MARANDA HIGH SCHOOL

The Kenya Certificate of Secondary Education

PRE-MOCK FORM 4 TERM 1

233/2 **Chemistry (Theory)** **Paper 2**

March, 2024 **Time: 2 Hours**

Name: MARKING GUIDE: ..... Adm No: .....

Stream: ..... Signature: .....

233/2 Chemistry PP2 - Theory
Thursday, 26th , 2023
Evening
Time: 7.00-9.00Pm

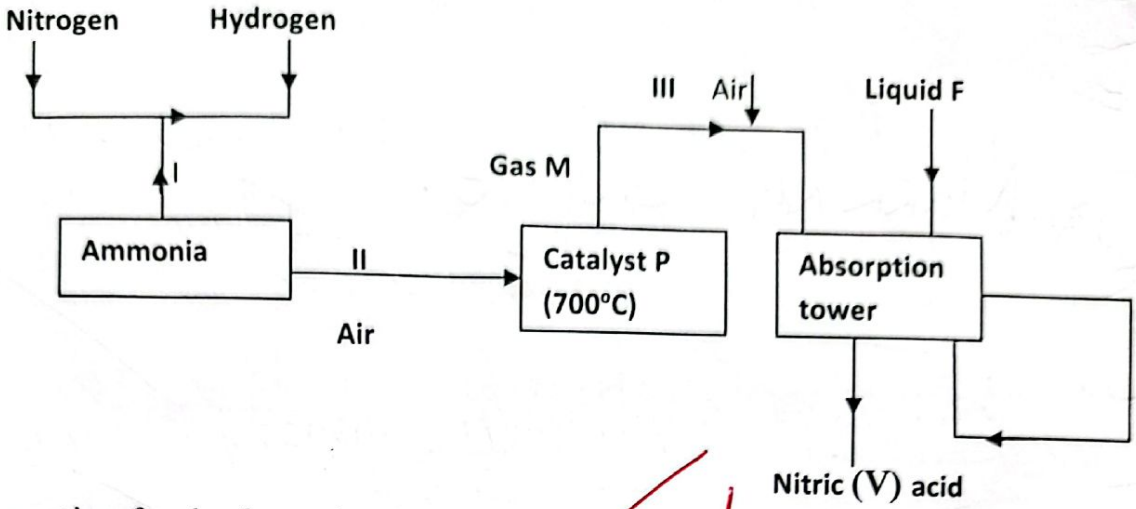
Instructions to candidates

(a)Write your Name, Stream, Admission Number and sign in the spaces provided above.
(b)Answer all the questions in the spaces provided in the question paper.
(c)KNEC mathematical tables and electronic calculators may be used for calculations.
(d)All workings MUST be clearly shown where necessary.
(e)This paper consists of 14 Printed pages. Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.
(g)Candidates should answer the questions in English.

FOR EXAMINERS USE ONLY

Questions	Maximum Score	Candidate's Score
1	9	
2	12	
3	12	
4	12	
5	12	
6	11	
7	10	
TOTAL	80	

1.Study the flow chart below and answer the questions which follow:



(a) (i) Write the equation for the formation in step I (1mark)

$N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$ 1

(ii) State two optimum conditions for the reaction in step I (1mark)

- Finely divided iron catalyst
- Temperature of 450 (400 – 500)
- Pressure of 2 or 3 atm (2-3 atm). Any 2 for 1mk. 1

(b) Identify gas M and catalyst P (1mark)

Gas M – Nitrogen (II) oxide / NO ½

Catalyst P – Platinum-Rhodium / Platinum / Nichrome. 1

(c) Write the equation for the reaction that occurs in step III (1mark)

$2NO(g) + O_2 \rightarrow 2NO_2$ 1

(a) (i) Identify liquid F (1mark)

Water 1

(a) (ii) Write the equation for the reaction that occurs in the absorption tower. (1mark)

$4NO_2(g) + 2H_2O(l) + O_2(g) \longrightarrow 4HNO_3(aq)$ 1

(e) (i) Name process IV (1mark)

Recycling 1

Mr. Alego

(ii) State the importance of process IV (1mark)

To prevent release poisonous gas into the atmosphere
To reduce the production cost / To make the process economical 1

(d) 60-65% Nitric (V) acid is produced in the absorption chamber. state how the acid can be concentrated (1mark)

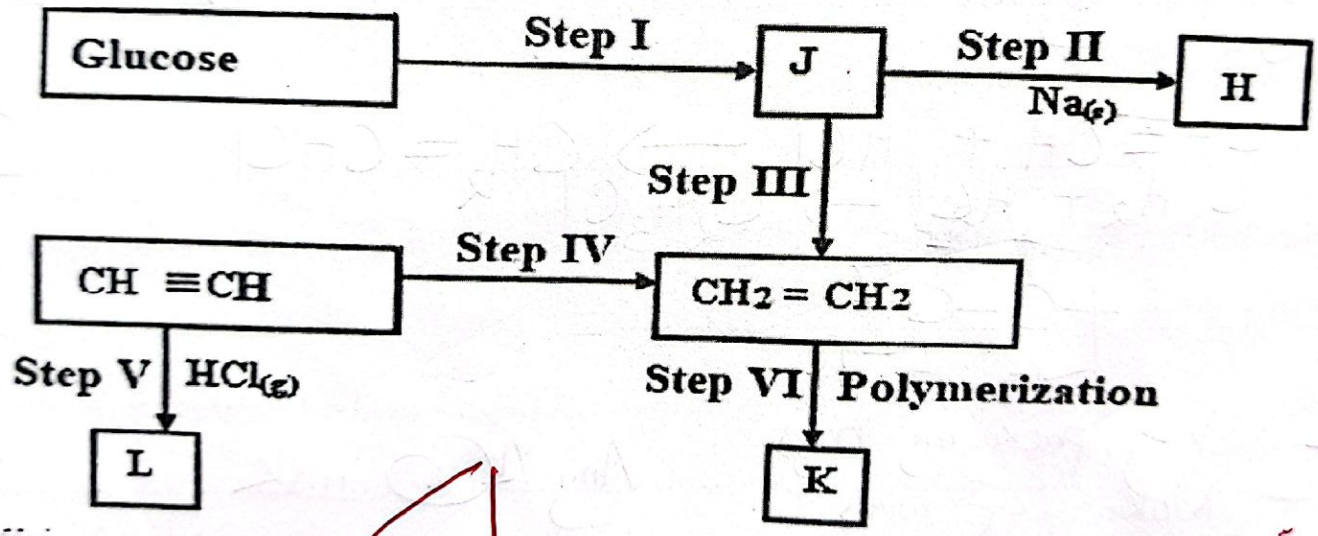
Carrying out Fractional distillation over phosphoric (V) acid 1

(f) State two uses of nitric(V)acid (1mark)

- Manufacture of Nitrogenous fertilizers
- Manufacture of dyes 1
- Etching design in some metals

Any 2 uses for 1mk

2. (a)Study the flow chart below and use it to answer the questions that follow.



(i)State the conditions for step I and step IV (2marks)

I ~~Yeast~~. 2

IV Nickel / palladium catalyst / Temperature of 180°C (150-250) rej Heat

(ii) Write an equation for the reaction in step II (1mark)

$2C_2H_5OH + 2Na \longrightarrow 2C_2H_5ONa + H_2$ 1

Edwin

06

(iii) I. Identify the process in step III (1mark)

Dehydration ✓ 1

II.Name the reagents and conditions necessary for the process named in(iii)I above (2marks) 2

Reagent: Concentrated Sulphuric (VI) acid ✓ 1

Condition: Heat / Temp of 180°c (150 - 200) ✓ 1

(iv)I. Identify process IV (1mark)

Addition hydrogenation / Hydrogenation 1

II.State one industrial application of the process named in (iv)I above (1mark)

Hardening of oils to fats in the manufacture of Margarine. 1

(V).Write an equation for step V (1mark)

$CH \equiv CH + HCl \longrightarrow CH_2 = CHCl$ 1

$C_2H_2 + HCl \rightarrow C_2H_3Cl$

(vi)I. Write the formula of substance K (1mark)

$\left[-CH_2-CH_2- \right]_n$ 1

II.State one use of substance K (1mark)

- Making packaging bags
- Making of ropes

Any 1 @ 1mk 1

(b) A compound whose structure is shown below is found in a detergent.

With reference to the structure, explain how the detergent removes grease during washing (3marks) 2marks

The non polar end dissolve in grease while the polar end dissolves into water. Agitation then takes place making grease to dislodge from the cloth when rinsing is done. 2

Hechuli / Malolo

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3.(a) The grid given below represents part of the periodic table. Study it and answer the questions that follow. *(The letters do not represent the actual symbols of elements)*

A								
C	D		E				B	
J	H						F	G

(a)Select two elements that form basic oxides (1mark)

C, J, D, H Any 2 @ 1mk 1

(b)(i) Write the equation of the reaction between element H and water (1mark)

$2H(s) + 2H_2O(l) \rightarrow H(OH)(aq) + H_2(g)$ 1

$Mg(s) + 2H_2O(l) \rightarrow Mg(OH)_2 + H_2(g)$

(ii) Compare the reactivity between element D and H with chlorine. Explain (2marks)

H is more reactive than D. H has a larger atomic radius; outermost electrons loosely held 2

(c) Compare the reactivity between elements B and F (2marks)

B is more reactive than F. B has a smaller atomic radius hence easily gains electron. 2

(d)Compare the melting points of elements

(i) D and E (2marks)

E has a higher m.p. E has more delocalised electrons hence stronger metallic bond. 2

Rose / Mag 08

(ii) C and J (2marks)

C has a higher m.p. C has a smaller atomic radius hence stronger metallic bond

(e) State one use of element G (1mark)

- Used in Flourescent tubes.
- Used in Arc welding. Any (a) mk.

4. (a) What is meant by molar heat of neutralization (1mark)

Enthalpy change that occurs when one mole of H^+ in an acid reacts with one mole of OH^- in a base to form one mole of water

(b) In an experiment to determine molar heat of neutralization ,50cm^{3}of 1M hydrochloric acid was neutralize by adding 10cm^3 portion of dilute sodium hydroxide. During an experiment the data in the table below was obtained.

Volume of sodium hydroxide(cm^3)	0	10	20	30	40	50	60
Temperature of mixture(^{0}C)	25.0	27.0	29.0	31.0	31.0	30.0	29.0

(i) Write the equation for the reaction in this experiment (1mark)

$NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$

Edwin/Jared

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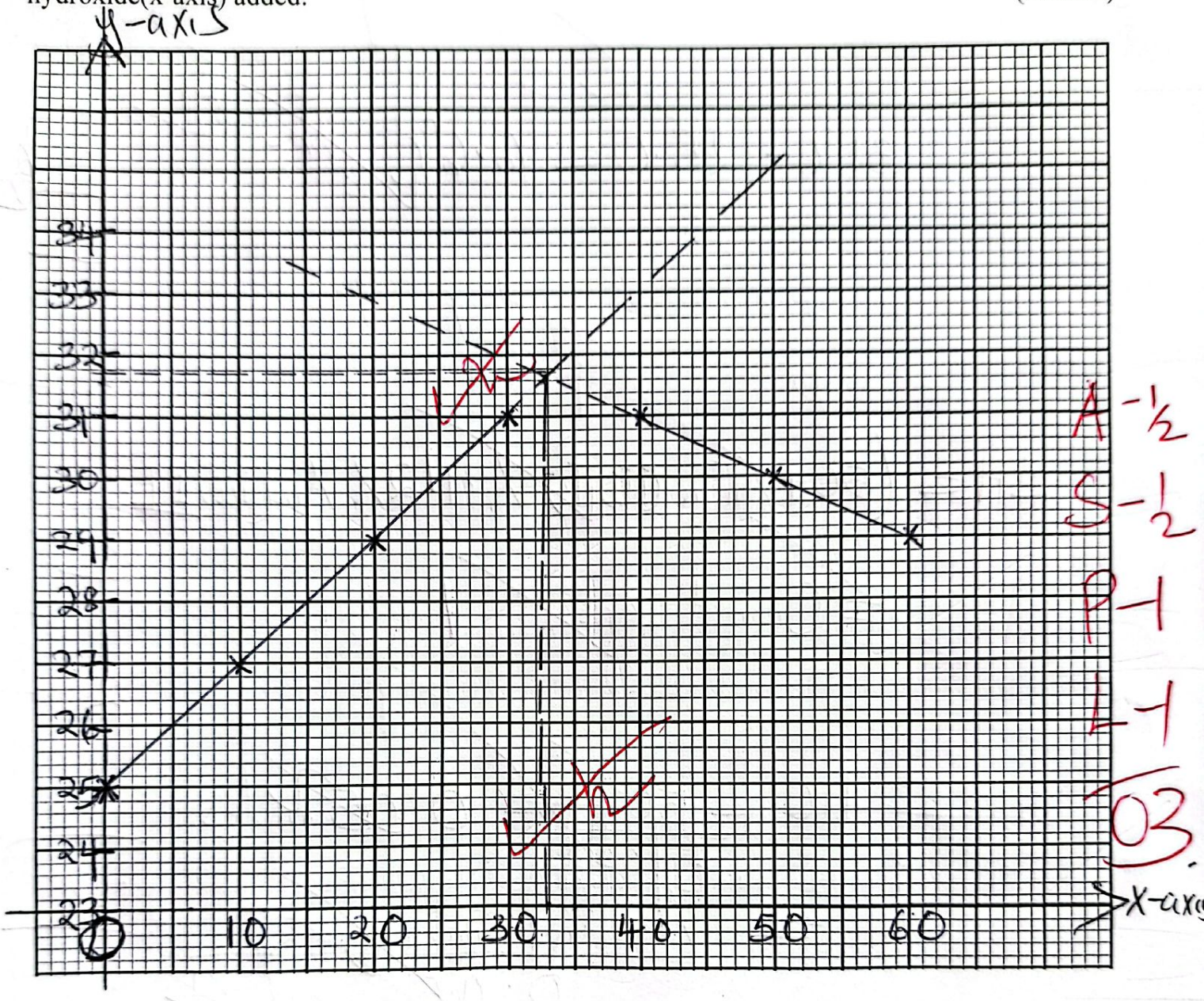
(ii) On the grid provided, plot a graph of temperature (Y-axis) against volume of sodium hydroxide(x-axis) added. (3marks)



A -½
S -½
P -1
L -1
03

(iii) Determine from the graph the:

I. Volume of sodium hydroxide which completely neutralizes $50cm^3$ of 1M hydrochloric acid

(1mark)

33.0°C ± 2 ✓ I

.....

Obonyo.

04

II.Change in temperature, ΔT when complete neutralization reaction (1mark)

31·6 − 25·0 = 6·6°C 1

(iv) Calculate:

I. The heat change , ΔH ,when complete neutralization occur

(Specific heat capacity=4.2J/g/K, density of solution of solution=1g/cm^3) (2marks)

ΔH = (50 + Ans in (iii) I) X 4·2 X Ans (iii) II

= Correct Ans 1 2

II.Molar heat of neutralization of hydrochloric with sodium hydroxide (1mark)

Moles of HCl = $\frac{50 \times 1}{1000}$ = 0·05 moles

= $\frac{\text{Ans in (iv) Taboye in kJ}}{0 \cdot 05}$ = Correct ans in kJ/mol 2

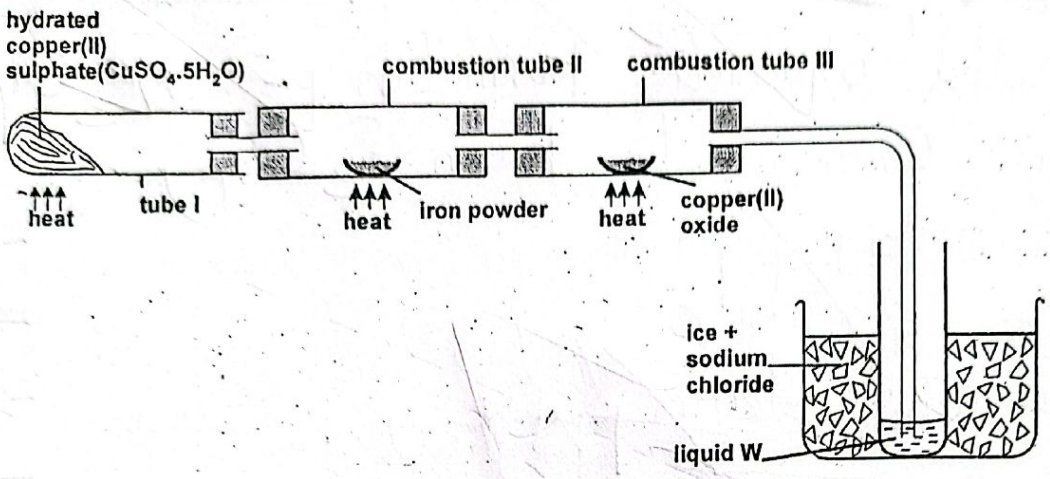
(v) How would the value of molar heat differ if 50cm^3 of 1M ethanoic acid was used instead of 1M hydrochloric acid? Give a reason (2marks)

Yes (The value would be lower). Some heat used to complete ionization of weaker ethanoic acid. 2

Joshua

07

5. The diagram below shows the apparatus for the preparation of gas A and investigate on its properties. Study it and answer the questions that follow.



a) (i) Name gas **A** (1 mark)

Hydrogen ✓ ref H_2 ✓ 1

(ii) Suggest the property of gas **A** under investigation. (1 mark)

Reducing ✓ ref Reduction ✓ 1

(iii) Write chemical equations for the reactions in the;

Boiling tube I (1 mark)

$CuSO_4.5H_2O(s) \xrightarrow{heat} CuSO_4(s) + 5H_2O(l)$ ✓ 1

Combustion tube II (1 mark)

$3Fe(s) + 4H_2O(g) \longrightarrow Fe_3O_4(s) + 4H_2(g)$ ✓ 1

b) (i) State and explain the observation made in

Tube I. (2 marks)

Blue hydrated copper (II) sulphate changes to white anhydrous copper (II) sulphate due to loss of ✓2 water of crystallization.

Malala

06

Combustion tube II

Brown solid observed. Formation of Fe_3O_4 (Grey iron changes to brown Fe_3O_4). (1mk) (2 marks)

c) (i) What is the use of hydrated copper (II) sulphate in the experiment. (1 mark)

To generate steam. 1

(ii) Name liquid W. (1 mark)

Water 1

(iii) What is the role of sodium chloride in the ice (freezing mixture) (1 mark)

Lowers the melting point of ice 1

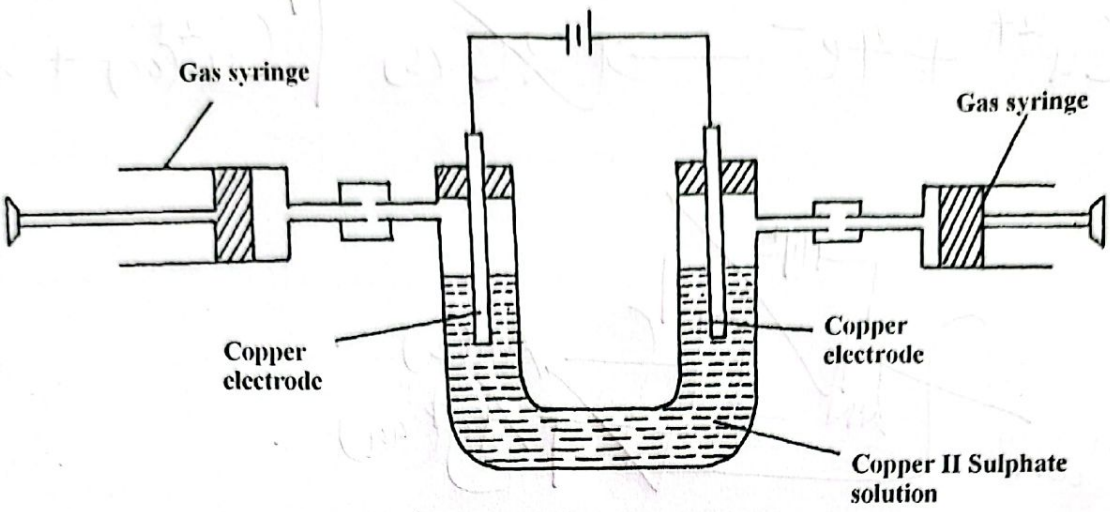
(iv) Explain why hydrogen gas has been replaced by helium in filling of aeroplane tyres. (1 mark)

~~Hydrogen is lighter/less dense~~ 1
Helium is inert/Hydrogen reacts explosively.

05

Jerry

6.Aqueous copper II sulphate was electrolysed using the set up represented by the diagram below



a) After sometimes it was found that no gas was produced at both electrodes. Explain. (1 mark)

Copper anode oxidized to Cu^{2+} and Cu^{2+} reduced at the cathode to Cu.

b)Write an equation for the reaction at each electrode.

(i) Anode $Cu(s) \rightarrow Cu^{2+}(aq) + 2e^-$ ✓1

(ii) Cathode $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ ✓1 (2marks)

c) What happens to the colour of the electrolyte during electrolysis. Explain (2marks)

Remains blue. Cu^{2+} discharged at the Cathode ✓ replaced through oxidation of Cu anode. ✓2

d) If in the above set up inert electrodes were used instead of copper electrodes; write equation at each electrode

Anode $4OH^- \rightarrow 2H_2O(l) + O_2(g) + 4e^-$ ✓ (1 mark)

SHARED by wechuli / Mutete

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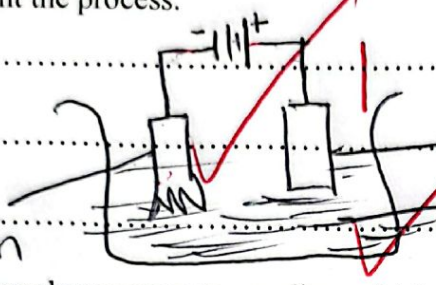
Cathode $2Cu^{2+} + 4e^- \rightarrow 2Cu(s)$ | $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ (1 mark) 1

e) An iron spoon is to be electroplated with silver. Draw a labeled diagram of the set-up that could be used to represent the process. (2marks)



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f)The table below shows ammeter readings obtained when different electrolytes of the same concentration were tested.

Electrolyte	Ammeter reading amps
Copper II sulphate solution	4.4
Ethanoic acid	1.2

g) Explain why ethanoic acid has a lower ammeter reading (2marks)

Ethanoic acid is a weaker; ionizes partially and has fewer mobile ions 2

7. (a) State Le Chatelier's principle (1 mark)

When a change in condition is applied to a system at equilibrium, equilibrium moves in a direction so as to oppose the change 1

(b) State and explain how a catalyst affect:

(i) Rate of reaction (2 marks)

Increases rate of reaction by lowering the activation energy 2

(ii) Yield of the product (1 mark)

No effect on the yield. 1

Rose

(c) One of the reaction in the manufacture of nitric (V) acid involves catalytic oxidation of ammonia as shown in the equation below.

$$4\,NH_{3(g)} + 5O_{2\,(g)} \rightleftharpoons 4NO_{(g)} + 6H_2O_{(g)} \; ; \; \Delta H = -909 \text{ kJ mol}^{-1}$$

The reaction is carried out at a pressure of 9 atmospheres and a temperature of 900 ^{0}C

(i) State and explain the effect on the position of equilibrium if the reaction is carried out:

I. At 9 atmospheres and 500 ^{0}C ; (2 marks)

Equilibrium shifts to the right: The forward reaction is exothermic, decrease in temperature favours forward reaction. 2

II. At 900 ^{0}C and 15 atmospheres pressure; (2 marks)

Equilibrium shifts to the left / Pressure increase favours a reaction towards the side with fewer gaseous molecules. 2

(d) State and explain the effect on the rate of the reaction if the reaction is carried out at 9 atmosphere and 450 ^{0}C (2 marks)

The rate of reaction will decrease/reduce. Temperature decrease reduces K.E. this reduces collision between particles thus reducing rate of reaction. 2

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Joshua.