NAME_____ADM NO_____ CLASS_____

MARANDA HIGH SCHOOL

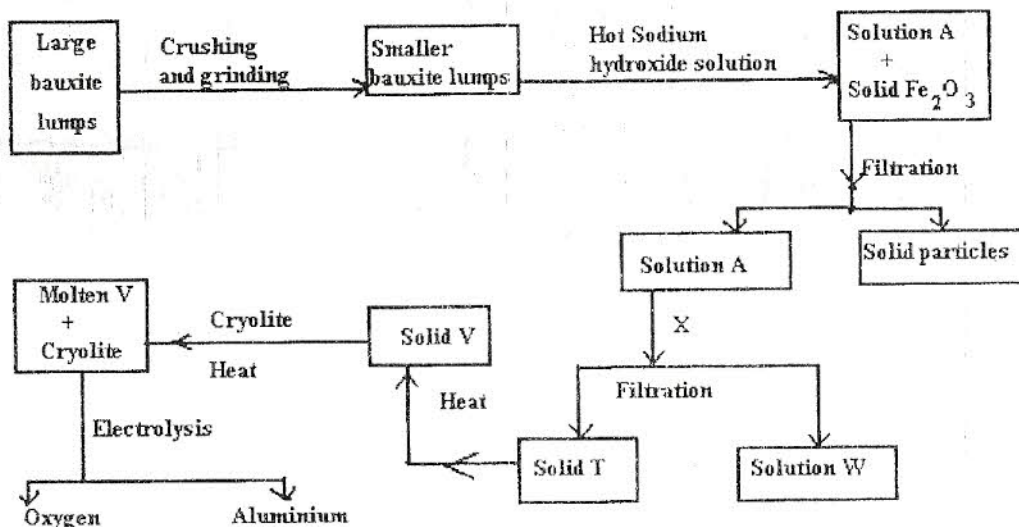**2013 MOCK EXAMINATIONS**

CHEMISTRY THEORY 233/2

PAPER 2

TIME: 2HOURS

*Answer **all** the questions in the spaces provided.*

1. The flow diagram below shows the processes of purification of an aluminium ore and extraction of aluminium from it.

a. State why bauxite is first crushed and ground into smaller particles? (½mk)

_____

b. Only aluminium oxide and silicon (IV) oxide dissolves chemically in the hot concentrated sodium hydroxide to form solution A, Iron (III) oxide does not.
   What property make aluminium oxide and silicon (IV) oxide react with sodium hydroxide solution?

   I   Silicon (IV) oxide_____ (1mk)

   II   Aluminium oxide_____ (1mk)

c. Write ionic equation for the reaction between sodium hydroxide solution and

   I   Silicon (IV) oxide_____ (1mk)

   II   Aluminium oxide_____ (1mk)

d. I. Identify solid T_____ (1mk)

   II Name substance X that could be used to precipitate out solid T from solution Q. (1mk)

   _____

III Write equation for the formation of solid from solid T (1mk)

_____

e. Why is cryolite added to substance? (½mk)

_____

f. Write half equation for the formation of aluminium at the cathode during electrolysis (1mk)

_____

g. Give one advantage of locating aluminium extraction plant near the

I. Source of hydroelectricity_____

_____(1mk)

II. Aluminium deposits or sea port._____(1mk)

h. Explain why an alloy of aluminium, instead of aluminium is used in overhead electric power cables. (1mk)

_____

i. State why the ore for extracting aluminium is known as bauxite and not aluminium oxide (1mk)

_____

2. Study the reaction scheme below and answer the questions that follow.
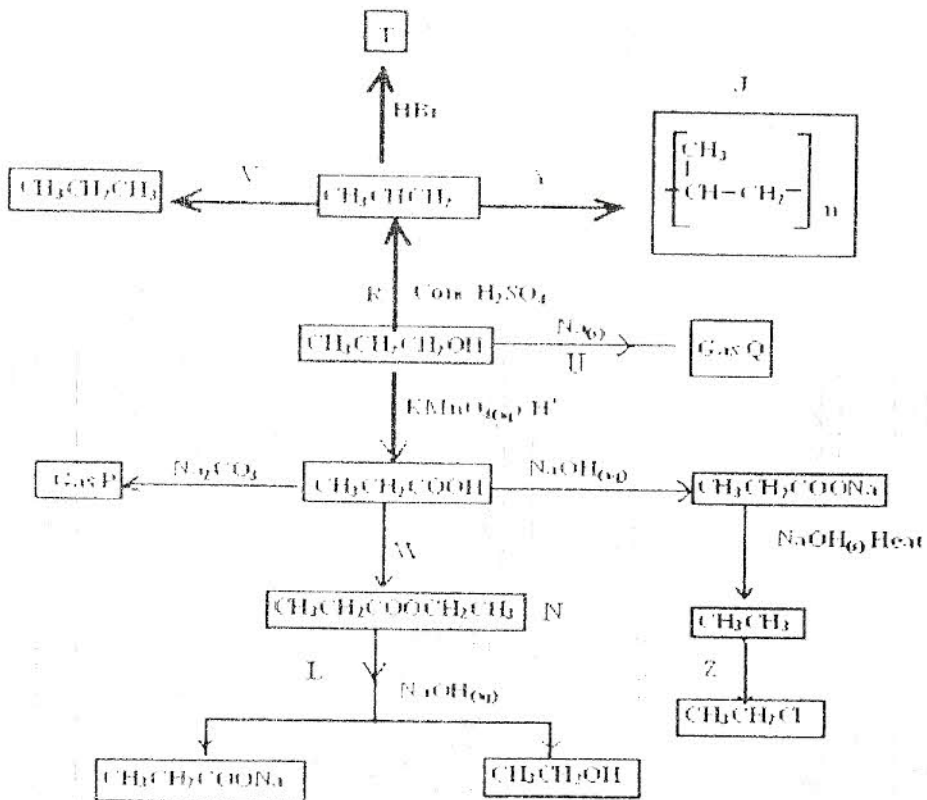
a. Name I gas P_____

II gas Q_____

2

III   Substance J _____ (1½mks)

b. Give the most probable structural formula of product T   (1mk)

_____

_____

_____

_____

c. I. Name reaction producing substance labeled N   (1mk)

_____

II.   State the characteristic property of N   (1mk)

_____

d. Complete the table below.

Reaction	Reagents	Condition
W		
Z		
V		

(3mks)

e. I. Name the organic product of reaction U   (½mk)

_____

II Write the equation for the reaction represented by U   (1mk)

_____

f. What is the specific name of process Y?   (½mk)

_____

g. What is the type of reaction represented by Z?   (½mk)

_____

h. Give two reasons why ethanoic acid has a higher melting point than ethanol when both of them have two   (2mks)

carbon atoms.

_____

_____

3. i. The following table gives the standard electrode potential for a number of half reactions.

Half equation	$E^\ominus$/volts
$Zn^{2+}_{(aq)} + 2e^- \longrightarrow Zn_{(s)}$	-0.76
$Fe^{2+}_{(aq)} + 2e^- \longrightarrow Fe_{(s)}$	-0.44
$I_{2(l)} + 2e^- \longrightarrow 2I^-_{(aq)}$	+0.54
$Fe^{3+}_{(aq)} + e^- \longrightarrow Fe^{2+}_{(aq)}$	+0.77
$Ce^{4+}_{(aq)} + e^- \longrightarrow Ce^{3+}_{(aq)}$	+1.61

a) Which half equation is used as the standard for the electrode potentials? (1mk)

_____

b) From the table identify:

i. Strongest oxidizing agent_____(½mk)

ii. Strongest reducing agent_____(½mk)

(c) identify two substances from the table which could be used to convert iodide ions to iodine. (1mks)

_____

d. A half cell (I)is constructed by putting platinum electrode in a solution of 1M with respect to Fe^{2+} and Fe^{3+} ions. The half cell is then connected to another half cell (II) with Fe^{2+} ions.

i. What is the e.m.f of this cell (1mk)

_____

ii. Write equation for reactions taking place in each cell. (2mks)

(I) _____

(II) _____

iii. In which direction do electrons flow in the circuit? (½mk)

_____

II. When copper (II) sulphate solution is electrolysed using platinum electrodes, the equation for the overall changes can be written as:

$$2CuSO_{4(aq)} + 2H_2O_{(l)} \longrightarrow 2Cu_{(s)} + O_{2(g)} + 2H_2SO_{4(aq)}$$

a) State the observation made at

i. Anode_____(½mk)

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ii. Cathode_____ (½mk)

iii. In the solution_____ (½mk)

b) Write ionic half equation for the reaction occurring at the anode. (1mk)

_____

c) During electrolysis, 1.27g of copper is produced. Calculate

i. The volume of oxygen, measured at room temperature that would be produced in the same time.

(Cu=63.5, MGV= 24dm^3, IF= 96 (2mks)

_____

_____

_____

_____

ii. The time for which a current of 0.5A would be maintained to form these products. (1mk)

_____

_____

_____

4. I. The diagram below summarizes the results of a series of chemical reactions.
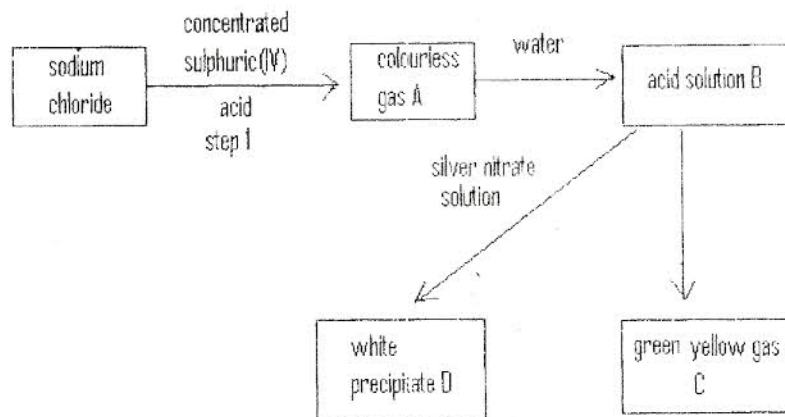
a) Name: A_____ (2mks)

      B_____

      C_____

      D_____

b) What reagent would you use to convert B into C? (1mk)

_____

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c) Write equation for the reaction in step 1 (1mk)

_____

d) Chlorine is used as bleaching agent. Name another substance that must be present for bleaching to occur.

_____ (½mk)

e) Give one other use of chlorine (1mk)

_____

f) Explain the observation made when white precipitate D is exposed to sunlight. (2mks)

_____

_____

II One stage in the manufacture of nitric acid involves the oxidation of ammonia by the reaction:

$$4NH_{3(g)} + 5O_{2(g)} \longrightarrow 4NO_{(g)} + 6H_2O_{(l)}$$

a. State one condition under which this reaction is carried out. (1mk)

_____

_____

b. Below is equation for the Haber process for the manufacture of ammonia.

$$3H_{2(g)} + N_{2(g)} \underset{500\ C}{\overset{o}{\rightleftharpoons}} 2NH_{3(g)} \quad \Delta H = -92\ kJ$$
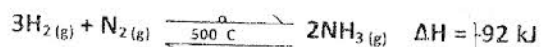
i. Name one material which is available in large scale and can be used as a source of hydrogen for this

process. _____ (1mk)

ii. Give one reason why the reaction of nitrogen with hydrogen cannot be used to produce ammonia at

room temperature and pressure. (1mk)

_____

iii. To maintain a constant temperature, the bed of catalyst particles must be cooled. Why would the

temperature of the catalyst rise if it were not cooled? (½mk)

_____

iv. The iron catalyst used is fed in form of Fe_3O_4, but this is converted to minute crystals of iron when it

is exposed to the hot mixture of nitrogen and hydrogen gases. Write an equation for the reaction

which converts the iron oxide to iron. (1mk)

_____

v. Suggest one disadvantage of using pure ammonia as fertilizer. (1mk)

_____

5. I. The equation below is for the manufacture of ethanol by direct hydration of ethane.

$$H_2O_{(g)} + C_2H_{4(g)} \longrightarrow C_2H_5OH_{(g)} \quad H = -46kJmol-1$$

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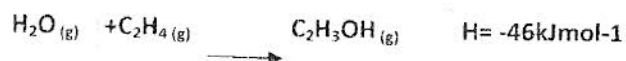
a) State the effect an increased in pressure will have on the equilibrium yield of ethanol and give a reason for your answer. (2mks)

_____

b) At high pressure, addition polymerization of one of the compounds in the reaction mixture may occur. Give the name of the polymer produced and structure of the repeating unit. (2mks)

_____

_____

II. In an experiment, excess solid calcium carbonate was added to $100cm^3$ of 0.2M hydrochloric acid at 20^oC. The volume of carbon (IV) oxide produced was measured at regular time interval. The results of the experiment are as shown in the table below.

Time (seconds)	0	10	20	30	40	50	60	70	80	90	100
Volume of carbon(IV)oxide(cm^3)	0	18	30	40	48	53	57	58	58	58	58

a) Draw a diagram of suitable apparatus for the experiment. (2mks)

_____

_____

_____

_____

b) On the grid provided plot of volume of CO_2 produced against time. (3mks)

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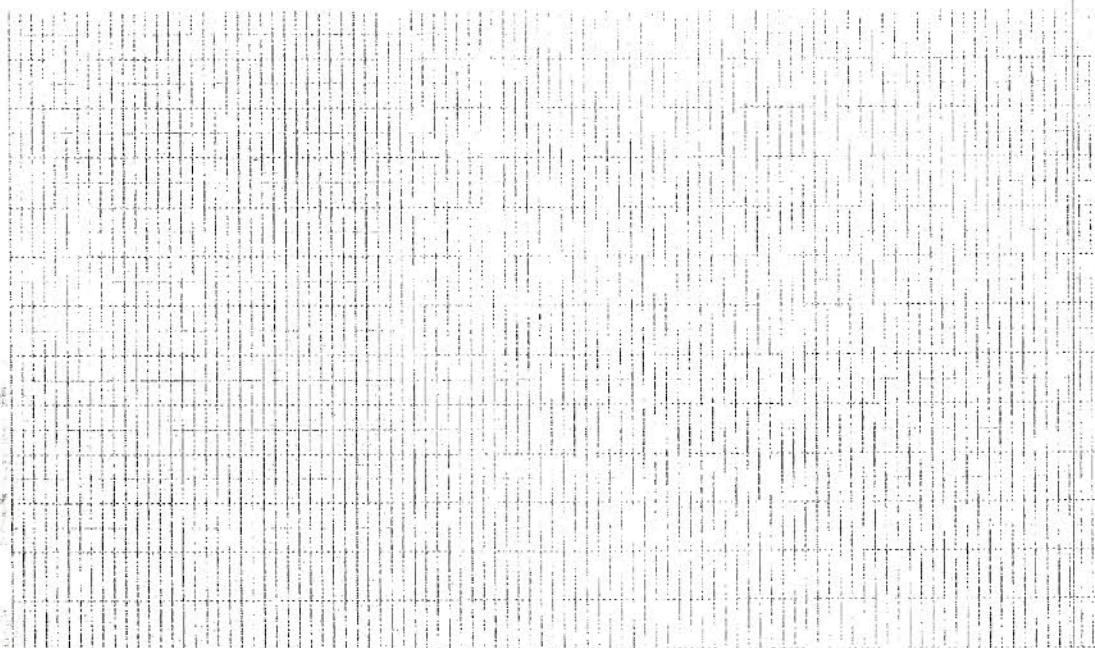
c) On the grid plot a graph you would expect if the acid was kept at 30°C. (1mk)

d) What is the rate of reaction if the volume of hydrogen per minute between 4th and 5th second (1mk)

_____

e) Other than raising the temperature state two ways by which the rate of reaction would be increased. (2mks)

_____

_____

6. Below is a section of the periodic table. Use it for the questions below.

A								
B	C						D	

a. In the grid, place

i. M in the space with the most reactive non metal. (1mk).

ii R in the space which could be occupied by an element capable of forming a covalent compound RD_3 (1mk)

b). Explain how the reducing power changes from A to B (2mks)

_____

_____

_____

c). How many protons are there in the atom of element C? _____ (1mk)

d. Element B reacts with water.

i. State two observations you would expect to make when a small piece of B is added to water. (2mks)

_____

_____

ii. Name the aqueous product formed in the above reaction and write chemical equation for the reaction. (2mks)

Product _____

Equation _____

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7. a. I. Aluminium chloride exists as a dimeric molecule Al_2Cl_6. Draw its dimeric structure. (2mks)

_____

_____

_____

_____

_____

II. State why aluminium chloride exist as a dimer. (1mk)

_____

b. The table below gives some properties of four substances. Use it to answer the questions that follow.

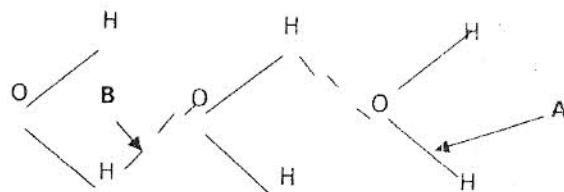| Substance	M.P. (°C)	B.P. (°C)	Electrical conductivity	
			Solid	Solid
V	1128	2657	Good	Good
X	-166	-95	Poor	Poor
Y	854	1790	Poor	Poor
Z	2230	3714	Poor	Poor

i. Which substance has

Giant atomic structure _____ (1mk)

Giant metallic structure _____ (1mk)

ii. The structure of water molecule can be represented as shown below.

Name the type of bonds represented by letters A _____ (½mk)

B _____ (½mk)

C Explain why sodium chloride conducts electricity when molten but not when solid. (2mks)

_____

_____

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