

JUNE

2023

KASSU PP2 - MARKING SCHEME

Name ..... ADM..... Class.....

School..... Date.....

233/2  
**CHEMISTRY**  
 Paper 2  
**THEORY**  
 June 2023  
 2 hours

**KASSU EXAMINATIONS**  
 Kenya Certificate of Secondary Education  
**CHEMISTRY**  
**Paper 2**  
**THEORY**  
 2 hours

**Instructions**

- Write your name, Index number and class in the spaces provided above.
- Answer **ALL** the questions in the spaces provided.
- Mathematical tables and silent electronic calculators may be used.
- All working **MUST** be clearly shown where necessary.

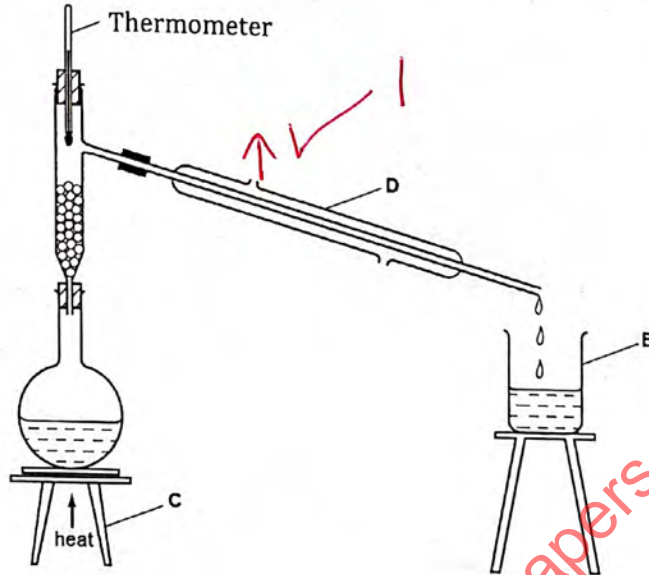
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Question	Maximum Score	Candidate's Score
1	10	10 ✓
2	<del>13</del> 12	12 ✓
3	<del>12</del> 10/4	<del>10/4</del> xx
4	<del>14</del> 13	13
5	<del>10</del> 10	10
6	10	10
7	11	11
<b>Total</b>	<b>80</b>	

This question paper has 13 printed pages.  
 Confirm that all the pages are printed as indicated and  
 No questions are missing.

80/80  
 80/80

1. The diagram below was used to separate a mixture of liquid W (b.p = 110 °C) and liquid Z (b.p = 88 °C).



- (a) Name the apparatus labelled B and C

(2 marks)

B - Beaker ✓  
C - Tripod stand ✓

(2)

- (b) Using an arrow, indicate on the diagram where the water leaves apparatus D

(1 mark)

on the diagram

- (c) Which liquid was collected in apparatus B first? Give a reason for your answer.

(2 marks)

Liquid Z ✓ His low Boiling point ✓

(02)

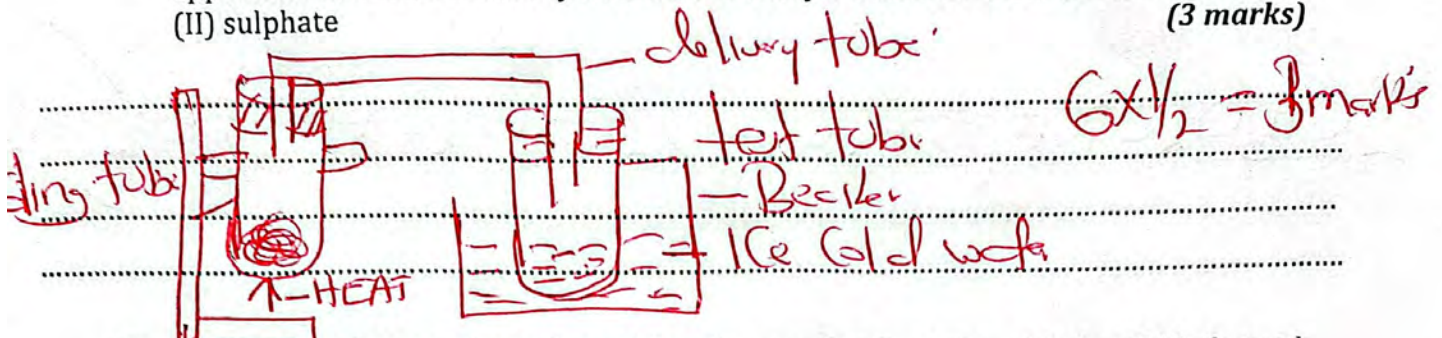
- (d) State the role of fractionating column in this experiment

(1 mark)

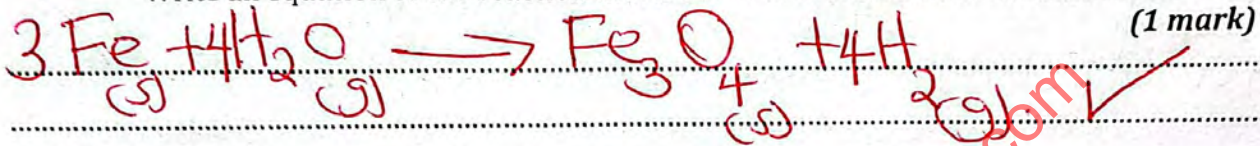
Allow vapor of liquid whose Boiling point has not been reached to flow back into the flask after condensing ✓



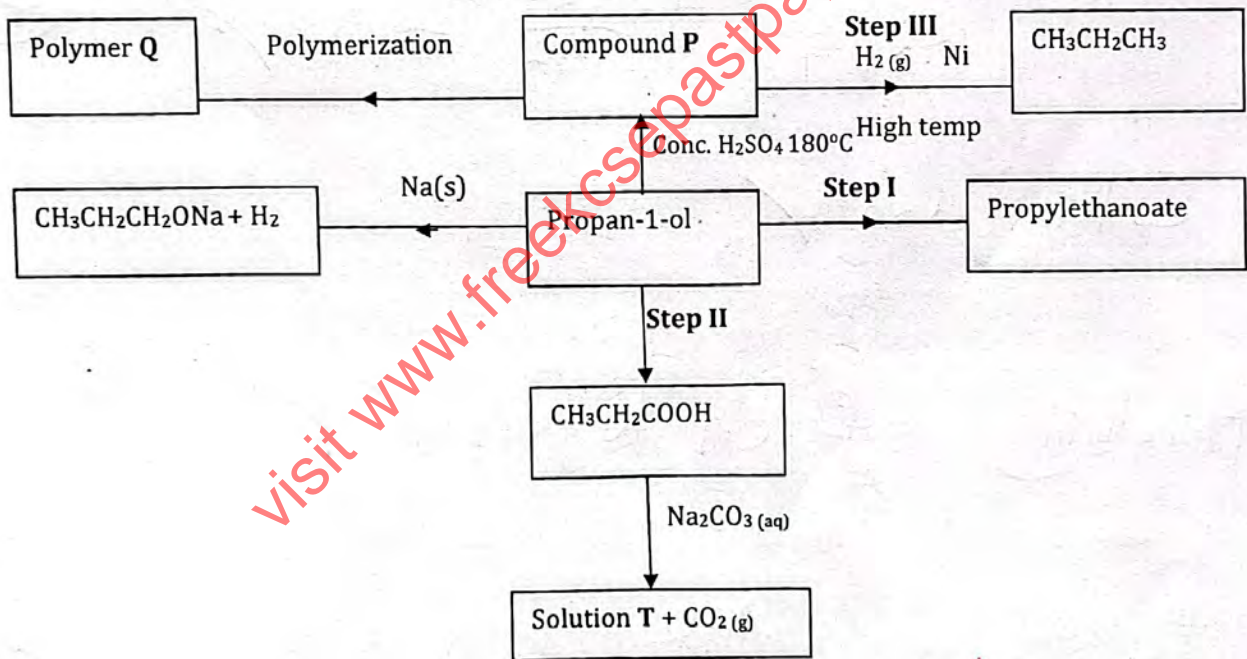
- (e) You are provided with a boiling tube, test tube, beaker, delivery tube, cork, ice cold water, stand & clamp, copper (II) sulphate crystals and source of heat. Draw a setup of apparatus that can be used by a student to study the effect of heat on hydrated Copper (II) sulphate (3 marks)



- (f) When steam is passed over heated iron in a combustion tube, a black solid is formed. Write an equation of the reaction that leads to the formation of the black solid (1 mark)



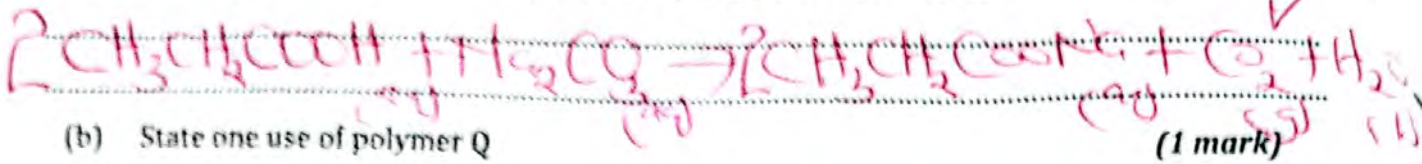
2. Study the scheme given below and answer the questions that follow:-



- (a) (i) Name compound P and solution T (2 marks)  
 Compound P: Propene ✓  
 Solution T: Sodium Propoate ✓



(ii) Write an equation for the reaction between  $\text{CH}_3\text{CH}_2\text{COOH}$  and  $\text{Na}_2\text{CO}_3$  (1 mark)



(b) State one use of polymer Q (1 mark)

(c) Name one oxidizing agent that can be used in step II (1 mark)

Aqueous Potassium manganate(VII)  
Aqueous Potassium dichromate(VI)

(d) A sample of polymer Q is found to have a molecular mass of 4200. Determine the number of monomers in the polymer (H = 1, C = 12) (2 marks)

$3\text{H}_6$   $12 \times 3 + 1 \times 6 = 42$   
 $n = \frac{4200}{42} = 100$

(e) Name the type of reaction in step I (1 mark)

Esterification

(f) State one industrial application of step III (1 mark)

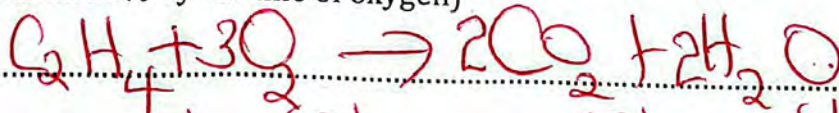
Hardening of oil to fats

(g) State how burning can be used to distinguish between propane and propyne. Explain your answer (2 marks)

Propane is in Alkane burn with blue flame  
Propyne is in Alkyne burn with yellow sooty flame  
N/B Tired



- (h)  $1000\text{cm}^3$  of ethene ( $\text{C}_2\text{H}_4$ ) burnt in oxygen to produce Carbon (II) Oxide and water vapour. Calculate the minimum volume of air needed for the complete combustion of ethene (Air contains 20% by volume of oxygen) (2 marks)



$1 \text{ (g)} \quad 3 \text{ (g)} \quad 2 \text{ (g)} \quad 2 \text{ (l)}$  ✓  
 $1 \rightarrow 1000 \text{ cm}^3$  | If 20%  $\rightarrow 3000$  ✓  
 $3 \rightarrow 3000 \text{ cm}^3$  | 100%  $\times 3000$  ✓  $15000 \text{ cm}^3$  ✓

3. I. (a) Sulphur exhibits allotropy. What is transition temperature? (1 mark)

Temperature at which one Allotrope changes to the other ✓

- (b) Briefly describe how an allotrope of Sulphur stable below  $96^\circ\text{C}$  can be prepared. (2 marks)

Sulphur is heated in a boiling tube containing Carbon (IV) sulphide. Filter paper is placed with filter paper. Rhombic sulphur is separated slowly to obtain Rhombic sulphur. ✓

- (c) Sulphur is used during vulcanization of rubber. State the role of Sulphur in vulcanization of rubber. (1 mark)

Making Rubber harder and stronger ✓

- (d) Explain why old newspapers turn brown after sometime. (1 mark)

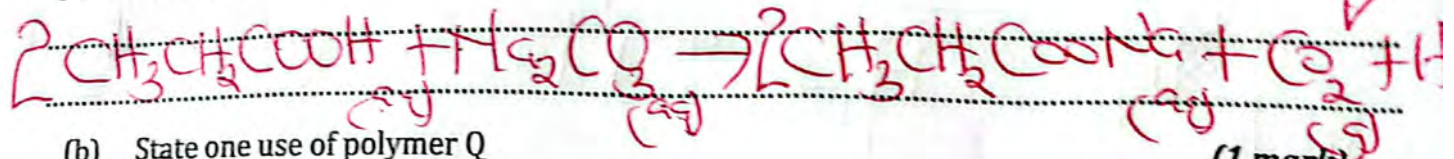
Due to oxidation ✓

- (e) State the observation made when Sulphur (IV) oxide gas is bubbled into a solution of acidified potassium dichromate (VI) in a boiling tube. (1 mark)

Acidified Potassium ~~hexa~~ dichromate (VI) changes from Orange to green ✓



(ii) Write an equation for the reaction between  $\text{CH}_3\text{CH}_2\text{COOH}$  and  $\text{Na}_2\text{CO}_3$  (1 mark)



(b) State one use of polymer Q (1 mark)

(c) Name one oxidizing agent that can be used in step II (1 mark)

Acidified Potassium manganate(VII)  
Acidified Potassium dichromate(VI) Any 1 ✓

(d) A sample of polymer Q is found to have a molecular mass of 4200. Determine the number of monomers in the polymer (H = 1, C = 12) (2 marks)

$3\text{H}_6$   $12 \times 3 + 1 \times 6 = 42$   $n = \frac{4200}{42} = 100$  (2)

(e) Name the type of reaction in step I (1 mark)

Esterification ✓

(f) State one industrial application of step III (1 mark)

Hardening of oil to fats ✓

(g) State how burning can be used to distinguish between propane and propyne. Explain your answer (2 marks)

Propane is in Alkane burn with blue flame ✓  
Propyne is in Alkyne burn with yellow sooty flame ✓  
N/B Tied

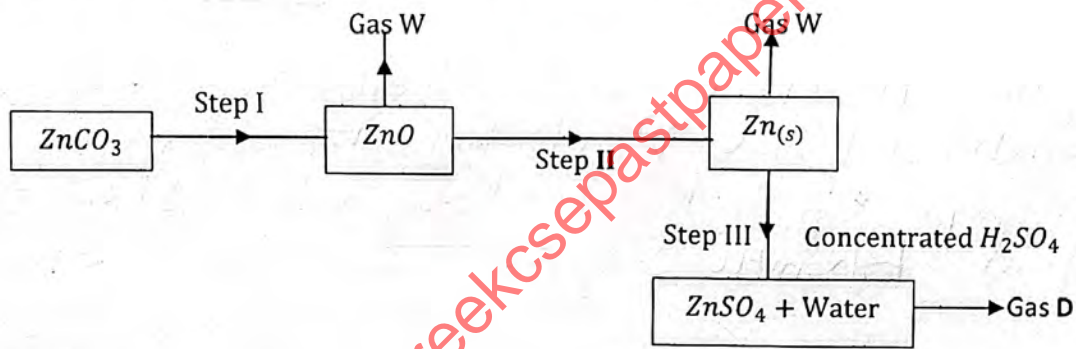


II. A rock was found in one of the valleys at Kilongolo. The rock was suspected to contain high percentage of zinc metal.

(a) Explain how you could confirm that the rock contains zinc metal. (3 marks)

Take small portion of the rock and grind into fine powder, add HNO<sub>3</sub> acid followed by Ammonium hydroxide solution. All is EXG, white precipitate forms in EXG.

(b) Study the flow chart below and answer the following questions



(i) State the condition necessary for the reaction in step I to occur.

Heat

(1 mark)

(ii) Name (a) Gas W -

Carbon (IV) oxide

(1 mark)

(b) Gas D -

Sulphur (IV) oxide

(1 mark)







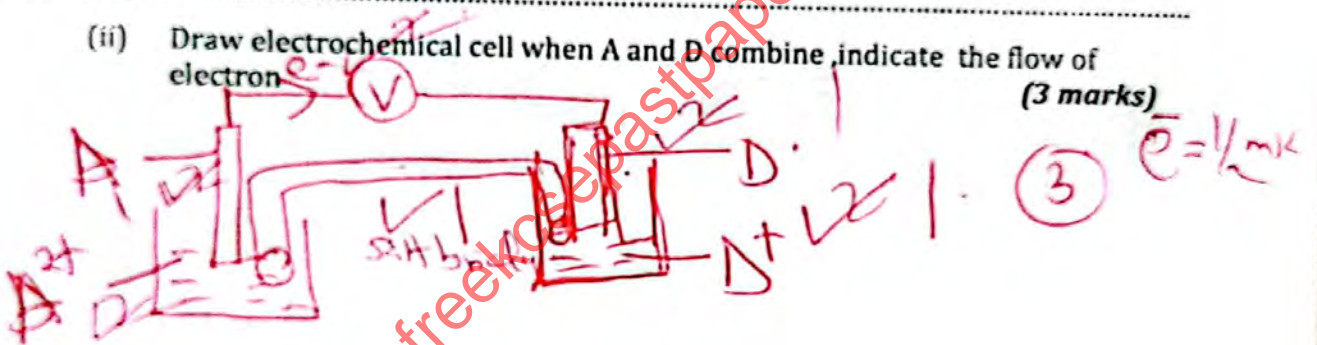
(c) The following are standard reduction potentials for some metals. The letters do not represent the actual elements.

	$E^\ominus$ (volts)
$A^{2+}_{(aq)} + 2e^- \rightarrow A_{(s)}$	-2.93
$B^{2+}_{(aq)} + 2e^- \rightarrow B_{(s)}$	-2.38
$C^{2+}_{(aq)} + 2e^- \rightarrow C_{(s)}$	+0.34
$D^{+}_{(aq)} + 2e^- \rightarrow D_{(s)}$	+2.87
$E^{2+}_{(aq)} + 2e^- \rightarrow E_{(s)}$	+1.44

(i) Which is the most reactive metal? Give a reason. (2 marks)

AV ✓ The most reactive metal is A ✓

(ii) Draw electrochemical cell when A and D combine, indicate the flow of electron. (3 marks)



(iii) Calculate the e.m.f of the cell in (ii) above. (2 marks)

$+2.87 - (-2.93) = +5.8V$  ✓

(iv) Explain if it is advisable to store a solution containing  $C^{2+}$  ions in a container made of D. (2 marks)

No ✓ D will displace C from its solution ✓



5. Define the following terms as used in radio activity

(2 marks)

i) nuclear fission

This is the splitting process of heavy nucleus material when hit by fast moving neutron ✓

ii) Nuclear fusion.

The combination of nuclei of high velocity resulting to formation of a heavy nucleus ✓

(II) Study the information below and use it to answer the question that follows.

Time (days)	Mass of Radio Isotope
0	800
4.1	400
8.2	200
16.4	100
24.3	50
32.4	25

(a) Plot a graph of mass of Isotope (y-axis) against time (days)

(3 marks)

Plotting - 1 (i) maximum penalty is  $\frac{1}{2}$

Curve - 1 (ii) No student should

Scale - 1 Score Zero in a graph unless inverted graph



(b) Use your graph to-

(i) Determine the half-life of the Radio Isotope

(1 mark)

8.1 days ✓ 01

(ii) The fraction of the original amount remains after 16.4 days

(1 mark)

Approximately "96-97-98" (96/100) / (98/100) Any / 100 ✓

(c) If the sample continues to decay, predict how long it will take to decay to Zero. (1 mark)

from graph - when the curve meets X-axis: Approximately 24.5 days ✓

(d) State one application of radioactivity in:

(2 marks)

i) History

Determining age of artefacts/fossils

ii) Medicine

(i) Destroying cancer tissue  
 (ii) Monitor growth in brain  
 Any

6. Study the ionization energies in Kilojoules per mole and answer the questions below.

Element	Ionization energies in kJ/mol					
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>
A	1590	2780	4700	6500	8100	12500
B	1010	1900	4900	5000	6300	7300
C	940	4800	6300	9180	12000	1600
D	1680	2010	3400	10900	12400	16500

(a) (i) What is meant by the term ionization energy

(1 mark)

Minimum energy required to remove an electron from atom/energy level in gaseous state ✓

(ii) Identify the group to which each element belongs to A, B, C, D

(1 mark)

group IV ✓



(iii) Write the formula of the oxide of D. (1 mark)

$D_4O_2$   $DO_2$  ✓ 1

(iv) What type of bond will be formed when C reacts with fluorine? Explain (2 marks)

Covalent bond ✓ Sharing of valence electrons between C and Fluorine ✓ 2

(b) The table below gives some physical properties of elements in the third period of the period table and their chlorides. The letters used are not actual symbols of the elements. Study the information and use it to answer the questions that follows.

Element	Melting Point	Boiling Point	Chloride Formula	Chloride M.P (°C)
H	98	883	HCl	801
I	649	1107	ICl <sub>2</sub>	714
J	660	2467	JCl <sub>3</sub>	190
K	1410	2355	KCl <sub>4</sub>	-70
L	44	280	LCl <sub>3</sub>	-161
M	119	443	MCl <sub>2</sub>	-78
N	-101	-38	-	-
O	-189	-186	No compound	-

(a) (i) Element K has a very high melting point. Explain why? (1 mark)

Strong covalent bonds with giant atomic structure ✓ 1

(iv) Explain why element O has a very low boiling point. (1 mark)

Due to weak Van-der Waals force of attraction ✓ 1

(v) Explain why O does not form a chloride (1 mark)

Has stable electronic configuration ✓ 1  
Can not gain or lose electrons ✓ 1

(b) Name the types of bonding and structure in the following chlorides (2 marks)

Chloride

ICl<sub>2</sub>

MCl<sub>2</sub>

Bonding type

ionic bond ✓  
Covalent bond ✓  
Coordinate/Dative ✓

Type of structure

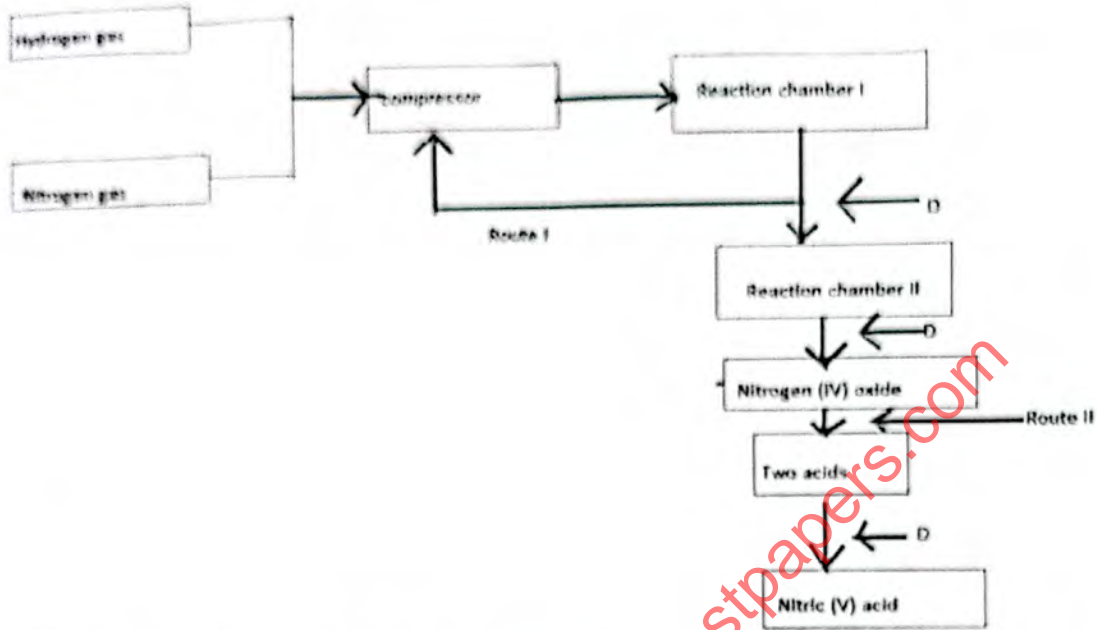
giant ionic ✓  
Simple molecular ✓

4x1/2

2



7. Study the flow chart below and answer the questions that follows



a) State one source of nitrogen (1 mark)

product of liquefied Air ✓

b) Name substances that goes through (2 marks)

i) Route I

Unreacted Nitrogen (IV) oxide ✓

ii) Route II

Katana ✓

c) Name gas D (1 mark)

Oxygen ✓ Best Air

d) Name the catalyst used in the reaction chamber ; (2 marks)

Chamber I

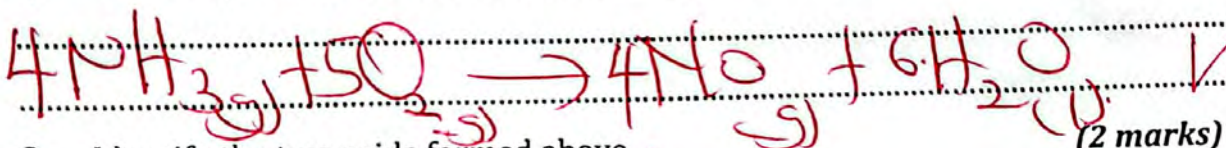
Platinum ✓  
finely divided Pt



Chamber II

Platinum ✓

e) Write equation for the reactions taking place in reaction chamber II (1 mark)



f) Identify the two acids formed above (2 marks)

Nitric (V) acid ✓ and Nitric (III) acid ✓

g) Write an equation for the reaction between one of the two acids above with reagent D (1 mark)



h) State one use of nitric (V) acid (1 mark)

(1) ✓

Any 1 ✓

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