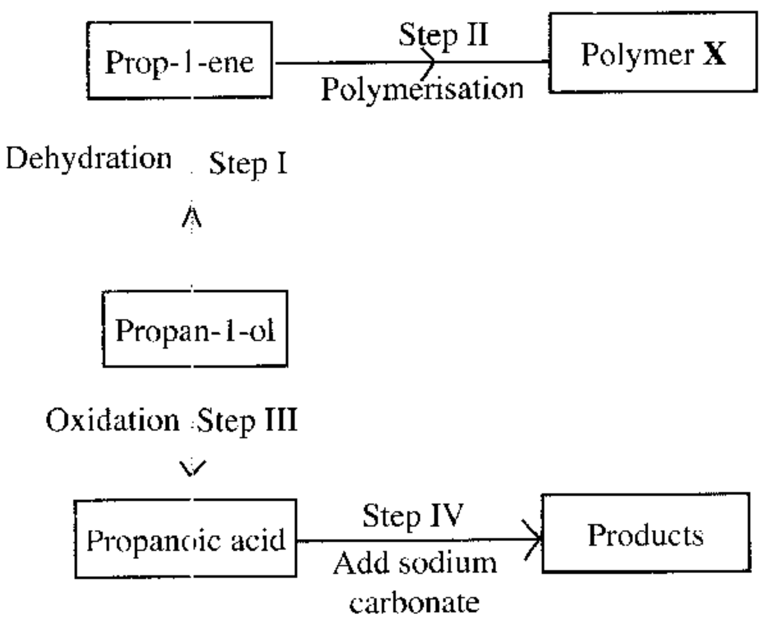
K.C.S.E CHEMISTRY PAPER 2 2012

1. a) Draw the structural formula for all the isomers of $C_2H_3CL_3$ (2marks)

b) Describe two chemical tests that can be used to distinguish between ethane and ethane. (4marks)

c) The following scheme represents various reactions starting with propan-i- ol. Use it to answer the questions that follow.



i) Name one substance that can be used in step I. (1mark)

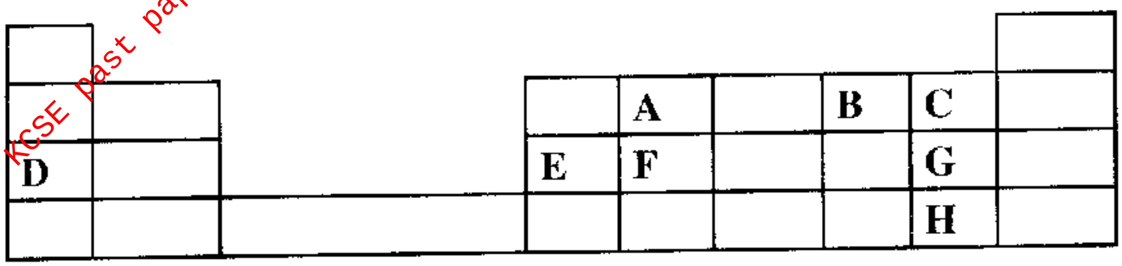
ii) Give the general formula of X. (1 mark)

iii) Write the equation for the reaction in step IV. (1mark)

iv) Calculate the mass of propan-I-ol which when burnt completely in air at room temperature and pressure would produce $18dm^3$ of gas. (C =

12.0; O = 16.0; H = 1.0; Molar gas volume = 24dm^3)
(3marks)

2. The grid below is part of the periodic table. Use it to answer the questions that follow. (The letters are not the actual symbols of the elements.)



a) Which is the most reactive non-metallic element shown in the table? Explain. (2marks)

b) i) Write the formula of the compound formed when element A reacts with element B. (1mark)

ii) Name the bond type in the compound formed in b (i) above. (1mark)

c) i) What is the name given to the group of elements where C, G and H belong? (1mark)

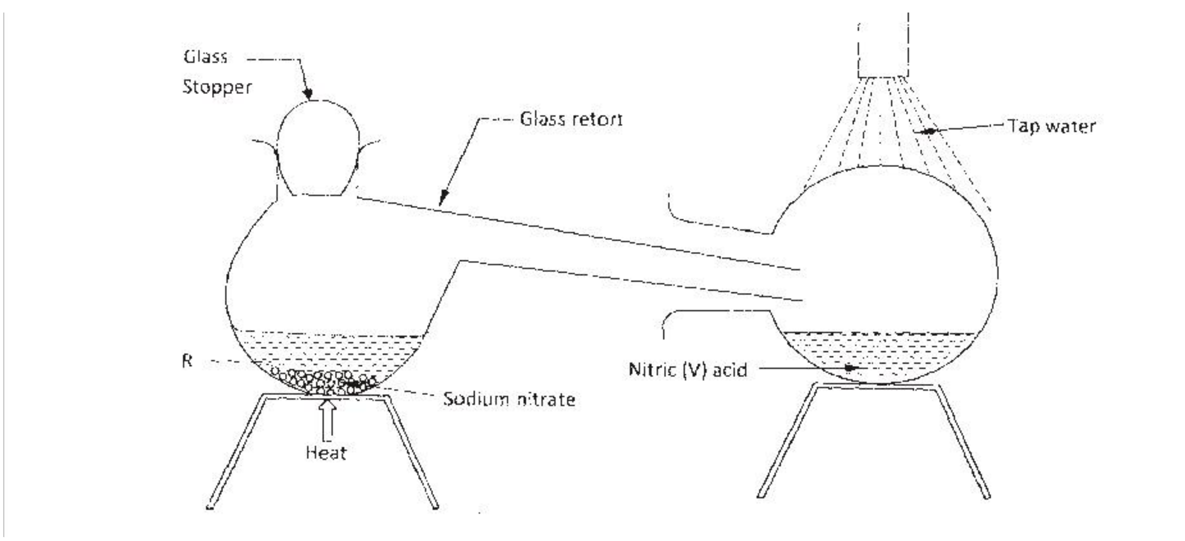
ii) Write an equation for the reaction that occurs when C in gaseous form is passed through a solution containing ions of element H. (2marks)

d) The melting points of elements F and G are 1410oC and -101oC respectively. In terms of structure and bonding, explain why there is a large difference in the melting points of F and G. (2marks)

e) D forms two oxides. Write the formula of each of the two oxides.(1mark)

f) J is an element that belongs to the 3rd period of the periodic table and a member of the alkaline earth elements. Show the position of J in the grid. (1mark)

3. In the laboratory, small quantities of nitric (V) acid can be generated using the following set up. Study it and answer the questions that follow.



a) i) Give the name of substance R. (1mark)

ii) Name one other substance that can be used in place of sodium nitrate. (1mark)

iii) What is the purpose of using tap water in the set up above? (1mark)

b) Explain the following;

i) It is not advisable to use a stopper made of rubber in the set-up (1mark)

ii) the reaction between copper metal with 50% nitric (V) acid in an open test-tube produces brown fumes. (1mark)

c) i) Nitrogen is one of the reactants used in the production of ammonia, name two sources of the other reactant. (2marks)

ii) A factory uses nitric (V) acid and ammonia gas in the preparation of a fertilizer. If the daily production of the fertilizer is 4800kg; calculate the mass of ammonia gas used in kg. (N = 14.0; O = 16.0; H = 1.0) (3marks)

iii) State two other uses of nitric (V) acid other than the production of fertilizers. (2marks)

4. The factors which affect the rate of reaction between lead carbonate and dilute nitric (V) acid were investigated by carrying out three experiments;

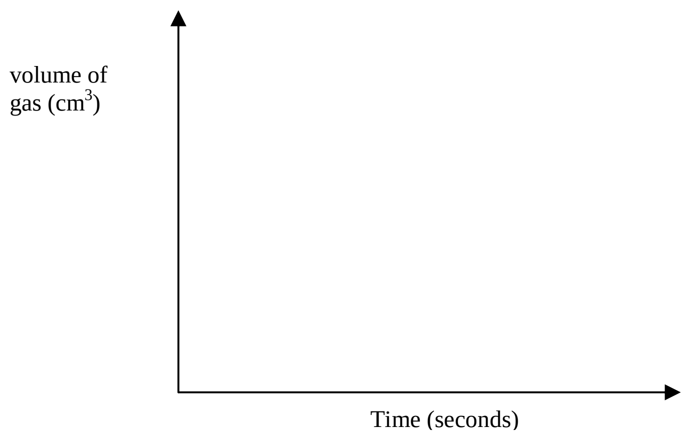
Experiment number	Lead carbonate	Concentration of nitric (V) acid
1	Lumps	4M
2	Powdered	4M
3	Lumps	2M

a) Other than concentration , name the factor that was investigated in the experiments. (1mark)

b) For each experiment, the same volume of acid (excess) and mass of lead carbonate were used and the volume of gas liberated measured with time.

i) Draw a set up that can be used to investigate the rate of reaction for one of the experiments. (3marks)

ii) On the grid provided, sketch the curves obtained when the volume of gas produced was plotted against time for each of the three experiments and label each as 1, 2 or 3. (4marks)



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

c) If the experiments were carried out using dilute hydrochloric acid in place of dilute nitric (V) acid, the reaction would start, slow down and eventually stop. Explain these observations. (2marks)

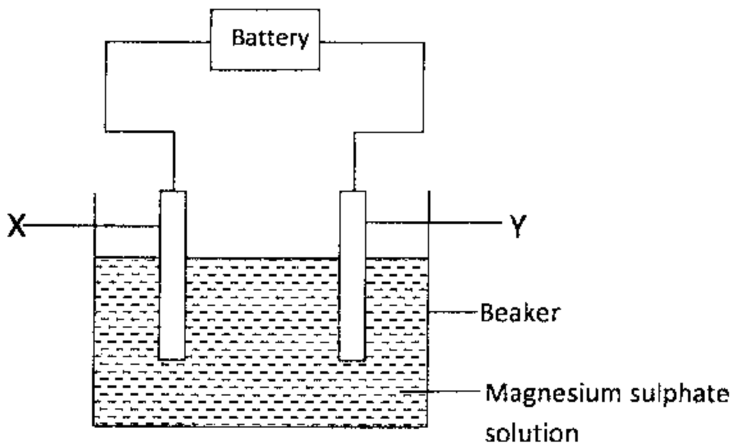
d) A solution of bromine gas in water is an example of a chemical reaction in a state of balance. The reaction involved is represented by the equation below.

$$Br_{2(g)} + H_2O_{(L)} \rightleftharpoons 2H^+_{(aq)} + Br^-_{(aq)} + OB^-_{(aq)}$$

Yellow/orange Colourless

State and explain the observation made when hydrochloric acid is added to the mixture at equilibrium. (2marks)

5. a) The set up below was used to investigate the products formed at electrodes during electrolysis of aqueous magnesium sulphate using inert electrodes. Use it to answer the questions that follow.



i) During the electrolysis, hydrogen gas was formed at electrode Y. identify the anode. Give a reason for your answer. (2marks)

ii) Write the equation for the reaction with takes place at electrode X. (1mark)

iii) Why is the concentration of magnesium sulphate expected to increase during electrolysis? (2marks)

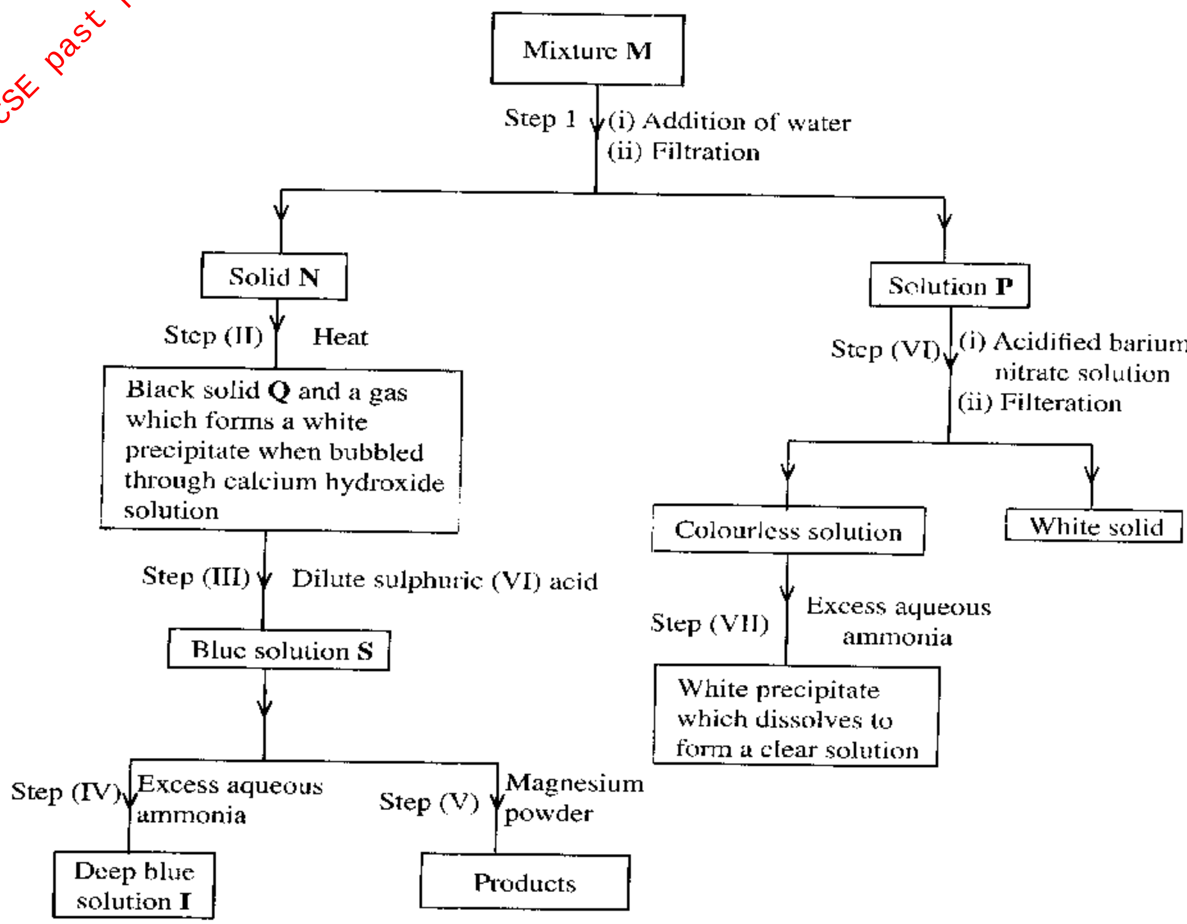
iv) What will be observed if red and blue litmus papers were dipped into the solution after electrolysis? (2marks)

b) During electrolysis of magnesium sulphate, a current of 0.3A was passed for 30 minutes. Calculate the volume of gas produced at the anode.

(Molar gas volume = 24dm3; 1 Faraday = 96,500C.). (3marks)

c) State two applications of electrolysis. (1mark)

6. The flow chart below shows a sequence of reactions involving a mixture of two salts, mixture M. Study it and answer the questions that follow.



a) Write the formula of the following;

i) anion in solid Q (1mark)

ii) the two salts present in mixture M. (2marks)

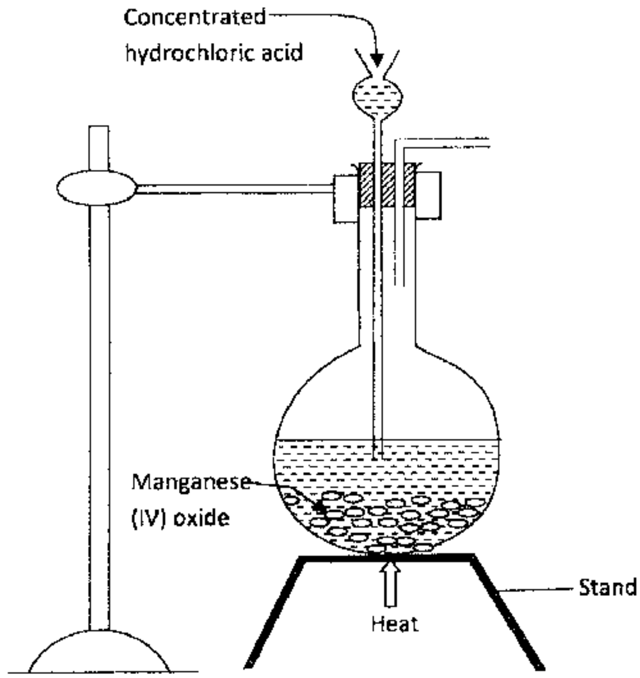
b) Write an ionic equation for the reaction in step (VI) (1mark)

c) State and explain the observations made in step (V). (3marks)

d) i) Starting with Lead (II) oxide, describe how a pure solid sample of lead sulphate can be prepared in the laboratory.
(2marks)

ii) How can one determine whether the lead sulphate prepared is pure?
(2marks)

7. a) The diagram below is part of set up used to prepare and collect dry chlorine gas.



i) Complete the diagram to show how a dry sample of chlorine gas can be collected. (3marks)

ii) Name another substance and condition that can be used instead of manganese (VI) oxide. (1mark)

iii) Write an equation for each of the following;
I. chlorine gas reacting with iron (1 mark)

II. chlorine gas reacting with hot concentrated sodium hydroxide solution. (1mark)

b) An oxide of chlorine of mass 1.83g was found to contain 1.12g of oxygen. Determine the empirical formula of the oxide (O = 16.0; Cl = 35.5). (3marks)

c) Other than the manufacture of weed killers, name two other uses of chlorine. (2marks)

K.C.S.E CHEMISTRY PAPER 3 2012 PRACTICAL

1. You are provided with:
- solution **A** containing an oxidising agent **A;**
- solution **B,** 0.05 M aqueous sodium thiosulphate;
- solution **C** containing a reducing agent **C;**
- aqueous potassium iodide;
- solution **D,** starch solution.

You are required to determine the: concentration of solution **A:**
rate of reaction between the oxidising agent **A** and the reducing agent **C.**

Procedure 1

1. Using a pipette and **pipette filler,** place 25.0 cm^3 of solution **A** into a 250 ml conical flask.

2. Measure 10 cm^3 of aqueous potassium iodide and add it to solution **A** in the conical flask. Shake the mixture. Add 10 cm^3 of 2 M sulphuric (VI) acid to the mixture and shake.

3. Fill a burette with solution **B** and use it to titrate the mixture in the conical flask until it just turns **orange-yellow.** Add 2 cm^3 of solution **D** to the mixture in the conical flask. Shake thoroughly. Continue titrating until the mixture **just turns colourless.** Record your results in **table 1** below.

4. Repeat the procedure and complete table 1. **Retain the remainder of** solution **A** and solution **D** for use in procedure II.

Table 1	**I**	**II**	**III**
Final burette reading			

Initial burette reading			
Volume of solution **B** used (cm^3)			

(4 marks)

(a) Calculate the:
(i) average volume of solution **B** used; (1 mark)

(ii) number of moles of sodium thiosulphate. (1 mark)

b) Given that one mole of A reacts with six moles of sodium thiosulphate, calculate the;
i) number of moles of A that were used; (1mark)

ii) concentration of solution A in moles per litre. (2marks)

Procedure II
1. Label six test - tubes as 1,2,3,4.5 and 6 and place them in a test - tube rack.
2. Using a clean burette, measure the volumes of distilled water shown in **table** 2 into the labelled test - tubes.
3. Using a burette, measure the volumes of solution **A** shown in **table** 2 into each of the test - tubes.
4. Clean the burette and rinse it with about 5 cm^3 of solution **C.**
5. Using the burette, measure 5 cm^1 of solution **C** and place it into a 100 ml beaker.
6. Using a 10 ml measuring cylinder, measure 5 cm^1 of solution **D** and add it to the beaker containing solution **C.** Shake the mixture.
7. Pour the contents of test - tube number 1 to the mixture in the beaker and immediately start a stop watch. Swirl the contents of the beaker. Record the time taken for a **blue** colour to appear in **table** 2.
8. Repeat steps 5 to 7 using the contents of test - tube numbers 2, 3,4, 5 and 6.

9. Complete **table** 2 by computing Rate = $\frac{1}{\text{time}}(s^{-1})$

Table 2

Test - tube number	1	2	3	4	5	6
Volume of distilled water (cm^3)	0	2	3	5	6	7
Volume of solution **A** (cm^3)	10	8	7	5	4	3
Time (seconds)						
Rate = $\frac{1}{\text{time}}(s^{-1})$						

(6 marks)

a) Plot a graph of rate (y-axis) against volume of solution A. (3marks)

b) What time would be taken for the blue colour to appear if the experiment was repeated using 4cm^3 of distilled water and 6cm^3 of solution A? (2marks)

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

(a) Place all of solid E in a boiling tube. Add about 20 cm^1 of distilled water and shake until all the solid dissolves, label the solution as solution E. Use solution E for experiments (i) and (ii).

(i) To 2 cm^3 of solution E, in a test - tube in each of experiments I, II, III and IV, add:

I. two drops of aqueous sodium sulphate;

Observations	**Inferences**
(1 mark)	(1 mark)

II. five drops of aqueous sodium chloride;

Observations	**Inferences**
(1 mark)	(1 mark)

III. two drops of barium nitrate:

Observations	**Inferences**
(1 mark)	(1 mark)

IV. two drops of lead (II) nitrate:.

Observations	**Inferences**

(1 mark)	(1 mark)

(ii) To 2 cm^3 of solution E, in a test - tube, add 5 drops of aqueous sodium hydroxide. Add the piece of aluminium foil provided to the mixture and shake. Warm the mixture and test any gas produced with both blue and red litmus papers.

Observations	**Inferences**
(2 marks)	(1 mark)

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

(a) Place all of solid **F** in a boiling tube. Add about 20 cm^3 of distilled water and shake until all the solid dissolves. Label the solution as solution **F.** Add about half of the solid sodium hydrogen carbonate provided to 2 cm^3 of solution **F.**

Observations	**Inferences**
(1 mark)	(1 mark)

Add about 10 cm^3 of dilute hydrochloric acid to the rest of solution **F** in the boiling tube. Filter the mixture. Wash the residue with about 2 cm^3 of distilled water. Dry the residue between filter papers. Place about one third of the dry residue on a **metallic** spatula and burn it in a Bunsen burner flame.

Observations	**Inferences**

(1 mark)	(1 mark)

(ii) Place all the remaining residue into a boiling tube. Add about 10 cm^3 of distilled water and shake thoroughly. **Retain the mixture for the tests in** (C).

Observations	**Inferences**
($^1/_2$ mark)	($^1/_2$ mark)

Divide the mixture into two portions:

(i) to the first portion, add the rest of the solid sodium hydrogen carbonate.

Observations	**Inferences**
(1 mark)	(1 mark)

ii) to the second portion, add two drops of bromine water.

Observations	**Inferences**

(1 mark)	(1 mark)