kenyaeducators@gmail.com

CHEMISTRY KCSE PREDICTION 2021

Paper 1

FORM FOUR

Kenya Certificate of Secondary Education

233/1 CHEMISTRY (Theory)

PAPER ONE

TIME: 2HRS

INSTRUCTIONS TO CANDIDATES

1. Write your name and admission number in the spaces provided above
2. Sign and write the date of examination in the spaces provided
3. Electronic calculators may be used.
4. All working must be clearly shown where necessary

FOR EXAMINERS USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE SCORE
	81-280	

1. The table below shows pH values of solutions ABC and D

Solution	A	B	C	D
pH value	1	7	10	13

a) Give solution that is;

i) Acidic (1mk)

……

ii) Weak base (1mk)

……

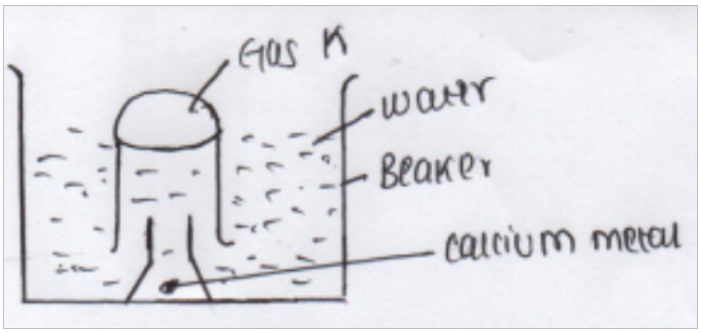
iii) Neutral (1mk)

……

b) Give the product formed when solution A react with a carbonate salt (1mk)

……

2. The set up below was used to collect gas K produced by the reaction between water and calcium metal



a) Name gas K (1mk)

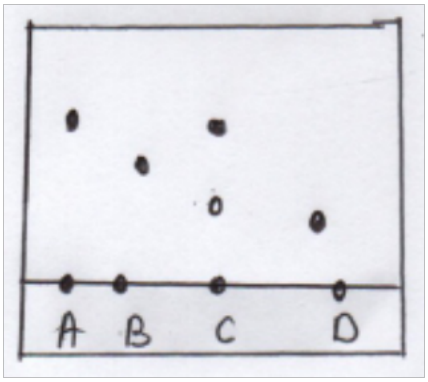
……

3. An organic compound P contains 64.9% carbon, 13.5 Hydrogen and the rest of the % is oxygen.

a) Determine empirical formula of the compound (3mks)

b) Determine the molecular formula given that the relative formula mass of P is 74 (1mk)

4. The diagram below shows spots of pure substances A, B and D on a chromatography paper. Spot C is that of the mixture.



a) On the diagram show the following

i) Baseline (½mk)

ii) Solvent front (½mk)

b) Which substances are present in C (2mks)

……

……

5. In a reaction $20cm^3$ of 0.1m sodium carbonate completely reacted with $13cm^3$ of dilute sulphuric (V) acid. Find h concentration of suphuric acid in moles per litres (3mks)

6. Using dots (·) and crosses (X) draw the structure of hydroxonium ion (H_3O^+) (2mks)

7. Study the information below and answer the questions that follows. Letters do not represent the actual symbol of element.

Element	Atomic No	Ionization energy kJmol

P	4	1800
Q	12	1450
R	20	1150

a) What is the general name given to the group in which element P, Q and R belong? (1mk)

……

b) Explain why P has highest ionization energy (2mks)

……

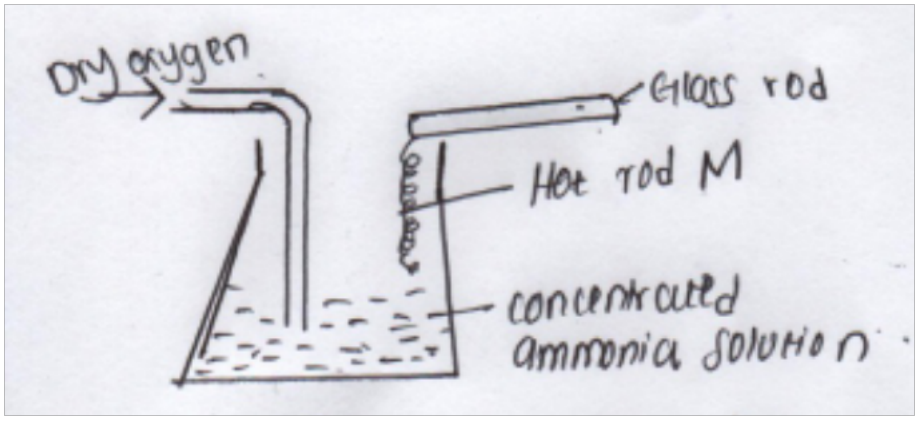
……

……

c) Write a balanced chemical equation for the reaction between element Q and water (1mk)

……

8. The diagram below shows catalytic oxidation of ammonia gas. Use it to answer the questions that follows.



a) Name metal M (1mk)

……

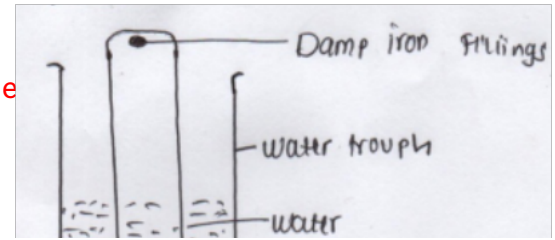
b) State and explain two observations made inside the flask (2mks)

……

……

……

9. In an experiment a gas jar containing some damp iron fillings was inverted in a trough containing some water and the set up was left for 3 days.



a) Why was iron fillings moistened (1mk)

……

b) State and explain observation made after 3 days
(2mks)

……

……

……

10. a) Distinguish between hygroscopy and efflorescence (2mks)

……

……

……

b) Starting with lead (II) oxide, describe how you would prepare lead (II) sulphute (3mks)

……

……

……

……

11. a) Define the term isotope (1mk)

……

……

b) Chlorine gas has a mass of 35.5. It is made up of two isotope $^{35}_{17}Cl$ and $^{37}_{17}Cl$. Determine the relative abundance of each isotope in the chlorine gas.
(2mks)

12. Explain the reason why Aluminium is used for making utensils like sufuria (1mk)

……

……

13. Describe a chemical test to differentiate between carbon (IV) oxide and carbon (II) oxide gas
(2mks)

……

……

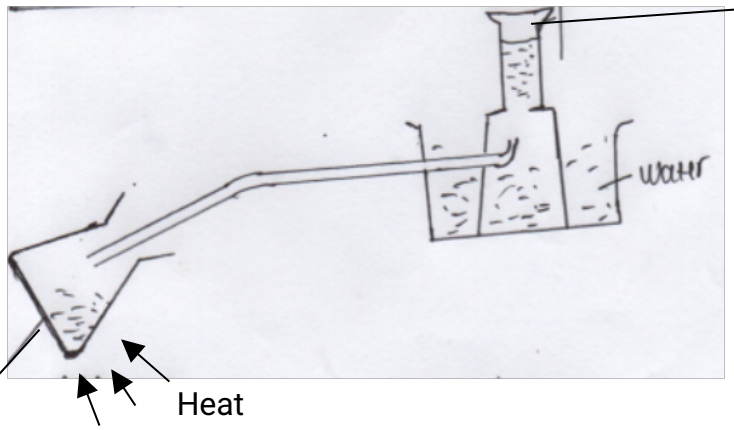
……

14. i) State Graham's law of diffusion (1mk)

……

ii) 120cm^3 of methane gas takes 30 seconds to diffuse through a certain membrane. Determine the rate of diffusion of surphure (IV) oxide gas through the same membrane (C=12, H=1, S=32, O=16) (3mks)

15. Study the set up below and answer the questions that follow



Sodium ethanoate +calcium oxide +solid K

i) Name gas Q (1mk)

……

ii) Identify solid K (1mk)

……

iii) What is the purpose of calcium oxide in the experiment (1mk)

……

……

16. Both ions Y^{2-} and Z^{2+} have an electron configuration of 2.8.8

a) Write the electron arrangement for:

Y ……. (½mk)

Z ……. (½mk)

b) What is the mass number of atom Z given that it has 20 neutrons (1mk)

17. Magnesium ribbon was burnt in air;

a) State the observation made

(1mk)

……

……

b) Write the equations for the reaction (2mks)

……

18. a) Distinguish between a weak acid and a dilute acid

(2mks)

……

……

……

b) Giving a reason, identify an acid in the reverse reaction below (2mks)

$H_3O^+_{(aq)} + NH_{3(g)} \rightleftharpoons NH_4^+ + H_2O_{(l)}$

Acid ……. (½mk)

Reason …… (½mk)

19. What causes water hardness (1mk)

……

……

20. a)Using ionic equation, explain how sodium carbonate removes permanent hardness (1mk)

b) State one disadvantage of using hardness in the boilers
(1mk)

……

21. Study the equation below

$CH_3CHClCHClCH_3$

i) Give the structural formula of Q (1mk)

……

ii) Name the type of reaction in the equation above
(1mk)

……

iii) To which family of hydrocarbons does Q belong?
(1mk)

……

22. Consider the scheme below for allotropes of sulphur

Allotrope J $\rightleftharpoons$ Allotrope K

i) What is the significance of temperature 96^0C (1mk)

……

ii) Name allotrope J and K (2mks)

……

……

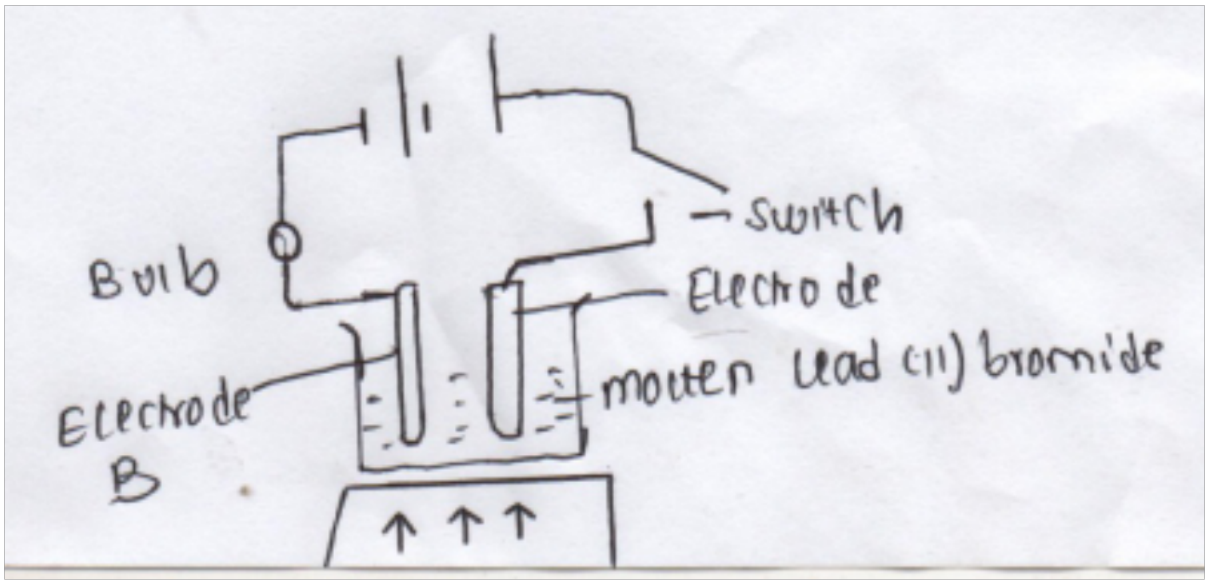
23. In term of structure and bonding explain why Diamond is used in drilling and graphite used as a lubricant
(2mks)

24. The table below gives the bond energies of some compounds.

Bond	Bond energy kJ/mole
H-H	435
Cl-Cl	244
H-Cl	431

Calculate the enthalpy change for the reaction $H2_{(g)} + Cl2_{(g)} \longrightarrow 2HCl_{(g)}$ (3mks)

25.



The diagram above shows the effect of electric current on lead (II) bromide. Study it and use it to answer the questions that follow.

a) On the diagram, Name electrodes A and B
(2mks)

b) State the observations made at electrode A (1mk)

……

……

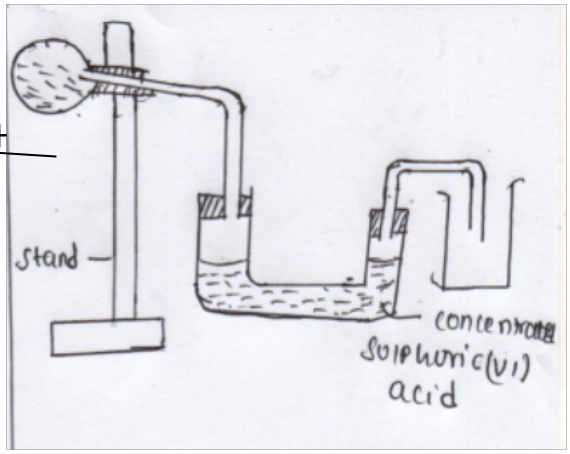
c) Write the equation that takes place at electrode B (1mk)

……

……

26. The diagram below represents the apparatus used to prepare and collect dry ammonia gas.

Ammonia chloride and KOH



a) State two mistakes in the set up of apparatus (2mks)

……

……

b) Write an equation for the reaction apparatus (2mks)

27. The table below gives the solubilities of potassium bromide and potassium sulphate at 0^0C and 40^0C.

Substance	Solubility g/100 water at	
	0^0C	40^0C
Potassium bromide	55	75
Potassium sulphate	10	12

When an aqueous mixture containing 60g of potassium bromide and 7g of potassium sulphate in 100g of water at 80^0C was cooled to 0^0C, some crystals were formed.

i) Identify the crystals (1mk)

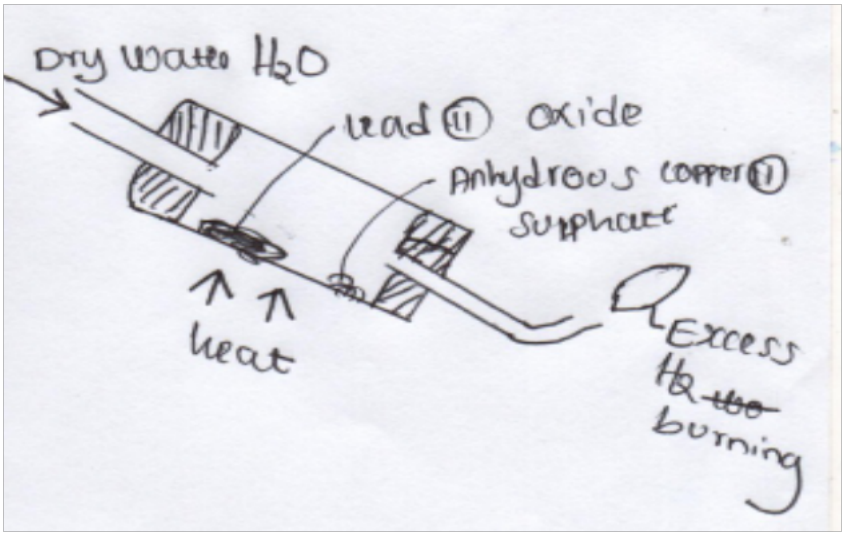
……

ii) Determine the mass of crystals formed (1mk)

iii) Name the method used to obtain the crystals (1mk)

……

28. Study the diagram below



a) What is the observation made on anhydrous copper (II) sulphate (1mk)

……

……

b) Write an aqueous for the reaction ,between hydrogen gas and lead (II) oxide (1mk)

c) What is the property of hydrogen gas being investigated above
(1mk)

……

……

kenyaeducators@gmail.com

Paper 2

NAME: _____ ADM NO:_____

CLASS: _____DATE:_____

SIGN:_____

233/1

CHEMISTRY THEORY

FORM FOUR PAPER 2

TIME: 2HOURS

CHEMISTRY THEORY

TIME: 2HRS

INSTRUCTIONS TO CANDIDATES

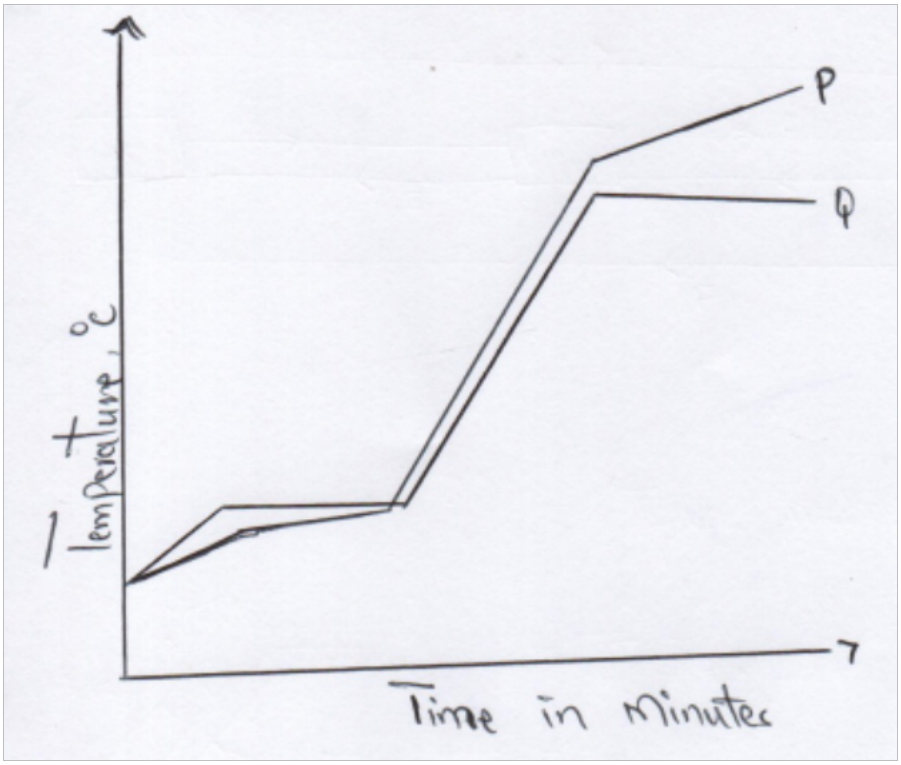
1. Write your name and admission number in the spaces provided above
2. Sign and write the date of examination in the spaces provided
3. Electronic calculators may be used.
4. All working must be clearly shown where necessary

FOR EXAMINERS USE ONLY

QUESTIONS	MAXIMUM SCORE	CANDIDATES SCORE
1	8	
2	10	
3	10	
4	12	
5	10	
6	10	

7 8	09 11	
	80MARKS	

1. (a) The curves below represent the variation of temperature with time when pure and impure samples of a solid were heated separately.



(i) (a)Which curve shows the variation in temperature for the pure solid? Explain. (2mks)

……
……
……

(ii) State the effect of impurities on the melting and boiling points of a pure substance.

I. Melting points ($^1/_2$ mk)

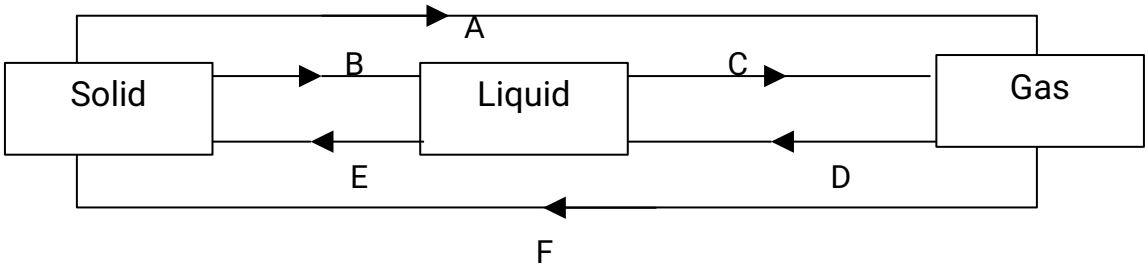
……
……

II. Boilling points ($^1/_2$ mk)

……

……..

(b)The diagram below shows the relationship between the physical states of matter.



i) Identify the processes B and D.
(2mks)

B……

D……..

ii) Name process A (1mk)

……

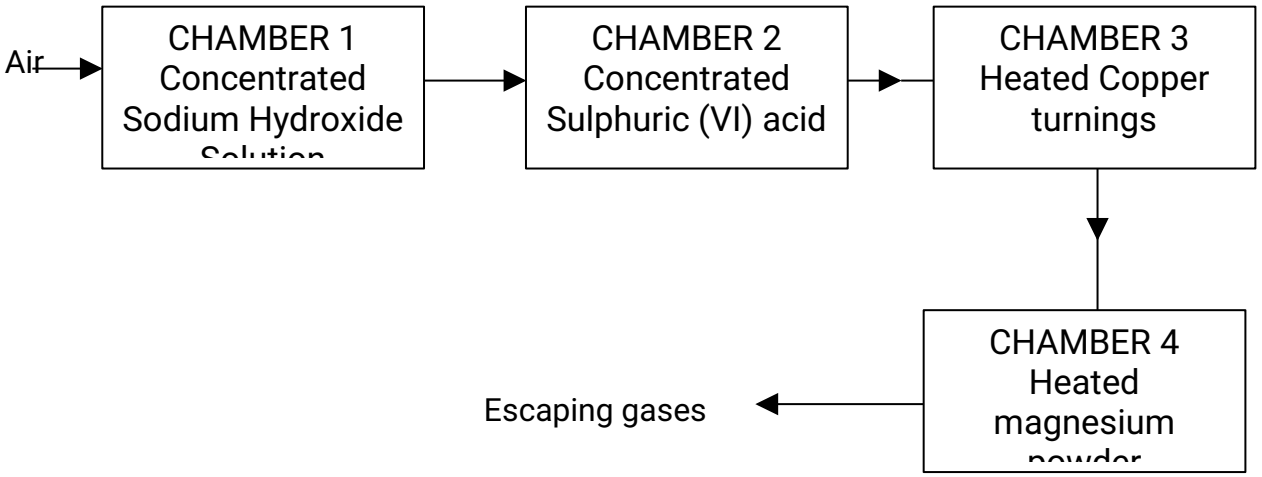
iii) State two substances in chemistry that undergo the process A (1mk)

……
……..

iv) Is the process E exothermic or endothermic? Explain (1mk)

……
……..

2.Air was passed through several reagents as shown below



(a) Name the main inactive component of air
(1mk)

……

(b) Name the components of air that are removed in the following chambers (3mks)

I. Chamber 1

……..

II. Chamber 3

……

III. Chamber 4

……..

C) What is the purpose of passing air through concentrated sulphuric (1v) acid. (1mk)

……
……

d) Write a chemical equation for thereaction which takes place in :-

I. chamber 1 (1mk)

……

II. Chamber4 (1mk)

……

e) State and explain the observation made in chamber 3 during reaction (2mks)

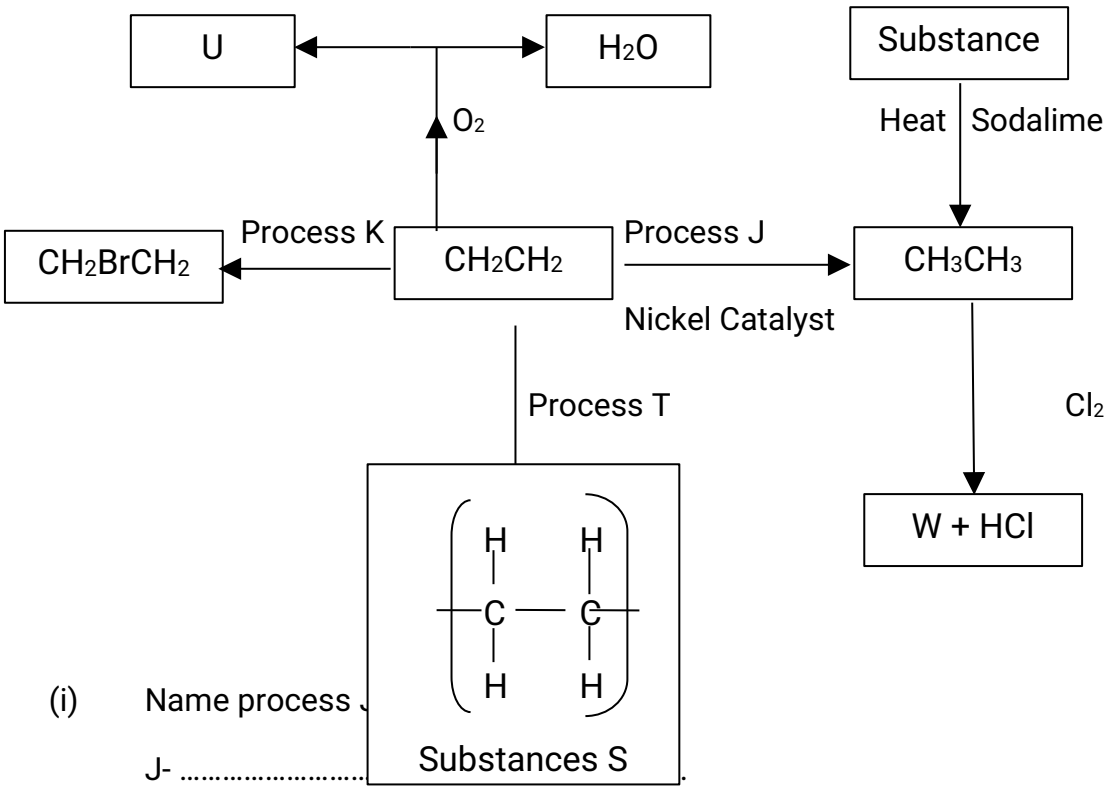
……
……

f) Name one gas which escapes from the scheme above
(1mk)

……

3. (a) Draw and name two isomers of Pentane (2mks)

(B) Study the flow diagram below and then answer the questions that follow.



(i) Name process J (3mks)

J- ……

K- ……

T- ……

(ii) State the reagents necessary for processed J and K (1mk)

……

(iii) Name substances U, W, S and Y (2mks)

U ……

W ……

S ……

Y ……

C) Describe how burning can distinguish CH_2CH_2 from CH_3CH_3 (2mks)

……
……
……

4. The grid below shows a part of the periodic table. The letters do not represent the actual symbols. Study it and answer the questions that follow.

C								T
						U		
X	K		M			Q	W	
	Y					P		Z
J								

a) Identify the elements in period 1 (1mk)

……

b) With a reason, identify the element with the largest atomic radius (2mks)

……
……

c) Draw the atomic structure of element Q (1mks)

d) Write down the electronic configurations of elements Y and W

Y- ……

W- ……

e) Element G forms an ion G^{3-} and its ionic configuration 2.8.8. indicate its position on the grid above (1mk)

f) Identify an element whose oxide reacts with both acids and alkalis (1mk)

……

g) i. Write down the chemical formular of the compound formed between elements K and W (1mk)

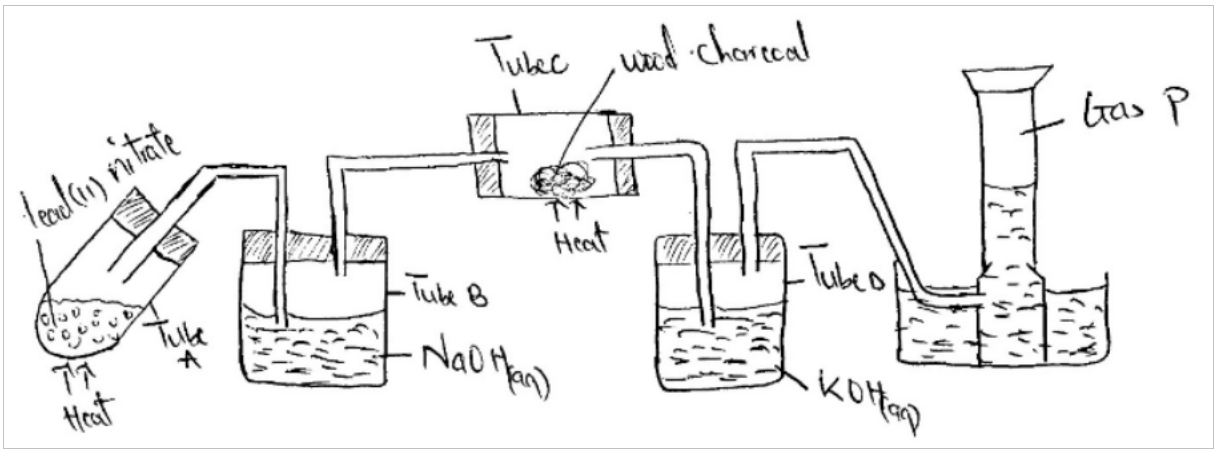
……

ii. Draw the bonding in the compound formed in (g) (i) above using dots (.) and crosses (x) to represent electrons (1mk)

h) Compare the atomic radius elements X and K. Explain (2mks)

……
……
……..

5 (a) Study the diagram below and answer the questions that follow



i) Write a chemical equation for the reaction in tube A (1mk)

……

ii) Name the two salts formed in tube B (1mk)

……

……

iii) State the observation made in tube C (1mk)

……

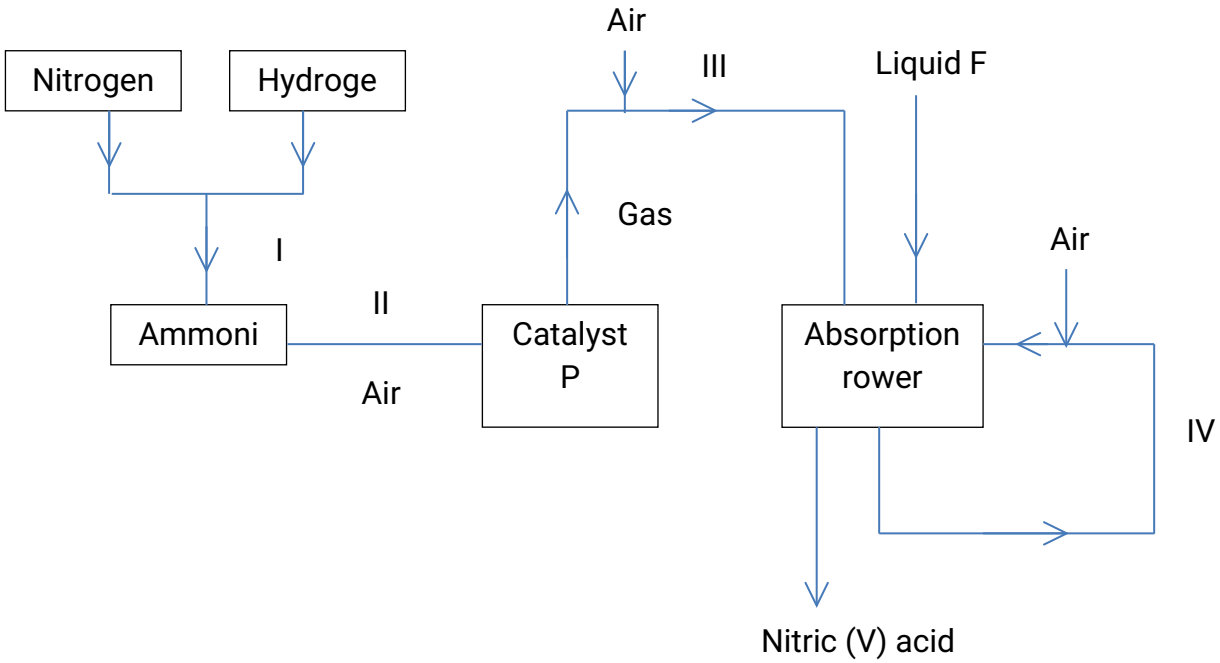
iv) What is the purpose of potassium hydroxide in tube D. (1mk)

……

v) Name gas P (1mk)

……

(b) The flow chart below shows some industrial processes. Use it to answer the questions that follow



(i) Give the source of the following raw materials

a) Nitrogen gas (½mk)

……

b) Hydrogen gas (½mk)

……

ii) Name the following substances;

a) Catalyst P (½ mk)

……

b) Gas M (½ mk)

……

c) Liquid F (½mk)

……

iii)Write the chemical equations for; formation of gas M. (1mk)

……

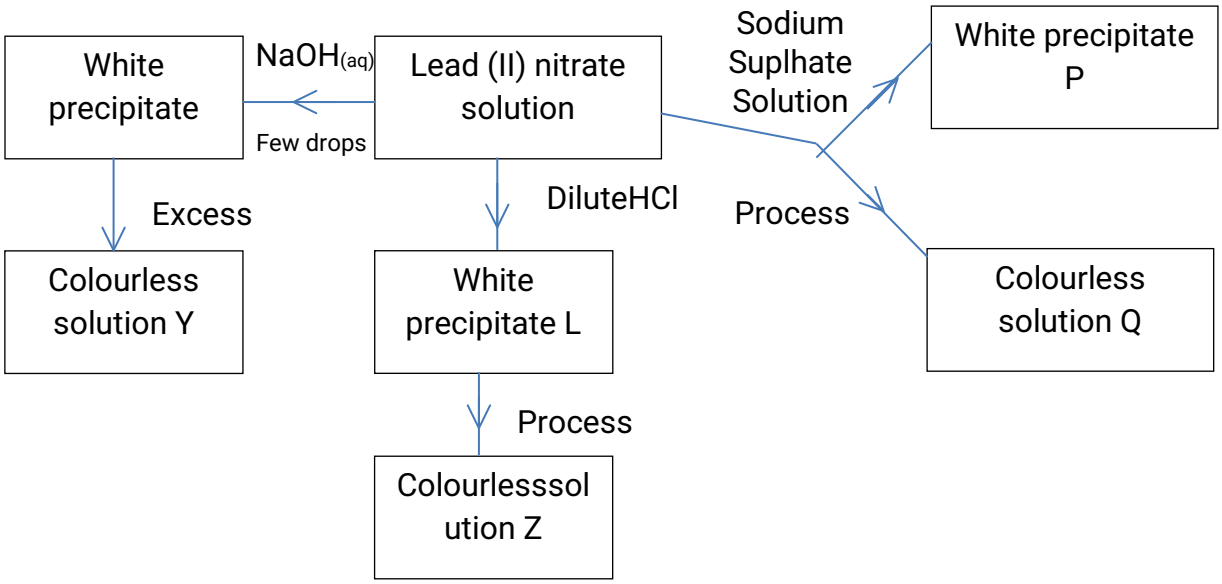
The reaction in the absorption tower (1mk)

……

iv) State one use of nitric (v) acid (½mk)

……

6. Study the reaction scheme below and answer the questions that follow



a) Write the chemical formular of compounds P and Q

i) P ……

ii) Q …… (2mks)

b) Write an ionic equation for the process that produces white precipitate P (1mk)

……

C) Name process 2 (1mk)

……

d) Name the process that separated P and Q (1mk)

P ……..

Q ……

e) Write a balanced chemical equation for the formation of white precipitate L. (1mk)

……

f) State the condition required for process 3 (1mk)

……

g) What physical process is exhibited in process 3 (1mk)

……

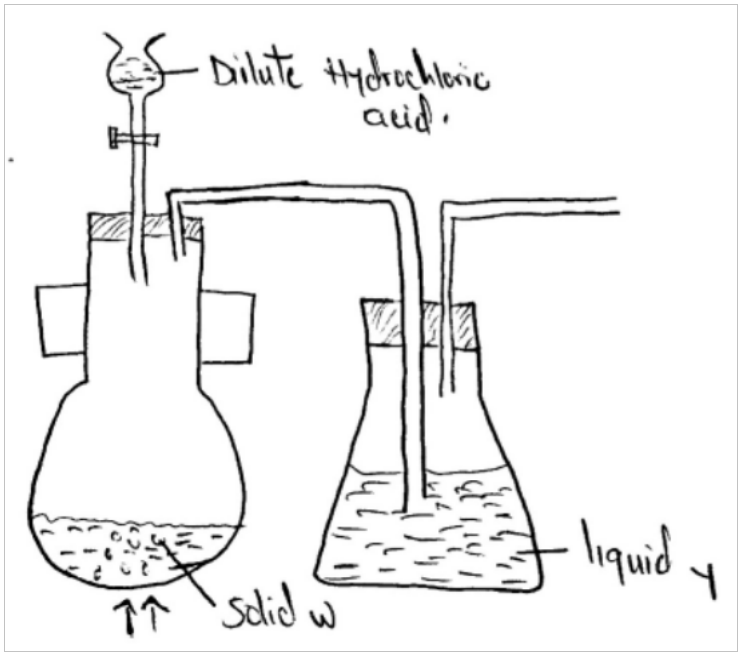
h) Name the anion present in colourless solution Z (1mk)

……

i) Write the formula of the complex ion present in colourless solution Y (1mk)

……

7. Below is a set of apparatus that was used to obtain a dry sample of sulphur(iv)oxide gas



a) Name;

i) Solid W (1mk)

……

(ii)The apparatus containing dilute hydrochloric acid (1mk)

……

b) State the role of Liquid Y (1mk)

……..

C) Complete the diagram to show how the gas could have been collected (1mk)

d) A sample of sulphur(iv)oxide gas was passed through freshly prepared iron(III)sulphate solution. State and explain the observation made (2mks)

……

……

……

e) 50cm^3 of 2M Hydrochloric acid was used during the above experiment. Determine the volume of sulphur(iv)oxide gas produced at r.t.p (molar gas volume = 24dm^3)

……

……

……

8. In an experiment, 40cm^3 of 0.1 M sodium hydroxide solution was placed in a suitable apparatus and 5.0cm^3 portions of hydrochloric acid were added. The resulting mixture was stirred with a thermometer and the temperature taken after each addition. Both solutions were initially at 20^{0}c

Volume of HCL (cm^3)	5	10	15	20	25	30	35	40	45
Temperature (^{o}c)	21.5	22.5	24.0	25.0	26.0	27.0	27.5	27.5	27.0

a) i. Plot a graph of temperature against volume of the acid added (4mks)

ii) Use the graph to determine the concentration in moles per litre of the

hydrochloric acid (2mks)

b) i) Calculate the heat change for the reaction (1½mk)

ii) Molar enthalpy of neutralization of hydrochloric acid by sodium hyndroxide solution (density of solution 1g/cm^3 specific heat capacity 4.2 kj/kg) (1½mks)

c) Write the thermochemical equation for the reaction (1mks)

……

……

d) Draw an energy level diagram for the reaction (1mk)

kenyaeducators@gmail.com

Paper 3

NAME: _____ ADM NO.:_____

SCHOOL: _____ SIGNATURE: _____

FORM 4

PAPER 3 (233/3)

CHEMISTRY (PRACTICAL)

TIE: 2¼HRS

INSTRUCTIONS

a) Write your name and index number in the spaces provided above.
b) Sign and write the data of the examination.
c) Answer all the questions in the spaces provided.
d) You are not supposed to start working with the apparatus for the first 15 minutes of 2¼ hours allowed for this paper. This time is meant to read through the paper and ensure you have all the chemicals and apparatus require.
e) All working must be clearly shown
f) KNEC mathematical tables and silent electronic calculations may be used.
g) All questions should be answered in English

FOR EXAMINERS USE ONLY

QUESTIONS	MAXIMUM	CANDIDATE'S SCORE
1	21	
2	11	

3	08	
TOTAL SCORE	40	

QUESTION 1

You are provided with:

- Solid A 5.0g $(COOH)_2 \cdot \times H_2O$
- Solution B 0.13M $KMnO_4$

Task

a) You are supposed to determine the solubility of A at different temperatures.

b) Determine the number of moles of water of crystallization in solid A.

PROCEDURE 1

a) Using a burette, add 4cm3 of distilled water to solid A in a boiling tube.
   - Head the mixture while stirring with the thermometer to about 80^0C.
   - When the whole solid dissolves, allow the solution to cool while stirring with the thermometer
   - Note the temperature at which crystals first appear and record this temperature in the table 1 below.

b) Using aburrete add $2cm^3$more into the content of the boiling tube and warm until the solid dissolve.
   - Remove from the flame and allow the solution to cool in air while stirring.
   - Record the temperature at which crystal first appear in table 1.
   - Repeat procedure (b) 3 more times and complete table 1 below.
   - Retain the content of the boiling tube for procedure II

Table 1

Volume of water in the boiling tube (cm^3)	Temperature at which crystals of solid A appear (^{0}C)	Solubility o solid A g/100g of water
4 6 8		

10 12		

I. a) Draw a graph of solubility of solid A (vertical axis) against temperature (3mks)

b) From your graph determine the solubility of solid A at 60^0C
(1mk)

PROCEDURE II

a) – Transfer the contents of the boiling tube into a 250ml volumetric flask.
- Add distilled water up to the mark
- Label this solution A

b) – Using a clean pipette and a pipette filler, transfer 25ml of solution A into a conical flask.
- Warm the mixture up to 60^0C
- Fill a burette with solution B
- Titrate B against the hot solution A until a permanent pink colour persist
- Read your results in Table 2 below

c) Repeat (b) 2 more times are record your results in the table 2 below.

TABLE 2

	I	II	III
FINAL BURETTE READING			
INITIAL BURETTE READING			

VOLUME OF SOLUTION B USED (CM^3)			

II) a) Calculate the average volume of solution B used (1mk)

b) Calculate the number of moles of B used (1mk)

c) Given 2 moles of $Kmno_4$ react with 5 moles of A, calculate the number of moles of A in $25cm^3$ (1mk)

d) Calculate the molarity of A (1mk)

e) Determine the molar mass of A (1mk)

f) Determine the value of X (1mk)

(C=12, O=16 H=1)

QUESTION 2

You are provided with solid C. Use it to carry the test below.

Dissolve the whole of C into 10cm3 of water and divide it into five portions.

a) To the 1st portion add sodium sulphate solution.

Observations	Inferences
(1mk)	(1½mks)

b) To the 2nd portion add Ammonia solution dropwise until in Excess.

Observations	Inferences
1mk)	1mk

c) To the 3rd portion add sodium Hydroxide dropwise until in Excess.

Observations	Inferences
(1mk)	(1mk)

d) To the forth portion add Lead (II) Nitrate solution

Observations	Inferences
(½mk)	(2mks)

e)To the last portion add Barium Nitrate solution

Observations	Inferences
(1mk)	(1mk)

QUESTION 3

You are provided with liquid D use it to carry the test below.

Divide liquid D into four equal portions

a) To the 1st portion add sodium hydrogen carbonate

Observations	Inferences
(1mk)	(1mk)

b) To the 2nd portion add acidified potassium manganite (VII) ($KmnO_4$)

Observations	Inferences

(1mk)	(1mk)

c) To the 3rd portion add Bromine water

Observations	Inferences
(1mk)	(1mk)

d) To the last portion add potassium dichromate(VI0 and wrm.

Observations	Inferences
(1mk)	(1mk)