23.6 CHEMISTRY (233)

23.6.1 Chemistry Paper 1 (233/1)

Name ..... **Index No:** ...../.....

233/1
CHEMISTRY
Paper 1
THEORY
Oct. /Nov. 2006
2 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL
Kenya Certificate of Secondary Education
CHEMISTRY
Paper 1
THEORY
2 hours

Write your name and index number in the spaces provided above.
*Answer **all** the questions in the spaces provided.*
Mathematical tables and electronic calculators may be used.
*All working **must** be clearly shown where necessary.*

For Examiner's Use Only

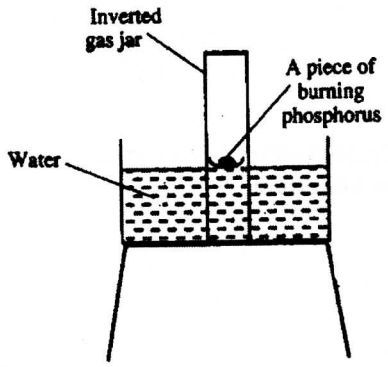
Questions	Maximum Score	Candidate's Score
1 – 28	80	

Candidates should check the question paper to ensure that all the pages are printed as indicated and no questions are missing.

1 (a) What is meant by isomerism? (1 mark)

(b) Draw and name two isomers of butene. (2 marks)

2 The diagram below represents a set-up that was used to show that part of air is used during burning.



(a) Given that the phosphorus used was in excess, draw a diagram of the set-up at the end of the experiment (When there was no further observable change). (1 mark)

(b) Suggest one modification that should be made on the apparatus if the percentage of the air used is to be determined. (1 mark)

3 60 cm^3 of oxygen gas diffused through a porous partition in 50 seconds. How long would it take 60 cm^3 of sulphur (IV) oxide gas to diffuse through the same partition under the same conditions? (S = 32.0, 0 = 16.0). (3 marks)

4 (a) Complete the nuclear equation below. (1 mark)

$$^{37}_{18}A + \cdots\cdots \longrightarrow {}^{37}_{17}B$$

(b) State one:

(i) use of radioisotopes in agriculture (1 mark)

(ii) danger associated with exposure of human beings to radioisotopes. (1 mark)

5 The atomic numbers of elements C and D are 19 and 9 respectively. State and explain the electrical conductivity of the compound CD in:

(a) solid state (1 ½ marks)

(b) aqueous state. (1 ½ marks)

6 In an experiment to study the properties of concentrated sulphuric acid, a mixture of the acid and wood charcoal was heated in a boiling tube.

(a) Write the equation of the reaction that took place in the boiling tube. (1 mark)

(b) Using oxidation numbers, show that reduction and oxidation reactions took place in the boiling tube. (2 marks)

7 A group of compounds called chlorofluorocarbons have a wide range of uses but they also have harmful effects on the environment.
State one:

(a) use of chlorofluorocarbons (1 mark)

(b) harmful effect of chlorofluorocarbons on the environment. (1 mark)

8 When 94.5g of hydrated barium hydroxide, $Ba(OH)_2 . nH_2O$ were heated to constant mass, 51.3 g of anhydrous barium hydroxide were obtained. Determine the empirical formula of the hydrated barium hydroxide.
(Ba = 137.0; 0 = 16.0, H = 1.0). (3 marks)

9 At 20°C, NO_2 and N_2O_4 gases exist in equilibrium as shown in the equation below

$$2NO_{2(g)} \rightleftharpoons N_2O_{4(g)}; \quad \Delta H = -ve$$

Brown Pale yellow

State and explain the observation that would be made when:

(a) a syringe containing the mixture at 20°C is immersed in ice-cold water (1 ½ marks)

(b) the volume of the gaseous **mixture** in a syringe is reduced. (1 ½ marks)

10 Name the process which takes place when:

(a) solid carbon (IV) oxide (dry ice) changes directly into gas (1 mark)

(b) a red litmus paper turns white when dropped into chlorine water (1 mark)

(c) propene gas molecules are converted into a giant molecule. (1 mark)

11 (a) Water from a town in Kenya is suspected to contain chloride ions but not sulphate ions. Describe how the presence of the chloride ions in the water can be shown. (2 marks)

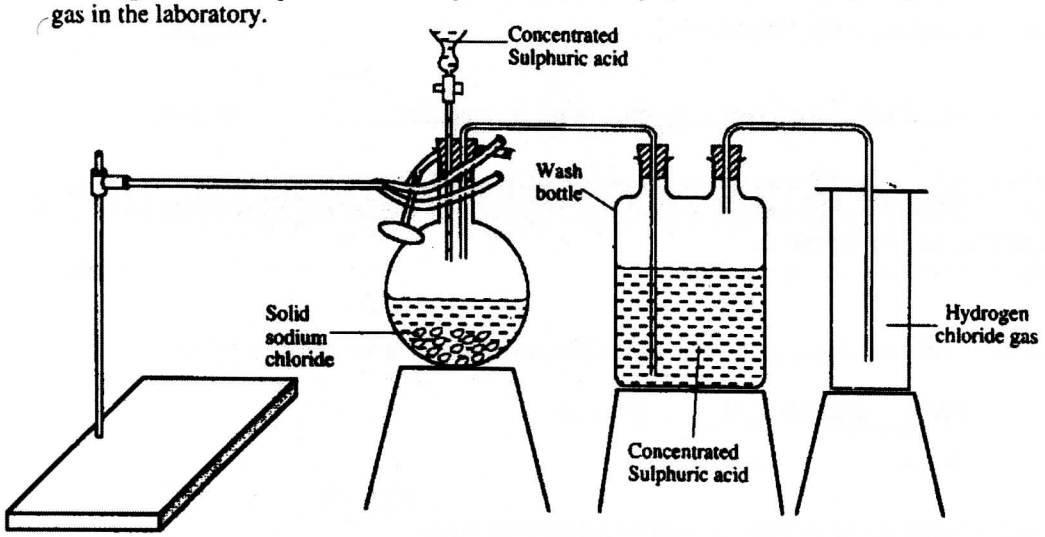
(b) State one advantage of drinking hard water rather than soft water. (1 mark)

12 The table below shows the relative atomic masses and the percentage abundance of the isotopes L_1 and L_2 of element L.

	Relative atomic mass	% abundance
L_1	62.93	69.09
L_2	64.93	30.91

Calculate the relative atomic mass of element L. **(3 marks)**

13 The diagram below represents the set-up that was used to prepare and collect hydrogen chloride gas in the laboratory.



(a) State the purpose of concentrated sulphuric acid in the wash bottle. (1 mark)

(b) Write an equation for the reaction between dry hydrogen chloride gas and heated iron (1 mark)

(c) Hydrogen chloride gas is dissolved in water to make hydrochloric acid.
State one use of hydrochloric acid. (1 mark)

14 Below is a list of oxides.
MgO, N_2O, K_2O, CaO, and Al_2O_3.

Select:

(a) a neutral oxide (1 mark)

(b) a highly water soluble basic oxide (1 mark)

(c) an oxide which can react with both sodium hydroxide solution and dilute hydrochloric acid. (1 mark)

15 Study the standard reduction potentials given below and answer the questions that follow. (The letters are not the actual symbols of the elements).

	E^{θ} (Volts)
$M^{2+}_{(aq)} + 2e \longrightarrow M_{(s)}$	-0.76
$N^{2+}_{(aq)} + 2e \longrightarrow N_{(s)}$	-2.37
$P^{+}_{(aq)} + e \longrightarrow P_{(s)}$	+0.80
$Q^{2+}_{(aq)} + 2e \longrightarrow Q_{(s)}$	-0.14

(a) The standard reduction potential for $Fe^{2+}_{(aq)}$ is -0.44 volts. Select the element which would best protect iron from rusting. (1 mark)

(b) Calculate the E^{θ} value for the cell represented as $M_{(s)}\left|M^{2+}_{(aq)}\right|\left|P^{+}_{(aq)}\right|P_{(s)}$. (2 marks)

16 When hydrogen sulphide gas was bubbled into an aqueous solution of iron (III) chloride, a yellow precipitate was deposited.

(a) State another observation that was made. (1 mark)

(b) Write an equation for the reaction that took place. (1 mark)

(c) What type of reaction was undergone by hydrogen sulphide in this reaction? (1 mark)

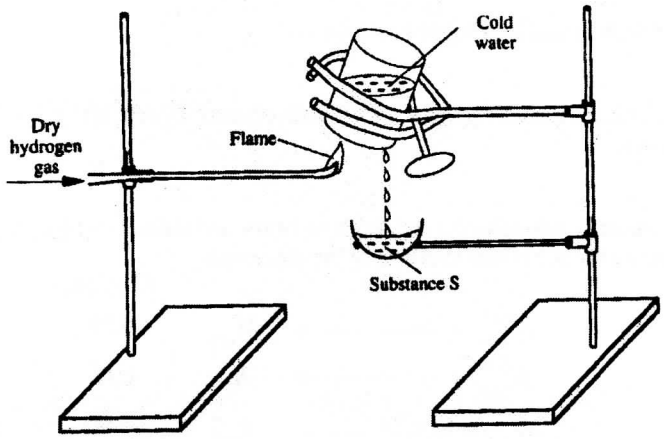
17 The first step in the industrial manufacture of nitric acid is the catalytic oxidation of ammonia gas.

(a) What is the name of the catalyst used? (1 mark)

(b) Write the equation for the catalytic oxidation of ammonia gas. (1 mark)

(c) Nitric acid is used to make ammonium nitrate. State two uses of ammonium nitrate. (1 mark)

18 Study the diagram below and answer the question that follows.



Describe **one** chemical test that can be carried out to identify substance S. (2 marks)

19 (a) Starting from solid magnesium oxide, describe how a solid sample of magnesium hydroxide can be prepared. (2 marks)

(b) Give **one** use of magnesium hydroxide. (1 mark)

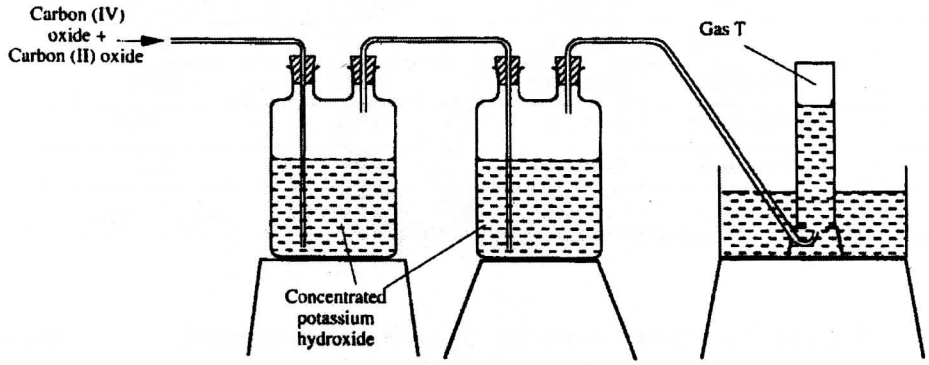
20 (a) Distinguish between a covalent bond and a co-ordinate bond. (2 marks)

(b) Draw a diagram to show bonding in an ammonium ion. (1 mark)
(N = 7, H = 1.)

21 (a) Explain why the metals magnesium and aluminium are good conductors of electricity. (1 mark)

(b) Other than cost, give **two** reasons why aluminium is used for making electric cables while magnesium is **not**. (2 marks)

22 The diagram below represents part of a set-up used to prepare and collect gas T.



(a) Name **two** reagents that are reacted to produce both carbon (IV) oxide and carbon (II) oxide. (1 mark)

(b) Write the equation for the reaction which takes place in the wash bottles. (1 mark)

(c) Give a reason why carbon (II) oxide is not easily detected. (1 mark)

23 Explain why the boiling point of ethanol is higher than that of hexane. (Relative molecular mass of ethanol is 46 while that of hexane is 86). (2 marks)

24 (a) Complete the table below to show the colour of the given indicator in acidic and basic solutions. (1 mark)

Indicator	Colour in	
	Acidic solution	Basic solution
Methyl orange	.....	Yellow
Phenolpthalein	Colourless	.....

(b) How does the p^H value of 0.1M potassium hydroxide solution compare with that of 0.1M aqueous ammonia? Explain. (2 marks)

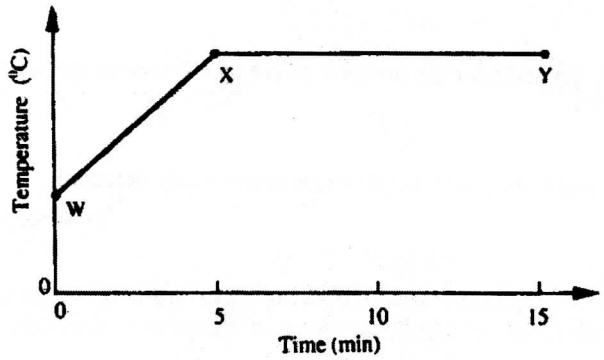
25 Study the properties of substances V_1 to V_4 in the table below and answer the questions that follow.

Substance	Solubility in water	Solubility in petrol	Melting Point (°C)	Boiling Point (°C)
V_1	Insoluble	Soluble	-30	250
V_2	Insoluble	Insoluble	1535	3000
V_3	Insoluble	Soluble	16.8	44.8
V_4	Insoluble	Soluble	75	320

(a) Which of the substances are liquids at 24°C? (1 mark)

(b) Describe how a mixture containing V_2 and V_4 can be separated. (2 marks)

26 The graph below shows a curve obtained when water at 20°C was heated for 15 minutes.

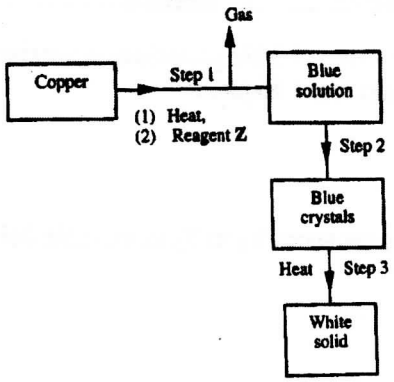


(a) What happens to the water molecules between points W and X? (1 mark)

(b) In which part of the curve does a change of state occur? (1 mark)

(c) Explain why the temperature does not rise between points X and Y. (1 mark)

27 Study the flow chart below and answer the questions that follow.

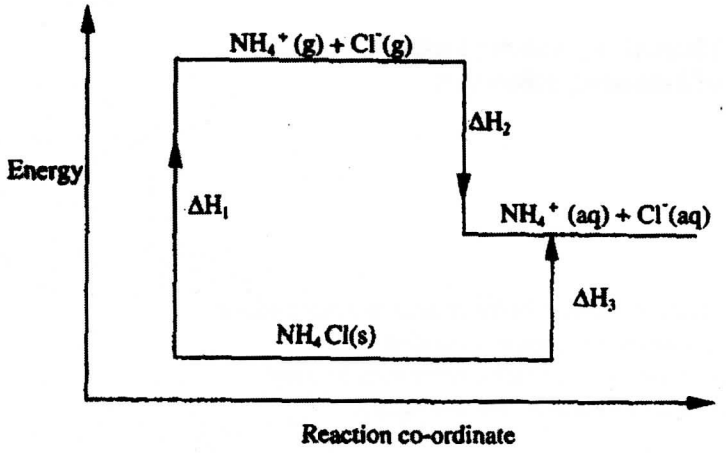


(a) Name reagent Z. (1 mark)

(b) Describe the process which takes place in step 2. (1 mark)

(c) Identify the white solid. (1 mark)

28 Study the diagram below and answer the questions that follow.



(a) What do ΔH_1 and ΔH_2 represent? (2 marks)

(b) Write an expression to show the relationship between ΔH_1, ΔH_2 and ΔH_3. (1 mark)

Name .....**Index number** ...../.....

233/2
CHEMISTRY
Paper 2
THEORY
Oct./Nov. 2006
2 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL
Kenya Certificate of Secondary Education
CHEMISTRY
Paper 2
THEORY
2 hours

Write your name and index number in the spaces provided above.
*Answer **ALL** the questions in the spaces provided.*
Mathematical tables and electronic calculators may be used.
*All working **must** be clearly shown where necessary.*

For Examiner's Use Only

Question	Maximum Score	Candidate's Score
1	11	
2	12	
3	10	
4	12	
5	11	
6	10	
7	14	
Total Score	**80**	

Candidates should check the question paper to ensure that all the pages are printed as indicated and no questions are missing.

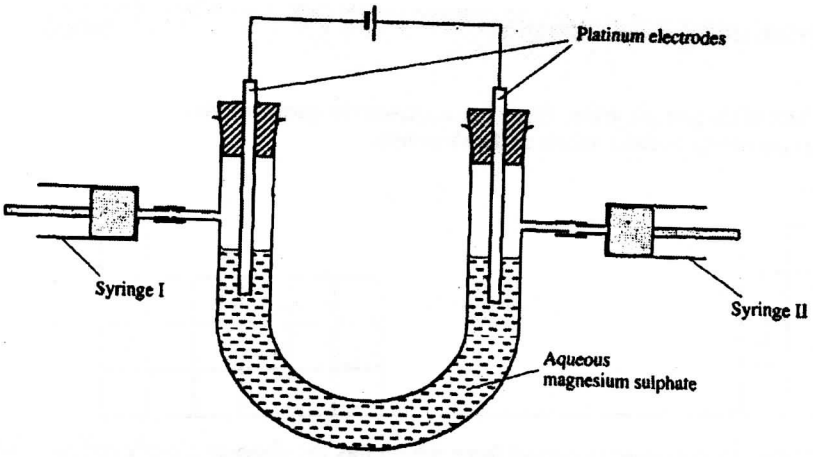
1. (a) What is an electrolyte? (1 mark)

(b) State how the following substances conduct electricity:

(i) molten calcium chloride (1 mark)

(ii) graphite. (1 mark)

(c) The diagram below shows a set up that was used to electrolyse aqueous magnesium sulphate.



(i) On the diagram above, using an arrow, show the direction of flow of electrons. (1 mark)

(ii) Identify the syringe in which hydrogen gas would be collected. Explain. (1 mark)

(d) Explain why the concentration of magnesium sulphate was found to have increased at the end of the experiment. (2 marks)

(e) During the electrolysis, a current of 0.72A was passed through the electrolyte for 15 minutes. Calculate the volume of gas produced at the anode. (1 Faraday = 96 500 coulombs; molar gas volume is 24000 cm^3 at room temperature). (4 marks)

2. (a) In an experiment to determine the molar heat of reaction when magnesium displaces copper, 0.15g of magnesium powder were added to 25.0cm^3 of 2.0M copper (II) chloride solution. The temperature of copper (II) chloride solution was 25°C. while that of the mixture was 43°C.

(i) Other than increase in temperature, state and explain the observations which were made during the reaction. (3 marks)

(ii) Calculate the heat change during the reaction (Specific heat capacity of the solution = 4.2$jg^{-1}K^{-1}$ and the density of the solution = 1g/cm^3). (2 marks)

(iii) Determine the molar heat of displacement of copper by magnesium. (Mg = 24.0). (2 marks)

(iv) Write the ionic equation for the reaction. (1 mark)

(v) Sketch an energy level diagram for the reaction. (2 marks)

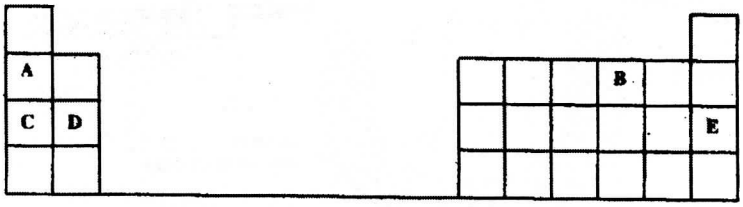
(b) Use the reduction potentials given below to explain why a solution containing copper ions should not be stored in a container made of zinc.

$$Zn^{2+}_{(aq)} + 2e \rightarrow Zn_{(s)}; \quad E^{\theta} = -0.76V$$

$$Cu^{2+}_{(aq)} + 2e \rightarrow Cu_{(s)}; \quad E^{\theta} = +0.34V$$ (2 marks)

3. (a) Distinguish between isotopes and allotropes. (2 marks)

(b) The chart below is part of the periodic table. Study it and answer the questions that follow. (The letters are not the actual symbols of the elements).



(i) Select the element in period three which has the shortest atomic radius. Give a reason for your answer. (2 marks)

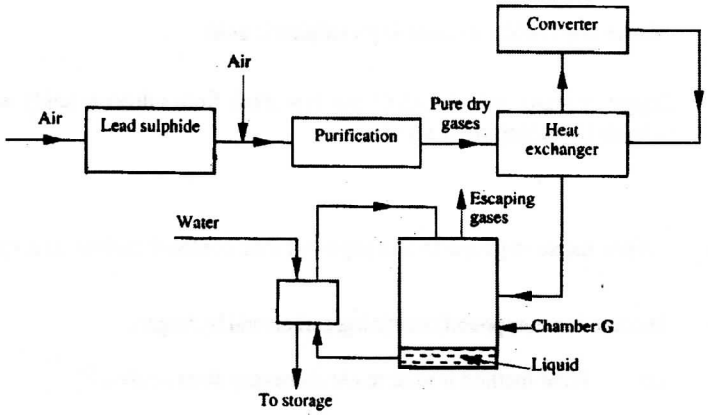
(ii) Element F has the electronic structure, 2.8.18.4. On the chart above, indicate the position of element F. (1 mark)

(iii) State one use of the elements of which E is a member. (1 mark)

(iv) Write an equation to show the action of heat on the nitrate of element C. (1 mark)

(c) When 3 litres of chlorine gas were completely reacted with element D, 11.875g of the product were formed. Determine the relative atomic mass of element D. (Atomic mass of chlorine = 35.5; molar gas volume = 24 litres). (3 marks)

4. (a) The diagram below shows some processes that take place during the industrial manufacture of sulphuric acid.



(i) Write the equation for the reaction in which sulphur dioxide gas is produced. (1 mark)

(ii) Why is it necessary to keep the gases pure and dry? (1 mark)

(iii) Describe the process that takes place in chamber G. (1 mark)

(iv) Name the gases that escape into the environment. (1 mark)

(v) State and explain the harmful effect on the environment of one of the gases named in (iv) above. (1 mark)

(vi) Give **one** reason why it is necessary to use a pressure of 2 -3 atmospheres and not more. (1 mark)

(b) (i) Complete the table below to show the observations made when concentrated sulphuric acid is added to the substances shown. (2 marks)

Substance	Observation
Iron filings	
Crystals of white sugar	

(ii) Give reasons for the observations made using:

I iron filings (1 mark)

II crystals of white sugar. (1 mark)

(c) Name one fertilizer made from sulphuric acid. (1 mark)

(d) Suggest a reason why $BaSO_4$ (A pigment made from sulphuric acid) would be suitable in making paint for cars. (1 mark)

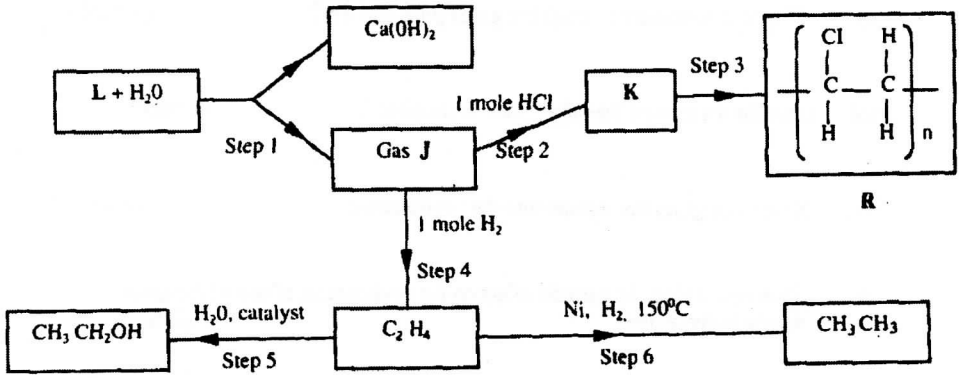
5. (a) What name is given to a compound that contains carbon and hydrogen only? ($^1/_2$ mark)

(b) Hexane is a compound containing carbon and hydrogen.

(i) What method is used to obtain hexane from crude oil? (1 mark)

(ii) State **one** use of hexane. (1 mark)

(c) Study the flow chart below and answer the questions that follow.



(i) Identify reagent **L**. (1 mark)

(ii) Name the catalyst used in Step 5. (1 mark)

(iii) Draw the structural formula of gas **J**. (1 mark)

(iv) What name is given to the process that takes place in step 5? ($^1/_2$ mark)

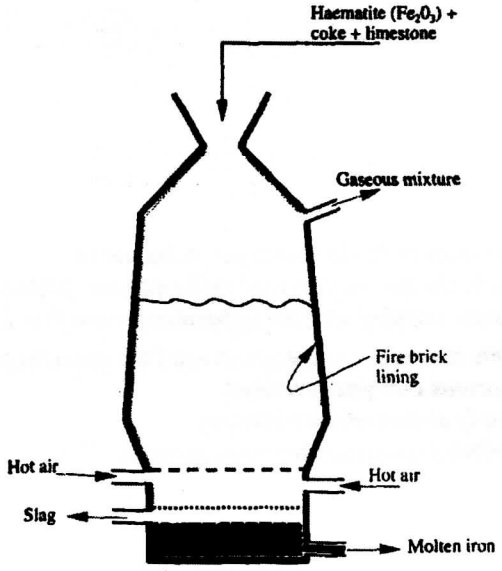
(v) State:
I **one** use of product **R** (1 mark)

II a commercial application of the process which takes place in step 6.
(1 mark)

(d) (i) Write the equation for the reaction between aqueous sodium hydroxide and aqueous ethanoic acid. (1 mark)

(ii) Explain why the reaction between 1g of sodium carbonate and 2M hydrochloric acid is faster than the reaction between 1g of sodium carbonate and 2M ethanoic acid. (2 marks)

6 The extraction of iron from its ores takes place in the blast furnace. Below is a simplified diagram of a blast furnace. Study it and answer the questions that follow.



23.6.3 Chemistry Paper 3 (233/3)

Name ..... **Index No.** ...../.....

233/3
CHEMISTRY
Paper 3
PRACTICAL
Oct./Nov. 2006
2 1/4 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL
Kenya Certificate of Secondary Education
CHEMISTRY
Paper 3
PRACTICAL
2 1/4 hours

Write your name and index number in the spaces provided above.
*Answer **ALL** the questions in the spaces provided in the question paper.*
*You are **NOT** allowed to start working with the apparatus for the first 15 minutes of the 2 1/4 hours allowed for this paper. This time is to enable you to read the question paper and make sure you have all the chemicals and apparatus that you may need.*
*All working **MUST** be clearly shown where necessary.*
Mathematical tables and electronic calculators may be used.

For Examiner's use only

Question	Max. Score	Score
1	21	
2	13	
3	06	
Total Score	40	

Candidates should check the question paper to ensure that all the pages are printed as indicated and no questions are missing.

6031 **Turn over**

1 You are provided with:

- 4.5 g of solid A in a boiling tube.
- Solution B, 0.06 M acidified Potassium manganate (VII)

You are required to determine:

(1) the solubility of solid A at different temperatures

(2) the number of moles of water of crystallisation in solid A.

Procedure

(a) Using a burette, add 4 cm^3 of distilled water to solid A in the boiling tube. Heat the mixture while stirring with the thermometer to about 70°C. When **all** the solid has dissolved, allow the solution to cool while stirring with the thermometer. Note the temperature at which crystals of solid A first appear. Record this temperature in table 1.

(b) Using the burette, add 2 cm^3 of distilled water to the contents of the boiling tube. Warm the mixture while stirring with the thermometer until **all** the solid dissolves. Allow the mixture to cool while stirring. Note and record the temperature at which crystals of solid A first appear.

(c) Repeat procedure (b) two more times and record the temperatures in table 1. **Retain the contents of the boiling tube** for use in procedure (e).

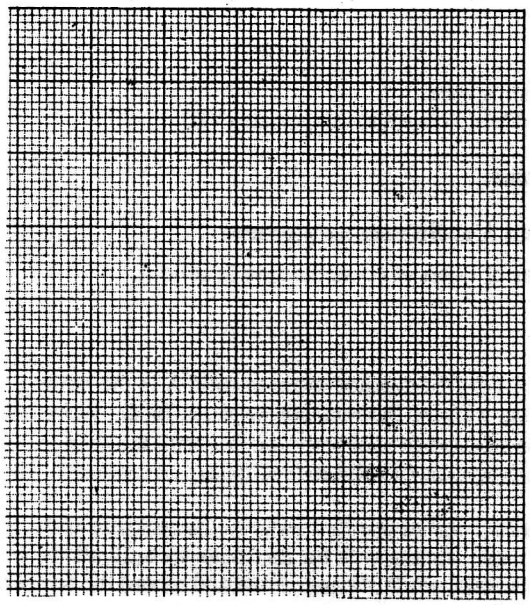
(d) (i) Complete table 1 by calculating the solubility of solid A at the different temperatures. The solubility of a substance is the mass of that substance that dissolves in 100 cm^3 (100 g) of water at a particular temperature.

Table 1

Volume of water in the boiling tube (cm^3)	Temperature at which crystals of solid A first appear (°C)	Solubility of solid A (g/100 g water)
4		
6		
8		
10		

(6 marks)

(ii) On the grid provided, plot a graph of the solubility of solid A (vertical axis) against temperature. (3 marks)



(iii) Using your graph, determine the temperature at which 100 g of solid **A** would dissolve in 100 cm^3 of water. (1 mark)

(e) (i) Transfer the contents of the boiling tube into a 250 ml volumetric flask. Rinse both the boiling tube and the thermometer with distilled water and add to the volumetric flask. Add more distilled water to make up to the mark. Label this solution **A**. Fill a burette with solution **B**. Using a pipette and a pipette filler, place 25.0 cm^3 of solution **A** into a conical flask. Warm the mixture to about 60°C. Titrate the hot solution **A** with solution **B** until a permanent pink colour persists. Record your readings in table 2. Repeat the titration two more times and complete table 2. **(Retain the remaining solution B for use in question 3 b(i)).**

Table 2

	I	II	III
Final burette reading			
Initial burette reading			
Volume of solution **B** used (cm^3)			

(3 marks)

(ii) Calculate the:

I average volume of solution **B** used (1 mark)

II number of moles of potassium manganate (VII) used (1 mark)

III number of moles of **A** in 25 cm^3 of solution **A** given that 2 moles of potassium manganate (VII) react completely with 5 moles of **A** (1 mark)

IV relative formula mass of **A**. (3 marks)

(iii) The formula of **A** has the form $D.xH_2O$. Determine the value of x in the formula given that the relative formula mass of **D** is 90.0 and atomic masses of oxygen and hydrogen are 16.0 and 1.0 respectively. (2 marks)

2 You are provided with solid **E**. Carry out the tests below. Write your observations and inferences in the spaces provided.

(a) Place about one third of solid **E** in a clean dry test-tube and heat it strongly.

Observations	Inferences
(1 mark)	(1 mark)

(b) Place the remaining solid **E** in a boiling tube. Add about 10 cm^3 of distilled water. Shake the mixture thoroughly for about one minute. Filter and divide the filtrate into four portions.

Observations	Inferences
(1 mark)	(1 mark)

(i) To the first portion, add 2 drops of phenolpthalein indicator.

Observations	Inferences
(1 mark)	(1 mark)

(ii) To the second portion, add 2 cm^3 of dilute hydrochloric acid.

Observations	Inferences
(1 mark)	(1 mark)

(iii) To the third portion, add 5 cm^3 of aqueous sodium sulphate.

Observations	Inferences
(1 mark)	(1 mark)

(iv) To the fourth portion, add dilute sodium hydroxide **dropwise** until in excess.

Observations	Inferences
(1 mark)	(1 mark)

3 You are provided with solid **F**.
Carry out the following tests and record your observations and inferences in the spaces provided.

(a) Using a **metallic** spatula, take one-third of solid **F** and ignite it using a Bunsen burner

Observations	Inferences
(1 mark)	(1 mark)

(b) Place the remaining solid **F** in a boiling tube. Add about 10 cm^3 of distilled water. Shake the mixture until all the solid dissolves.

(i) To about 4 cm^3 of the solution, add 2 to 3 drops of acidified potassium manganate (VII), solution **B**.

Observations	Inferences
(1 mark)	(1 mark)

(ii) To about 4 cm^3 of the solution, add 2 to 3 drops of bromine water. Warm the mixture.

Observations	Inferences
(1 mark)	(1 mark)