRUCTIONS TO CANDIDATES

Section **A** *Consists of 10 structured questions Answer* **all** *in this section.*
Answers to these questions **must** *be in the spaces provided.*
Section **B** *consists of 4 semi-structured questions .Attempt any* **two** *questions from this section.*
Answers to the questions must be written in the booklets provided.

In both sections all working must be clearly shown.
[Ag = 108; Cl = 35.5; C = 12; Fe =56; H=1; K = 39;
Na = 23; Mg =24; N = 14; O = 16; Pb = 207; S = 32]

1 Mole of a gas occupies 24 l at room temperature.
1 Mole of a gas occupies 22.4 l at s.t.p.

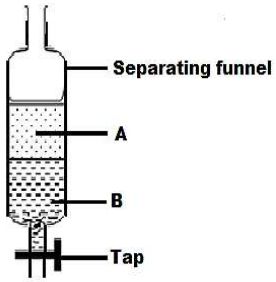
For Examiner's Use Only															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total

SECTION A: (50 Marks)

Answer **all** *questions in this section.*

1. Figure 1 shows a set up of the apparatus that was used for separating a mixture of water and kerosene.

(a) Identify liquids A and B.



(i) A (01 mark)

……

(ii) B (01 mark)

……

(b) State why liquid A forms the upper layer. (02 marks)

……

(c) State why the two liquids form a liquid junction as shown in figure 1. (01 mark)

……

……

……

2. The electronic configuration of an atom of element, *A* , is 2:8:3.

(a) State the group in the Period Table to which *A* belongs. (01 mark)

……

(b) Write the:

(i) Electronic configuration of the ion of *A*. (01 mark)

……

……

(ii) Formulae of the oxide and chloride of *A*. (02 mark)

……

……

……

(c) State the type of bond that exists in the oxide of A. (01 mark)

……

……

……

……

3. (a) A compound , Y , contains 52.17 % carbon, 13.04 % hydrogen and 34.78 % oxygen. The molecular mass of Y is 46.

Determine the:

(i) empirical formula of Y. (03 marks)

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(ii) molecular formula of Y. (01 mark)

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(b) When Y was heated with excess concentrated sulpheric acid, a colourless gas , Z , which turned bromine water colourless was evolved.
Identify:
(i) Y (01 mark)

……

(ii) Z (01 mark)

……

4. When anhydrous iron (II) sulphate heated strongly, a colourless gas, T, was observed,
(a) State what was observed. (01 mark)

……

……

……

……

(b) Write equation for the reaction. (1 ½ marks)

……

(c) (i) Name the reagent that was used to identify T. (½ mark)

……

(ii) State what would be observed when T was tested with the reagent you have named in (c) (i).

……

…… (01 mark)

5. (i) Name **one** substance that when reacted with dilute hydrochloric acid can produce sulphur dioxide.

…… (01 mark)

(ii) State the condition for the reaction. (½ mark)

……

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……

(iii) Write an ionic equation for the reaction leading to the formation of sulphur dioxide. (1½ marks)

……

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……

(b) A gas jar containing hydrogen sulphide was inverted over a gas jar containing moist sulphur dioxide.

(i) State what was observed. (½ mark)

……

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

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6. Ethane burns in oxygen according to the following equation;

$$2\ C_2H_6\ (g) + 7\ O_2\ (g) \rightarrow 4CO_2\ (g) + 6\ H_2O\ (l)$$

When 2.0 g of ethane was burnt in excess oxygen, 104 KJ of heat was produced.
Calculate the:

(a) Mass of water formed (03 marks)

(b) Molar heat of combustion of ethane. (0 2 marks)

7. Anhydrous iron (III) chloride was prepared using the set up of the apparatus in figure **2.**

(a) Identify:

(i) X…… (½ mark)

(ii) R…… (01mark)

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

……

……

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……
……

(c) State what would be observed if iron (III) was exposed to air. (01 mark)

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……
……

(ii) Give a reason for your answer in (c) (i) above. (01 mark)

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……
……

8. (a) Complete the following equations.
(Your equations should be balanced)

(i) $NaNO_3$heat ……. (1½ marks)

(ii) $AgNO_3$heat ……. (1½ marks)

(b) Concentrated nitric acid was added to copper metal and the mixture heated.
(i) State what was observed. (1½ marks)

……
……
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(ii) Write an equation for the reaction. (1½ marks)

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9. When aqueous ammonia was added drop wise to a solution containing Zinc sulphate, a white precipitate, Q, was formed. Q dissolved in excess aqueous ammonia to form a colourless solution.

(a) Write :

(i) an ionic equation for the reaction leading to the formation of Q. (1½marks).

……

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……

……

(ii) the formula of the cat ion present in the colourless solution. (01 mark)

……

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(b) (i) Name a reagent that can be used to identify the sulphate ions in solution. (01 mark)

……

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(ii) State what would be observed when the reagent you have named in (b) (i) is used. (½ mark)

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10. When a mixture containing 3g of lead (II) sulphate was reacted with excess dilute nitric acid, 0.44g of carbon dioxide was evolved.

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

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(b) Calculate the percentage of lead(II) carbonate in the mixture. (3½ marks)

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SECTION B: (30 Marks)

Answer any **two** questions from this section.

11. (a) Describe the structure of graphite. (5½ marks)

(b) State **two** properties in which graphite differs from diamond. (02 marks)

(c) Graphite was heated in excess air and the gas given off passed through aqueous calcium hydroxide for a long time.

(i) State what was observed. (01 mark)

(ii) Write equation(s) for the reaction (03 marks)

(iii) Carbon monoxide reacts with iron(111) Oxide according the following equation:

$Fe_2O_3(s) + 3CO\ (g) \rightarrow 2\ Fe(s) + 3\ CO_2\ (g)$

If excess carbon monoxide was passed over 3.5 g of hot iron (111) oxide, calculate the volume of carbon dioxide evolved at s.t.p. (3½ marks

12. (a) Sodium carbonate is more soluble in water than sodium hydrogen carbonate.
Briefly, describe how a dry sample of sodium hydrogen carbonate can be obtained from a solution containing both salts. (3 ½ marks)

(b) Write equation for the reaction that would take place if:

(i) Dilute hydrochloric acid is added to sodium hydrogen carbonate. (1½ marks)

(ii) Sodium hydrogen carbonate is strongly heated. (1½ marks)

(c) State what would be observed and write equation for the reaction that would take place if magnesium sulphate solution is added to a solution containing:

(i) Carbonate ions.

(ii) Hydrogen carbonate ions. (2½ marks)

(d) 6.4 g of an impure sample of anhydrous sodium carbonate was dissolved in water and the solution made up to 500 cm^3 on was.. 25.0 cm3 of this solution required 24.0 cm3 of a 0.2 M hydrochloric acid solution for complete reaction.Calculate the:

(i) Number of moles of the acid that reacted. (1½ marks)

(ii) Number of moles of the carbonate that reacted. (01 mark)

(iii) Molarity of the carbonate solution. (01 mark)

(iv) Percentage of sodium carbonate in the sample. (2½ marks)

13. Oxygen is formed from hydrogen peroxide in the presence of manganese (IV) oxide according to the following equation:

$2H_2O_2$ (aq) + $MnO_2\rightarrow$ $2H_2O$ (l) + O2 (g).

(a) In an experiment, a certain volume of hydrogen peroxide was used to prepare oxygen at room temperature.

With the aid of a suitable diagram, describe how the following can be determined:

(i) The volume of oxygen evolved. (5½ marks)

(ii) The rate of evolution of oxygen (03 marks)

(b) In another experiment, one half of the volume of hydrogen peroxide used in (a) was diluted with an equal volume of water. On the same axes draw graphs to show the variation of volume of oxygen with time for experiments in (a) and (b). (03 marks)

(c) Oxygen produced from 200 cm3 of a 0.5 M hydrogen peroxide solution reacted completely with magnesium.

Calculate the mass of magnesium that reacted. (3½ marks)

14. Explain the following observations and in each case write equation(s) to illustrate your answer.

(a) Pure water does **not** conduct electricity, but when the water is mixed with a little sulphuric acid, the solution conducts electricity. (04 marks)

(b) A burning magnesium ribbon when lowered into a gas jar containing carbon dioxide continues burning to form a white powder and some black particles. (7½ marks)

(c) Water from limestone areas reacts with soap to form white curds. (3½ marks)

END

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545/2 CHEMISTRY PAPER 2 Nov./Dec. 2009 2 hours	UGANDA NATIONAL EXAMINATION BOARD Uganda Certificate of Education CHEMISTRY Paper 2 Time: 2 hours

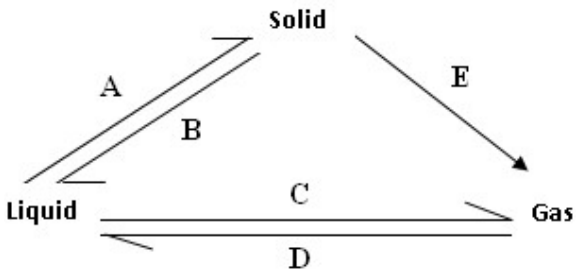
INSTRUCTIONS TO CANDIDATES

Section **A** consists of 10 structured questions. Answer **all** questions in this section.
Answers to this section **must** be written in the spaces provided.
Section **B** consists of 4 semi-structured questions. Answer any **two** questions from this section. Answers to this section **must** be written in the answer booklet(s) provided.
In both sections all working must be clearly shown.
[H = 1; C = 12; N = 14; O = 16; Na = 23; S = 32; Cl = 35.5]
1 mole of gas occupies 24***l*** at room temperature
1 mole of gas occupies 24***l*** at s.t.p.

SECTION A

Answer **all** questions in this section

1. The diagram in figure 1 shows how states of matter can change under different conditions.



(a) Name the change of state of matter represented by:
(i) A ……
(ii) B ……
(iii) C ……
(iv) D ……
(v) E ……

(2½ marks)

(b) Name two substances which can undergo the change of state represented by **E**.
……
……

(02 marks)

(c) State one condition other than temperature that can bring about the change of state represented by **D**.
……
……

(½ mark)

2. Write equation to show the reaction that would take place if each of the following was strongly heated in air.
(a) $K NO_3$
……
……

(1½ marks)

(b) $Na_2CO_3 \bullet 10\ H_2O$

…….....

…….....

(01 mark)

(c) $FeCO_3$

…….....

…….....

(1½ marks)

3. (a) Oxygen can be prepared using sodium peroxide and water.

(i) Write an equation for the reaction between sodium peroxide and water.

…….....

…….....

(1½ marks)

(ii) Name one other substance from which oxygen can be prepared in the laboratory.

…….....

…….....

(01 mark)

(b) (i) State the condition(s) under which oxygen can react with iron.

…….....

…….....

(01 mark)

(ii) Write an equation for the reaction that takes place when iron is treated with oxygen under the condition(s) you have stated in b (i).

…….....

…….....

(1½ marks)

4. The molecular formulae of organic ***J*** and ***M*** are C_3H_6 and C_3H_8 respectively.

(a) Write the structural formula and name of ***J*** and ***M***.

Compound	**Structural formula**	**Name**
J		
M		

(b) Name one reagent that can be used to distinguish between ***J*** and ***M***.

…….....

…….....

(01 mark)

(c) State what would be observed if the reagent you have named in (b) was treated with

(i) ***J***

…….....

…….....

(01 mark)

(ii) ***M***

…….....

…….....

(01 mark)

5. The atomic numbers and the positions of the elements **A, B, C, D, E, F, G, H** and **I** in the periodic table are shown below. The letters are not normal symbols of the elements.

A^{3}													E^{6}			G^{9}	H^{10}
												D^{13}					
										C^{29}					F^{34}		I^{36}
B^{37}																	

(a) Which one of the elements is a noble (an inert) gas?

…….....

…….....

(1½ marks)

(b) What name is given to the elements in the group to which **G** belongs?

…….....

…….....

(½ mark)

(c) Which element is likely to:

(i) react more violently with chlorine?

…….....

…….....

(½ mark)

(ii) form colored compound?

…….....

…….....

(½ mark)

(d) Write the formula of the:

(i) Oxide of element **D**.

…….....

…….....

(01 mark)

(ii) Compound formed between element **F** and hydrogen.

…….....

…….....

(01 mark)

(e) State the type of bond that would exist in the chloride of element **E**.

…….....

…….....

(01 mark)

6. A compound ***Z*** of molecular formula $A_xB_y \bullet nH_2O$ consists of 8.57% of ***A***, 45.71% ***B*** and 45.72 of water.

(a) Determine the values of *x*, *y* and *n*.

[H = 1, O = 16, A = 27, B = 96]

…….....

…….....

…….....

…….....

…….....

…….....

…….....

…….....

(04 marks)

(b) Write the molecular formula of ***Z***.

…….....

…….....

(01 mark)

7. (a) What is meant by the term **enthalpy of combustion**?

…….....
…….....

(02 marks)

(b) Ethanol burns in oxygen according to the following equation:

$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O; \Delta H = -1360 \text{ kJ mol}^{-1}$

Calculate the mass ethanol that is required to raise the temperature of $1000cm^3$ of water by 100◦C. [*Specific heat capacity of water = $402Jg^{-1} K^{-1}$*]

…….....
…….....
…….....
…….....
…….....
…….....
…….....
…….....

(03 marks)

8. (a) When dilute nitric acid was diluted with copper, a colourless gas, ***G*** which turned brown when exposed to air was evolved.

(i) Name gas ***G***.

…….....

(01 mark)

(ii) Write the equation for the reaction leading to the formation of the brown gas.

…….....
…….....

(1½ marks)

(b) Write an equation for the reaction that would take place if the brown gas was dissolved in water.

…….....
…….....

(1½ marks)

(c) State what would be observed if concentrated nitric acid was heated with iron (II) sulphate solution.

…….....
…….....

(01 mark)

9. (a) State what would be observed if dilute ammonia was added drop-wise until in excess to the aqueous solution of;

(i) Zinc sulphate

…….....
…….....

(02 marks)

(ii) Aluminium nitrate

…….....
…….....

(1½ marks)

(b) Write an ionic equation for the reaction in (a) (ii).

…….....
…….....

(1½ marks)

10. (a) Carbon dioxide was passed through a saturated solution of calcium hydroxide until there was no further change. Write equation(s) for the reaction(s) that took place.

…….....
…….....
…….....
…….....

(03 marks)

(b) Soap solution was added to the resultant mixture in (a) above. State;

(i) what was observed

…….....
…….....

(01 mark)

(ii) one physical method that can be used to prevent the reaction between soap and the resultant mixture in (a)

…….....

(01 mark)

SECTION B

*Answer **two** questions from this section.*

11. (a) Hydrogen chloride can be prepared from sodium chloride according tothe following ionic equation.

$Cl^-_{(s)} + H^+_{(aq)} \rightarrow H\,Cl_{(g)}$

Calculate the mass of sodium chloride that would be required to produce 3.60 dm^3 of hydrogen chloride measured at room temperature. [H = 1, Na = 23, Cl = 35.5; One mole of a gas at room temperature occupies 24.0 dm^3.] ***(2½ marks)***

(b) State what would be observed and in each case write an equation for the reaction that would take place when:

(i) an aqueous solution of hydrogen chloride is added to a solution containing lead (II) ions. ***(02 marks)***

(ii) excess dry hydrogen chloride is passes over strongly heated iron heated wire. ***(2½ marks)***

(c) Briefly explain the following observations and in each case illustrate your answer with equation(s).

(i) Anhydrous iron (II) chloride cannot be prepared by direct synthesis using chlorine and iron. ***(2½ marks)***

(ii) An aqueous solution of hydrogen chloride gives a white precipitate with silver nitrate whereas a solution of hydrogen chloride in tetrachloromethane shows no observable change when treated with silver nitrate solution. ***(04 marks)***

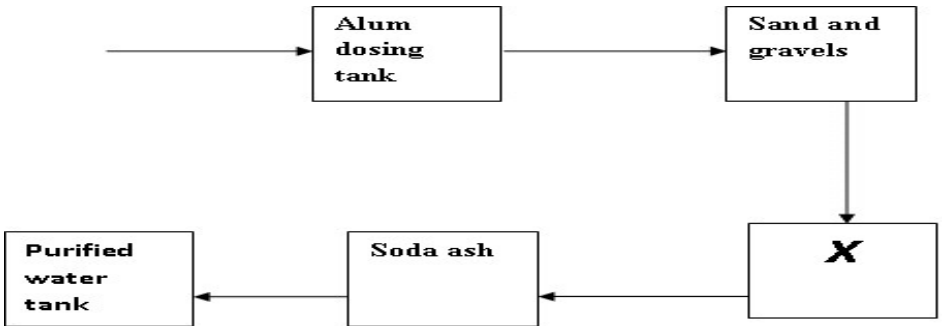
(d) Write an ionic equation for the reaction between an aqueous solution of iron (II) chloride and excess ammonia solution. ***(1½ marks)***

12. (a) What is meant by the term **water pollution**? ***(02 marks)***

(b) (i) Name two substances that can cause water pollution. ***(01 mark)***

(ii) Describe how each of the substances you have named in (b)(i) above can cause water pollution. ***(03 marks)***

(c) The following diagram below shows the general scheme used in water purification.



(i) State the purpose of the alum dosing and the sand and gravels. ***(02 marks)***

(ii) Identify ***X*** and state its purpose. ***(02marks)***

(iii) State the role of soda ash. ***(02marks)***

(iv) Write equations to show the role of soda ash. ***(03 marks)***

3. (a) (i) Write an equation for the reaction between dilute nitric acid and Calcium carbonate ***(1½ marks)***

(ii) State how temperature can affect the rate of the reaction in (a)(i) above. ***(01mark)***

(iii) Give a reason why a large surface area of calcium carbonate can speed up the rate of reaction (a)(i). ***(02marks)***

(b) Magnesium can react with hydrochloric acid to form hydrogen. State conditions and write an ionic equation for the reaction. ***(2½ marks)***

(c) The table below shows the volumes of hydrogen evolved when various lengths of magnesium ribbon were reacted with fixed volumes of hydrochloric acid.

Length of ribbon (cm)	1.0	2.0	3.0	5.0	6.0
Volume of hydrogen (cm^3/min)	2.2	3.6	5.2	9.2	10.8

(i) Plot a graph of volume of hydrogen (vertical axis) against length of magnesium ribbon (horizontal axis). ***(05 marks)***

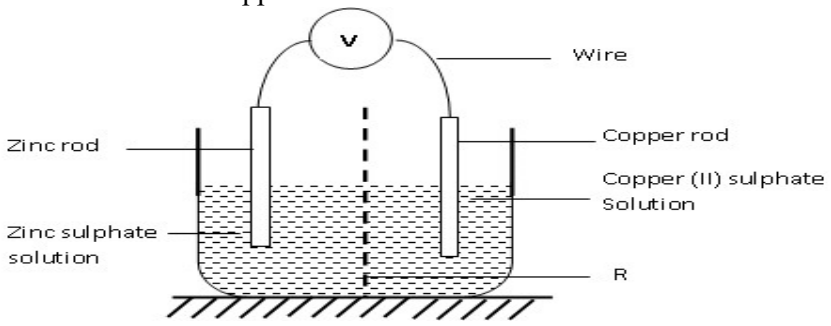
(ii) Explain the shape of the graph you have drawn. ***(02marks)***

(iii) Using the graph, determine the rate of the reaction if 4.0 cm of magnesium ribbon was used. ***(01 mark)***

14. (a) (i) Using examples, state the difference between **an electrolyte** and **an electrode** ***(04 marks)***

(ii) Explain why aqueous solution of sodium chloride conducts electricity whereas solid sodium chloride does not. ***(02marks)***

(b) The diagram below shows a set up of an electro-chemical cell which can be used to compare the reactivities of zinc and copper.



(i) Identify the rod that is positively charged. ***(01 mark)***

(ii) Identify R and state its purpose. ***(1½ marks)***

(iii) Write equations for the reactions taking place at the copper and zinc rods. ***(03 marks)***

(iv) Write equations for the overall reaction in the cell. ***(1½ marks)***

(v) State what would happen if zinc metal is dropped in a solution containing copper (II) ions. ***(02marks)***

END

545/2 **CHEMISTRY** **PAPER** 2 **Nov./Dec. 2010** 2 **hours**	**UGANDA NATIONAL EXAMINATION BOARD** **Uganda Certificate of Education** **CHEMISTRY** **Paper 2** **Time: 2 hours**

INSTRUCTIONS TO CANDIDATES

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

Section **B** consists of 4 semi-structured questions. Answer any **two** questions from this section. Answers to this section **must** be written in the answer booklet(s) provided.

In both sections all working must be clearly shown.

[H = 1; C = 12; N = 14; O = 16; Na = 23; S = 32; Cl = 35.5]

1 mole of gas occupies 24***l*** at room temperature
1 mole of gas occupies 24***l*** at s.t.p.

SECTION A (50 MARKS)

*Answer **all** questions in this section*

1. (a) State what would be observed when a mixture of iron filings and sulphur is warmed with
   (i) carbon disulphide. ***(01 mark)***
   (ii) dilute sulphuric acid. ***(02 marks)***
   (b) A mixture of iron filings and sulphur was heated strongly.
   (i) Name the substance that was formed. ***(½ mark)***
   (ii) Write equation for the reaction between the substance you have named in (b) (i) and dilute hydrochloric acid. ***(1½ marks)***

2. (a) Magnesium hydrogen carbonate can be converted to magnesium carbonate according to the following equation.

   $$Mg(HCO_3)_2(aq) \rightarrow MgCO_3(s) + H_2O\ (l) + CO_2\ (g)$$

   State:
   (i) the condition for the reaction. ***(01 mark)***
   (ii) **one** practical application of the reaction. ***(01 mark)***
   (1½ marks)
   (b) Calculate the maximum mass of magnesium carbonate that can be obtained from 100.0 cm^3 of a 0.5 M magnesium hydrogen carbonate solution. ***(03 marks)***

3. (a) When a white solid *T* was heated with sodium hydroxide solution, an alkaline gas *X*was formed. Identify the anion in *T*. ***(½ mark)***
   (b) When an aqueous solution of *T* was treated with lead (II) nitrate solution, a bright yellow precipate was formed. Identify the anion in *T*. ***(½ mark)***
   (c) Write ionic equation for the reaction leading to the formation of
   (i) gas X in (a). ***(1½ marks)***
   (ii) the yellow precipitate in (b). ***(1½ marks)***
   (d) Chlorine was bubbled through an aqueous solution of T. State what was observed. ***(01 mark)***

4. (a) The oxides of some elements are listed below.
   - Lead (II) oxide
   - Sulphur dioxide
   - Copper (II) oxide
   - Aluminium oxide

   State the oxides(s) which will react with
   (i) acid only. ***(½ mark)***
   (ii) alkalis only. ***(½ mark)***
   (iii) both acids and alkalis. ***(01 mark)***
   (b) When excess oxygen was passed over 1.6 g of a strongly heated metal Z, 1.8 g of an oxide of the metal was obtained. Determine the empirical formula of the oxide of Z. [Z = 63.6] ***(03 mark)***

5. (a) Sodium chloride reacts with sulphuric acid to produce hydrogen chloride gas according to the following equation:

   $$NaCl(s) + H_2SO_4(aq) \rightarrow NaHSO_4(aq) + HCl\ (g)$$

   (i) State the conditions for the reaction. ***(1½ marks)***
   (ii) Calculate the volume of hydrogen chloride gas that would be produced at room temperature if 5.85 of sodium chloride was completely reacted with sulphuric acid. ***(02 marks)***
   (b) Dry hydrogen chloride was passed over heated iron.
   (i) State what was observed. ***(½ mark)***
   (ii) Write equation for the reaction that took place. ***(1½ marks)***

6. Gas *P* was passed over heated lead (II) oxide. The gaseous product turned lime water milky.
   (a) Identify *P*. ***(½ mark)***
   (b) State what was observed when P was passed over heated lead (II) oxide. ***(01 mark)***
   (c) Write the equation for the reaction between:
      (i) *P* and lead (II) oxide. ***(1½ marks)***
      (ii) the gaseous product and lime water. ***(1½ marks)***
   (d) Name one other ooxide that can be used instead of lead (II) oxide. ***(½ mark)***

7. (a) An aqueous ammonia was added to aluminium sulphate solution.
      (i) State what was observed. ***(½ mark)***
      (ii) Write the reaction for the reaction that took place. ***(1½ marks)***
   (b) Dilute sodium hydroxide solution was added drop-wise until in excess to the product in (a).
      (i) State what was observed. ***(01 mark)***
      (ii) Expalin your observation in (b) (i) . ***(02 marks)***

8. (a) Oxygen was prepared from hydrogen peroxide in the presence of manganese (IV) oxide as a catalyst.
      (i) Write equation for the reaction that took place. ***(1½ marks)***
      (ii) State the conditions under which oxygen can be produced from hydrogen peroxide at a fast rate without a catalyst. ***(01 mark)***
   (b) (i) Write equation for the reaction between sulphur and oxygen. ***(1½ marks)***
      (ii) State the condition for the reaction in (b) (i). ***(½ mark)***
      (iii) State **one** use of the product in (b) (i). ***(½ mark)***

9. Using a suitable yeast, glucose can be converted to ethanol and carbon dioxide according to following equation.

$$C_6H_{12}O_6 \xrightarrow{\text{yeast}} 2CH_3CH_2OH + CO_2\ (g)$$

   (a) Name the
      (i) enzyme in yeast that converts glucose to ethanol. ***(02 marks)***
      (ii) process by which glucose is converted to ethanol in the presence of yeast. ***(01 mark)***
   (b) Glucose also produces carbon dioxide when burnt in air. The reaction takes place according to the following equation.

$$C_6H_{12}O_6(s) + 6O_2\ (g) \rightarrow 6CO_2\ (g) + H_2O\ (g)$$

   Calculate the mass of glucose that when burnt, would produce 1.2 dm3 of carbon dioxide at room temperature. ***(03 marks)***

10. (a) An aqueous solution of copper (II) sulphate was electrolysed between graphite electrodes.
      (i) State what was observed at the cathode. ***(01 mark)***
      (ii) Write the equation for the reaction that took place at the anode. ***(1½ marks)***
   (b) The solution that remained after electrolysis in (a) was tested with litmus solution.
      (i) State what was observed. ***(½ mark)***
      (ii) Give a reason for your answer in (b) (i). ***(01 mark)***
   (c) The electrolysis in (a) was repeated using copper electrodes that had been weighed before the experiment. State the change in mass of the electrode that took place after the electrolysis.

(01 mark)

SECTION B: (30 MARKS)

*Answer **two** questions from this section.*

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

(ii) With the aid of a labelled diagram, describe how the three particles are located in an atom. (04 marks)

(b) The full symbol of the atom of an element is $^{32}_{16}Q$. State what the numbers 16 and 32 stand for.

(c) If the full symbol of another atom is $^{34}_{16}R$, state the

(i) similarity and the difference between the atoms Q and R. (01 mark)

(ii) name given to the atoms Q and R. (01 mark)

(d) The atomic numbers of elements *W*, *X* and *Y* are 6, 12 and 17 respectively.

(i) Write the electronic configurations of *W*, *X* and *Y*. (1½ marks)

(ii) Using the outermost shell electrons only, draw a diagram to show how W and Y form a compound.

(iii) State the type of bond formed between *X* and *Y*; *W* and *Y*. (02 marks)

(iv) Identify the element that exists as a diatomic molecule. (01 mark)

12. (a) Describe how nitric acid can be manufactured using hydrogen and nitrogen as raw materials. [Illustrate your answer with equations]. (10½ marks)

(b) Write equations to show the effect of heat on

(i) NH_4NO_3 (1½ marks)

(ii) $Zn(NO_3)_2$ (1½ marks)

(c) Potassium nitrate was heated with concentrated sulphuric acid.
Write equation for the reaction that took place. (1½ marks)

13. (a) Alkanes and alkenes are hydrocarbons:

(i) Define the term **hydrocarbon**. (01 mark)

(ii) State the structural difference between **alkanes** and **alkenes**. (01 mark)

(b) The boiling points of straight chain alkanes having two to seven carbon atoms are shown in the table below.

Number of carbon atoms	2	3	5	6	7
Boiling point (°C)	-79	-42	37	69	98

(i) Plot a graph of boiling point against number of carbon atoms. (04 marks)

(ii) From the graph, determine the boiling point of alkane with **four** carbon atoms. (01 mark)

(c) (i) What is the shape of your graph? (01 mark)

(ii) State the relationship between the boiling point of an alkane and the number of carbon atoms in the alkane. (01 mark)

(d) (i) Name one one reagent other than bromine that can be used to distinguish between ethane and ethene. (01 mark)

(ii) State what would be observed if the reagent you have named in (d) (i) was separatley treated with ethane and ethene. (02 marks)

(e) Ethene burns in air according to the following equation:

$$\mathbf{C_2H_4(g) + 3O_2(g) \rightarrow 2CO_2(g) + 2H_2O(g) \quad \Delta H = -1410\ kJmol^{-1}.}$$

Calculate the amount of heat evolved when 12.5 g of ethene is completely burnt. (03 marks)

14. State and explain the effect of each of the following conditions on the rate of a chemical reaction.

(a) Particle size. (04 marks)

(b) Concentration of reactants. (05 marks)

(c) Temperature. (06 marks)

END

545/2
CHEMISTRY
PAPER 2
Nov./Dec. 2011
2 **hours**

UGANDA NATIONAL EXAMINATION BOARD
Uganda Certificate of Education
CHEMISTRY
Paper 2
Time: 2 hours

1. (a) Duralumin is an alloy containing copper and other metals.

(i) Name two other metals that are present in duralumin (1 mark)

.....

.....

(ii) Arrange the metals present in Duralumin in their order of reactivity, starting with most reactive. (1 mark)

.....

.....

(iii) State **one** use of Duralumin. (½ mark)

.....

.....

(b) Name

(i) One other alloy that contains copper. (1 mark)

.....

(ii) The other metal(s) present in the alloy you have named in (b)(i)
(½ mark)

.....

(c) State one use of the alloy you have named in (b)(i). (½ mark)

.....

.....

2. (a) An atom of element **R**, has 12 neutrons and mass number 23. Write the formula of the oxide of **R.** (1 mark)

.....

.....

(b) The oxide of ***R*** was dissolved in water and the aqueous solution tested with litmus solution.

(i) State what was observed. (½ mark)

.....

.....

(ii) Write equation for the reaction between the oxide of R and water. (1 ½ marks)

.....

.....

(c) A piece of **R** was ignited and lowered into a gas jar containing chlorine.

(i) State what was observed. (1/2 mark)

.....

.....

(ii) Write equation for the reaction that took place. (1 ½ marks)

.....

.....

3. The atomic numbers of elements X and Y are 7 and 20 respectively.

(a) Write the electronic configurations of the elements. (2 marks)

.....

.....

(b) State the periods in the Periodic Table to which X and Y belong.

(i) X (1 mark)

.....

(ii) Y

.....

(c) Write the formula of the compound formed X and Y. (1 mark)

.....

.....

(d) State the type of bond in the compound formed in (c). (1 mark)

.....

.....

4. A hydrated salt T, consist of 20.2% iron, 11.5% sulphur, 23% oxygen and 45.3% water of crystallization.

(a) Calculate the empirical formula of T. (2 ½ marks)
(Fe = 56; S = 32; O = 16; H = 1)

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.....

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.....

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.....

(b) Deduce the molecular formular of T. (Relative formula mass of T = 278.)
(1 ½ marks)

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.....

.....

.....

.....

(c) Write equation for the reaction between a solution of T and chlorine.
(1 ½ marks)

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.....

5. (a) State what would be observed if to aqueous lead (II) nitrate was added

(i) Dilute sulphuric acid. (1 mark)

.....

.....

(ii) Sodium iodide solution. (1 mark)

.....

.....

(b) Write ionic equation for the reaction in

(i) (a)(i) (1 ½ marks)

.....

.....

.....

(ii) (a)(ii) (1 ½ marks)

.....

.....

.....

6. (a) Carbon dioxide can best be prepared by reacting calcium carbonate with dilute hydrochloric acid. The reaction proceeds according to the following equation:

$$CaCO_3(s) + 2HCl(aq) \longrightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$$

(i) Explain why sulphuric acid is not normally used instead of hydrochloric acid. (2 marks)

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(ii) Calculate the mass of calcium carbonate that would liberate 250 cm^3 of carbon dioxide at room temperature. [Ca = 40 ; C = 12; O = 16; *1 mole of a gas occupies 24 dm^3 at room temperature.*] (2 marks)

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.....

(b) Carbon dioxide was bubbled through lime water for a long time. State what was observed. (1 mark)

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.....

.....

7. State what would be observed and write equation for the reaction that would take place if the following salts were heated.

(a) Calcium nitrate crystals.

Observation (1 ½ marks)

.....

.....

.....

Equation (1 ½ marks)

.....

.....

(b) Anhydrous iron(II) sulphate

Observation (1 ½ marks)

.....

.....

.....

Equation (1 ½ marks)

.....

.....

.....

8. (a) Glucose, $C_6H_{12}O_6$, in the presence of an enzyme undergoes fermentation to form ethanol.

(i) Write equation for the fermentation of glucose. (1 ½ marks)

.....

.....

(ii) Name the enzyme used in the fermentation process. (1 mark)

.....

.....

(b) Ethanol burns in oxygen according to the following equation.

$C_2H_5OH(l) + 3O_2(g) \longrightarrow 2CO_2(g) + 3H_2O(l) + heat.$

When 15.07 g ethanol were burnt in oxygen, 466.50 kJ of heat was liberated. Calculate the heat of combustion of ethanol. [H = 1, C = 12, O = 16] (2 ½ marks)

.....

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.....

9. (a) Write equation for the reaction between magnesium ribbon and dilute sulphuric acid. (1 ½ marks)

.....

.....

(b) State **three** ways by which the reaction in (a) could be made to proceed at a faster rate than normal. (3 marks)

.....

.....

.....

(c) Name **one** metal that would react with sulphuric acid in a similar way like magnesium. (½ mark)

.....

.....

10. (a) State what would be observed if chlorine was bubbled through

(i) Water (½ mark)

.....

.....

(ii) A solution of potassium bromide. (1 mark)

.....

.....

(b) (i) Explain your answer in (a)(ii) (1 mark)

.....

.....

.....

(ii) Write ionic equation to show the reaction that took place in (a)(ii).
(1 ½ marks)

.....

.....

SECTION B
Answer two questions from this section.

11. (a) When a solid Q was added to hydrogen peroxide, oxygen was evolved.

(i) Identify Q. (½ mark)
(ii) Write equation for the reaction that took place. (1 ½ marks)

(b) Briefly describe how oxygen can be prepared in the laboratory using sodium peroxide. [*Your answer should include equation(s) and method of collection but not diagrams.*] (4 marks)

(c) Draw a labelled diagram of the setup of apparatus that can be used to prepare oxygen by electrolysis of water. (3 ½ marks)

(d) State how oxygen can react with sodium and iron, and in each case, write equation to illustrate your answer. (5 ½ marks)

12. (a) State the conditions under which iron can react with hydrochloric acid and write equation for the reaction. (2 ½ marks)

(b) Draw a fully labelled diagram for the setup of apparatus which can be used to prepare anhydrous iron(III) chloride in the laboratory.
(4 marks)

(c) A student left a slasher made of iron on the compound for two weeks. State what was observed and explain your answer. (2 ½ marks)

(d) (i) Name **one** reagent can be used to distinguish between iron(II) sulphate and iron(III) sulphate. (1 mark)

(ii) State what would be observed if the reagent you have named in (d)(i) above were separately treated with the two iron salts and write equations for the reactions. (5 marks)

13. (a) (i) Draw a labelled diagram of the setup of apparatus that can be used to prepare a dry sample of ammonia in the laboratory. (3 ½ marks)

(ii) Write equation for the ammonia. (1 ½ marks)

(b) Write equation for the reaction between ammonia and

(i) Hydrogen chloride (1 ½ marks)
(ii) Lead(II) oxide (1 ½ marks)
(iii) Aqueous solution of lead(II) nitrate (1 ½ marks)

(c) State what would be observed if ammonia solution was added to a solution of copper(II) chloride drop-wise until in excess. (1 ½ marks)

(d) On heating a mixture of ammonium sulphate and aqueous potassium hydroxide, ammonia gas was produced according to the following equation.

$(NH_4)_2SO_4 + 2KOH(aq) \longrightarrow K_2SO_4(aq) + 2H_2O(l) + 2NH_3(g)$

When X g of ammonium sulphate was heated with excess potassium hydroxide until there was no further change, 424.5 cm^3 of ammonia gas was evolved at s.t.p.

Calculate the value of X. (4 marks)

[S = 32; K = 39; H = 1 ; N = 14; O = 16; 1 mole of gas occupies 22.4 dm^3 at s.t.p]

14. (a) State two factors that can determine the product formed at an electrode during electrolysis. (2 marks)

(b) Explain why aqueous solution of copper(II) chloride conducts electric current whereassolid copper (II)chloride does not. (2 marks)

(c) A dilute solution of copper(II) chloride was electrolyzed using graphite electrodes.

(i) State what was observed at the cathode and write equation for the reaction that took place. (2 ½ marks)

(ii) Name the substance that was produced at the anode. (01 mark)

(iii) Explain how the product you have named in (c)(ii) is formed at the anode and write equations to illustrate your answer. (05 marks)

(d) The electrolysis of copper(II) chloride was repeated using copper electrodes. State what was observed at the anode and briefly explain your answer. (2 ½ marks)

CHEMISTRY
PAPER 2
Nov./Dec. 2012
2 **hours**

UGANDA NATIONAL EXAMINATION BOARD
Uganda Certificate of Education
CHEMISTRY
Paper 2
Time: 2 hours

1. State how the following mixture of substances can be separated. (05 marks)

Mixture	**Method of seperation**
Sulphur and iron	
Ink	
Oxygen and nitrogen	
Iodine and potassium sulphate	
Sodium chloride and sodium carbonate	

2. The full symbol of an atom of elements ***X*** is $^{27}_{13}X$

(a) (i) State the number of protons in X. (01 mark)

.....

(ii) Write the electronic configuration of X. (01 mark)

.....

(iii) State the group in the Periodic Table to which X belongs. (1/2 mark)

.....

(b) (i) Write the formula of the oxide of X. (01 mark)

.....

(ii) State the type of bond that exists in the oxide of X. (01 mark)

.....

3. State whether the following oxides are acidic, basic, neutral or amphoteric.

(a) ZnO (01 mark)

.....

(b) SO_2 (01 mark)

.....

(c) CuO (01 mark)

.....

(d) CO (01 mark)

.....

4. A compound *Q* of formula mass 60, contains carbon, 40%, hydrogen 6.7% and the rest being oxygen.

(a) (i) Calculate the empirical formula of *Q*. (2 ½ marks)
(H = 1; C = 12; O == 16)

.....

.....

(ii) Determine the molecular formula of Q. (01 mark)

.....

.....

(b) Q dissolves in aqueous sodium hydrogen carbonate with effervescene.

(i) Suggest the chemical nature of Q. (1/2 mark)

.....

.....

(ii) Write an ionic equation for the reaction between Q and aqueous sodium hydrogen carbonate. (1 ½ marks)

.....

.....

5. Dilute sulphuric acid was added to copper (II) carbonate and the gas evolved passed through aqueous calcium hydroxide solution as shown in the figure 1. The addition of sulphuric acid was continued until there was no further change.

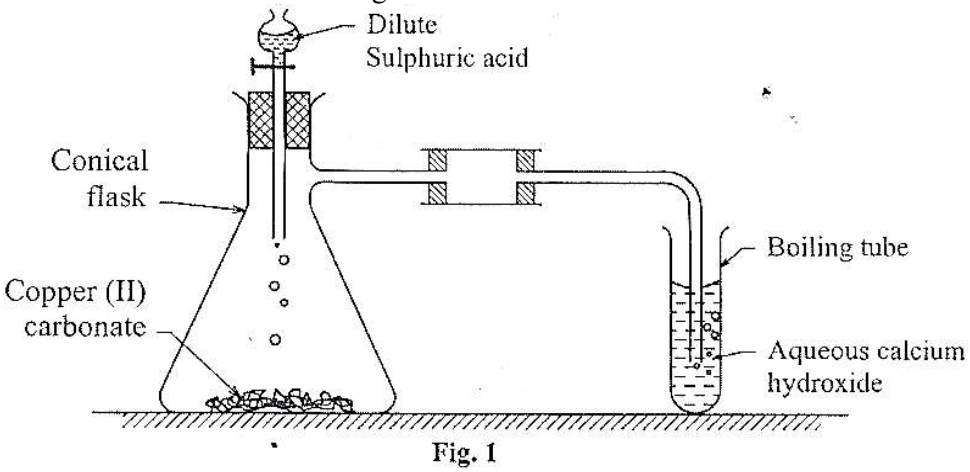

Fig. 1

(a) State what was observed in the conical flask. (1 ½ marks)

.....

.....

(b) Write equation(s) for the reaction(s)

(i) between sulphuric acid and copper(II) carbonate. (1 ½ marks)

.....

.....

(ii) that took place in the boiling tube. (03 marks)

.....

.....

6. (a) (i) Write equation to show how ammonia can be prepared from calcium hydroxide. (1 ½ marks)

.....

.....

(ii) Name one substance that can be used to dry ammonia. (01 mark)

.....

(b) Ammonia was passed over heated copper(II) oxide.

(i) State what was observed. (01 mark)

.....

.....

(ii) Write equation for the reaction that took place. (1 ½ marks)

.....

.....

7. Figure 2 shows the set – up of the apparatus in which electric current was produced by dipping two different metal rods A and B into dilute sulphuric acid.

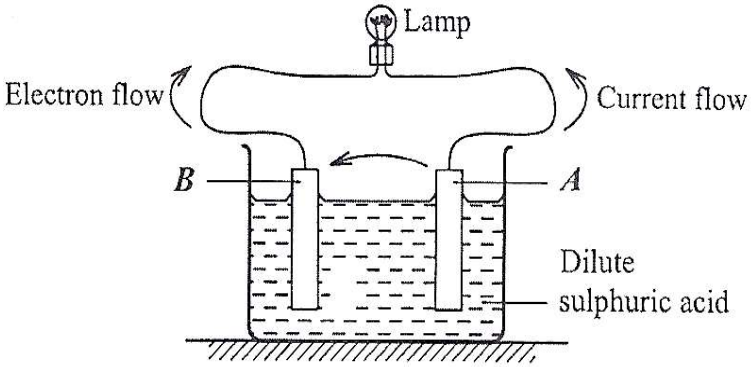

Fig. 2

(a) Name one metal that can be used as

(i) A

.....

(ii) B

.....

(b) State which of the metals A and B is the

(i) Anode

.....

(ii) Cathode

.....

(c) Both A and B are divalent metals.
Write equation for the reaction at

(i) Anode (1 ½ marks)

.....

.....

(ii) Cathode (1 ½ marks)

.....

.....

8. (a) Write the structural formula of

(i) Ethene (01 mark)

.....

.....

(ii) ethane (01 mark)

.....

.....

(b) Name **one** reagent which can be used to distinguish between ethene and ethane.
(1/2 mark)

.....

(c) State what would be observed if ethene was treated with the reagent you have named in (b).
(01 mark)

.....

.....

(d) Write equation for the polymerisation of ethene. (01 mark)

.....

.....

9. (a) State what would be observed when the following are reacted.

(i) Potassium nitrate and concentrated sulphuric acid. (1/2 mark)

.....

(ii) Lead (II) nitrate and dilute sulphuric acid. (1/2 mark)

.....

(b) State the condition for the reaction in (a)(i). (1/2 mark)

.....

(c) Write equation for the reaction in

(i) (a) (i) (1 ½ marks)

.....

(ii) (a) (ii) (1 ½ marks)

.....

.....

10. When aqueous ammonia was added dropwise until in excess to a solution containing a cation X, a white precipitate was formed which dissolved to give a colourless solution.

(a) Identify X. (01 mark)

.....

(b) Write the formula of the cation in the colourless solution. (01 mark)

.....

(c) Write an ionic equation for the reaction leading to the formation of the white precipitate. (1 ½ marks)

.....

.....

(d) Name **one** other metal ion that when treated with aqueous ammonia would form a precipitate soluble in excess ammonia.

.....

(e) State what would be observed if the metal ion you have named in (d) was treated with aqueous ammonia until in excess. (1 mark)

.....

.....

SECTION B: (30 MARKS)

Answer any two questions from this section.
Additional questions answered will not be marked.

11. (a) Name the raw materials which are used in the extraction of iron using a blast furnace. (02 marks)

(b) Briefly describe the reactions that lead to the formation of iron during the extraction using a blast furnance. (*Your answer should include equations for the reactions.)* (6 ½ marks)

(c) State what would be observed and write equation for the reaction that would take place when the follwing gases are passed over heated iron.

(i) Dry chlorine (2 ½ marks)

(ii) Steam (2 ½ marks)

(d) Dilute hydrochloric acid was added to iron fillings and the mixture warmed. Write the equation for the reaction that took place. (1 ½ marks)

12. A sample of dry hydrogen can be prepared in the laboratory using zinc and dilute sulphuric acid in the presence of a catalyst.

(a) (i) Draw a diagram to show a set – up of the apparatus that can be used to prepare dry hydrogen in the laboratory. (3 ½ marks)

(ii) Name the catalyst that can be used in this reaction. (01 mark)

(iii) Write the equation for the reaction leading to the formation of hydrogen. (1 ½ marks)

(iv) State how hydrogen can be identified. (01 mark)

(b) Dry hydrogen was passed over heated lead (II) oxide.

(i) State what was observed. (1 ½ marks)
(ii) Write equation for the reaction that took place. (1 ½ marks)

(c) Hydrogen burns in oxygen according to the following equation.

$2H_2(g) + O_2(g) \longrightarrow 2H_2O(l) + heat$

(i) Name one substance that can be used to identidy the product of theh combustion of hydrogen in oxygen. (01 mark)

(ii) State what would be observed if the reagent you have named in (c) (i) was used to identify the product. (01 mark)

(iii) Calculate the volume of hydrogen at s.t.p that would burn in oxygen to produce 5720 J of heat.
(*The molar heat of combustion of hydrogen = - 286 kJ mol^{-1}; 1 mole of gas occupies 22.4 dm^3 at s.t.p*)

13. (a) Explain giving exampple(s) what is meant by

(i) **"basicity"** of an acid (3 ½ marks)
(ii) An **"acid salt"** (2 ½ marks)

(b) Outline how a pure dry sample of sodium hydrogen sulphate can be prepared in the laboratory. (*No equation or diagram required)* (6 ½ marks)

(c) An acidified solution of barium chloride was added to aqueous sodium hydrogen sulphate. State what was observed and write equation for the reaction that took place.

14. (a) Describe how a pure dry sample of chlorine can be prepared in the laboratory starting from potassium manganate(VII).
(*NO diagram is required, but your description must include conditions and equation for the reaction).*

(b) State what would be observd and write equation(s) for the reaction(s) that would occur if

(i) Chlorine was bubbled into an aqueous sodium hydroxide. (02 marks)

(ii) Burning magnesium was lowered into a jar of dry chlorine. (03 marks)

(iii) Chlorine was passed through a solutin of potassium iodide. (2 ½ marks)

(c) State **one** use of chlorine. (½ mark)

PLEASE SEND US YOUR COMMENTS AND QUESTIONS. swaibj@yahoo.com