Name………………………………………………………**Index No**…………………./…………

School…………………………………………**Adm No**…………………Stream………………

Date…………………………………………………**Sign**…………………………………………..

233/3
CHEMISTRY
Paper 2
(THEORY)
NOVEMBER/DECEMBER 2021
TIME: 2 HOURS

SAMIA SUB-COUNTY JOINT EXAMINATION-2021
Kenya Certificate of Secondary Education (K.C.S.E) Trial Examination
CHEMISTRY
PAPER 2

INSTRUCTIONS TO CANDIDATES
- *Write your **name**, **School** and **Index Number** in the spaces provided above.*
- ***Sign** and **write date** of examination in the spaces provided above.*
- *Answer **ALL** questions in the spaces provided.*
- *Mathematical tables and silent non-programmable electronic calculators may be used.*
- *All working **MUST** be clearly shown where necessary.*
- *Candidates should answer the questions in **English***
- *Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing*
- *This paper contains 9 printed pages*

For Examiner's Use Only

Questions	Maximum score	Candidate's Score
1	12	
2	10	
3	13	
4	11	
5	11	
6	11	
7	12	
Total	**80**	

1.
a. The information below relates to element N, P,Q, Rand S . Study it and answer the
questions that follow. The letters are not the actual symbols for the elements.

Element	Atomic radius(mm)	Ionic radius(mm)	Formula of oxide	Melting point of oxide
N	0.364	0.421	N_2O	-119
P	0.830	0.711	PO_2	837
Q	0.592	0.485	Q_2O_3	1466
R	0.381	0.446	R_2O_5	242
S	0.762	0.676	SO	1054

i. Name the elements that are metal. **Give** a reason. (2mks)

ii. Compare the melting points of the oxides of S and R in terms of structure and bonding. (2mks)

iii. Name the pair of elements that would react most vigorously with each other?
   Explain (2mks)

b. The table bedlow has information about chlorides of elements in period 3 of the periodic
table:
Sulphur to sulphur

Chloride	NaCI	$MgCI_2$	$AICI_3$	$SiCI_4$	PCI_5
Melting point (ºC)	801	712	Sublimes at 183	-70	-80

What are the possible PH values of the solutions formed when the following chlorides are
dissolved in water? Explain
$MgCI_2$ (1mk)

$AICI_3$ (1mk)

c. The molecular formula of Aluminum chloride is AI2CI6. Draw the structural (not dot and cross diagram) of Aluminum chloride indicating clearly the different types of bonds present. (2mks)

d. Using dot ( ) and cross (×), draw a diagram to show bonding in sodium chloride. (Na=11, CI=17)
   (2mks)

2.
   a. What is the molar enthalpy of neutralization? (1mk)

   b. In order to determine the molar heat of neutralization of sodium hydroxide, 100cm3 of 1M sodium hydroxide and 1M of hydrochloric acid both at the initial temperature were mixed and stirred continuously using a thermometer. The temperature of the resulting solution was recorded after every 30seconds until the highest temperature was attained. Thereafter the temperature of the solution was recorded for a further two minutes.

      i. Why was it necessary to stir the mixture of the two solutions? (1mk)

      ii. Write an ionic equation for the reaction that took place. (1mk)

iii. The sketch below was obtained when temperature of the mixture was plotted against time. Study it and answer the questions that follow.

Y_2

Y_3

Temperature (^oC)

Y_1

Time (**Seconds**)
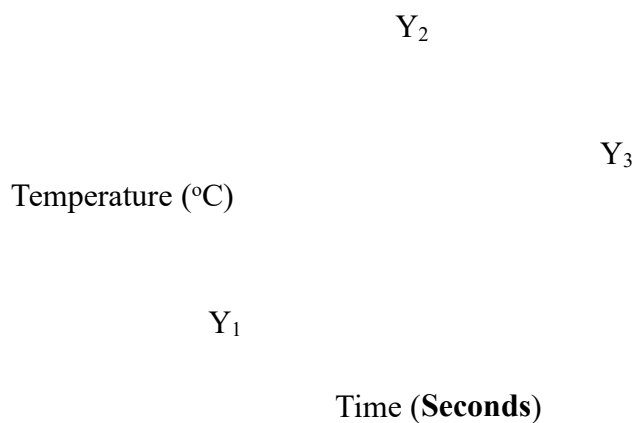
Explain the temperature changes between points
Y_1 and Y_2 (1mk)

Y_2 and Y_3 (1mk)

iv. If the initial temperature for both solution was 25^oC and the highest temperature was 31.4^oC for the mixture. **Calculate;**
Heat change for the reaction (Specific heat capacity of solution=42Hg^{-1}K^{-1}, Density of the solution =1gcm^{-3}) (2mks)

Molar heat of neutralization of sodium hydroxide.   (2mks)

v. **Explain** how the molar heat of neutralization obtained in this experiment would compare with one that would be obtained using 1.0M ethanoic acid and 100cm^3 of 1M sodium hydroxide solution.   (2mks)

Draw an Energy level diagram for the reaction represented by reaction between hydrochloric acid and sodium hydroxide solution.   (3mks)

3.
   a. Give the name of **one** reagent which when reacted with concentrated hydrochloric acid produces chlorine gas.   (1mk)

b. The set up below was used to prepare iron (III) chloride using the apparatus shown in the diagram below.

Guard tube

Iron fillings

Dry chlorine gas

Iron(III) Chloride

Heat

i. State **one** precaution that should be taken in carrying out the above experiment. (1mk)

ii. Explain why
Calcium oxide would be preferred to calcium chloride in the guard tube. (2mks)

It is necessary to pass chlorine gas through the apparatus before heating begins. (2mks)

iii. Write a **chemical** equation for the reaction that took place in the guard tube.(1mk)

iv. What property of Iron (III) chloride makes it possible to be collected as shown in the diagram? (1mk)

v. During the reaction in the combustion tube, the total mass of iron (III) chloride formed was found to be 1.5g. **Calculate** the volume of chlorine gas that reacted with iron. (Fe=56.0, CI=35.5 and molar gas volume at 298k is 24,000cm³) (3mks)

c. **Draw** and **name** the structure of the compound formed when excess chlorine gas is reacted with ethane gas. (2mks)
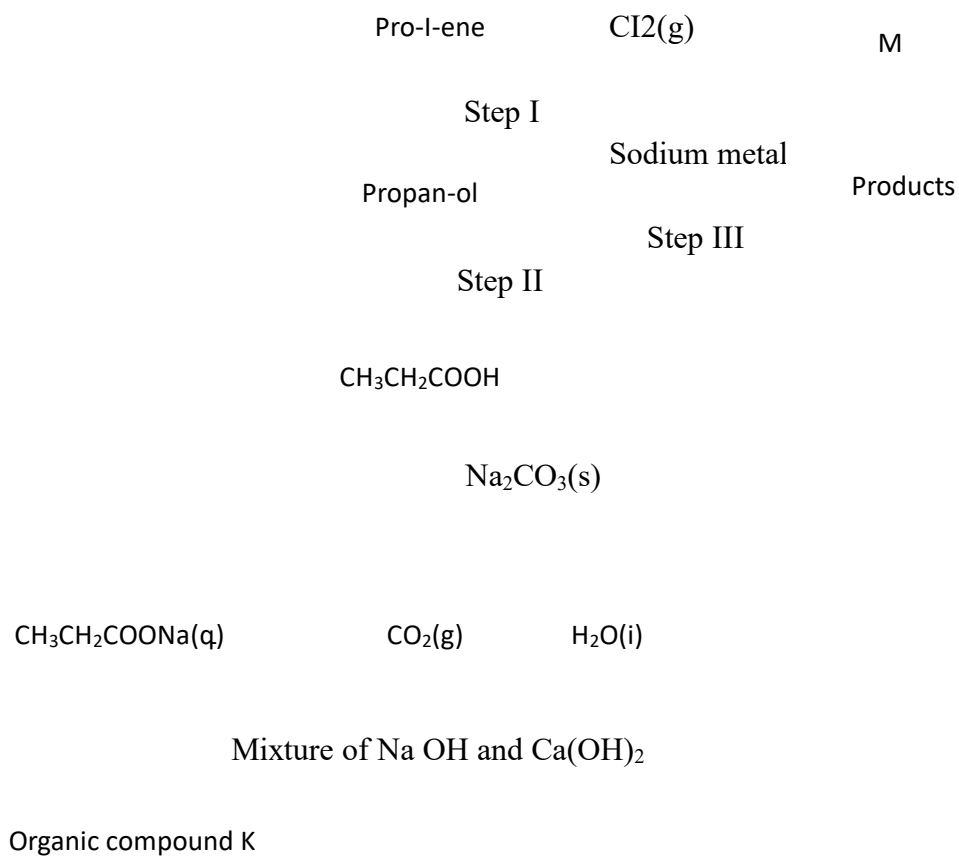
d. State **one** use of chlorine gas. (1mk)

4.

a. Give the systematic names for the following compounds

i. $HCOOCH_2CH_3$ (1mk)

ii. $CH_3CH_2CH_2CHCH2$ (1mk)

iii.   CH C CH$_2$ CH$_3$ (1mk)

b.   Study the flow chart below and use it to answer the questions that follow

Pro-l-ene   CI2(g)   M

Step I

Sodium metal

Propan-ol   Products

Step III

Step II

CH$_3$CH$_2$COOH

Na$_2$CO$_3$(s)

CH$_3$CH$_2$COONa(q)   CO$_2$(g)   H$_2$O(i)

Mixture of Na OH and Ca(OH)$_2$

Organic compound K

i. Identify the organic compound **K**   (1mk)

ii. Write the formula of **M**   (1mk)

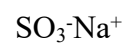iii.Give **one** reagent that can be used in
    Step I   (1mk)

Step II   (1mk)

iv. Write the equations for the reaction in **step II**   (1mk)

c. The structure below represents a type of cleansing agent.

$$SO_3^-Na^+$$

R

Describe how the cleansing agent removes grease from a piece of cloth.   (3mks)

5.

a. The set up below was used to collect gas F, produces by the reaction between water and calcium metal

Test tube

Gas F

Beaker

Calcium metal

Water

i. Name gas **F**   (1mk)

ii.   At the end of the experiment, the solution in the beaker was found to be a week base. **Explain** why the solution is a weak base.   (2mks)

iii.   Give **one** laboratory use of the solution formed in the beaker   (1mk)

b.   When excess calcium metal was added to 50cm3 of 2 M aqueous copper (II)nitrate in a beaker, a brown solid and bubbles of gas were observed.

i.   Write **two** equations for the reactions which occurred in the beaker.   (2mks)

ii.   **Explain** why it is not advisable to use sodium metal for this reaction.   (2mks)

c. **Calculate** the mass of calcium metal reacted with copper(II)nitrate solution (Relative atomic mass of Ca=40   (2mks0

6.
  a. Write the **formula** of the complex Ion formed in each of the reactions below.
     i. Lead metal dissolves in hot alkaline solution.   (1mk)

     ii. Zinc hydroxide dissolves ammonia solution.   (1mk0

  b. Give the name of each of the processes described below which takes place when the salts are exposed to air for some time.
     i. Anhydrous copper (II) sulphate becomes wet.   (1mk)

     ii. Iron (III) chloride forms an aqueous solution.   (1mk)

     iii. Fresh crystals of sodium carbonate decahydrate become covered with a powder of solution of carbonate monohydrate.   (1mkl)

  c. A certain hydrate salt has the following composition by mass. Iron 20.2%, sulphur 11.5%, water 45.5% and the rest oxygen. Its relative formula mass is 278.
     i. **Determine** the formula of the hydrated salt (Fe=56,S=52, O=16, H=1)   (3mks)

     ii. 6.95g of the hydrated salt were dissolved in distilled water and the total volume made to 250cm^3 of solution. **Calculate** the concentration of the salt solution.   (2mks)

7. The table below shows solubility of potassium nitrate and lead nitrate

Temperature ºC	0	20	40	60	80	100
Solubility of KNO_3 in 100g of H_2O	12.5	32.5	62.5	110.0	137.5	
Solubility of $Pb(NO_3)$ in 100g of H_2O	37.5	52.5	69.0	87.5	110.0	131.0

i. Draw the solubility curves for both salts on the same axis. (Temperature on the x-axix)

(3mks)
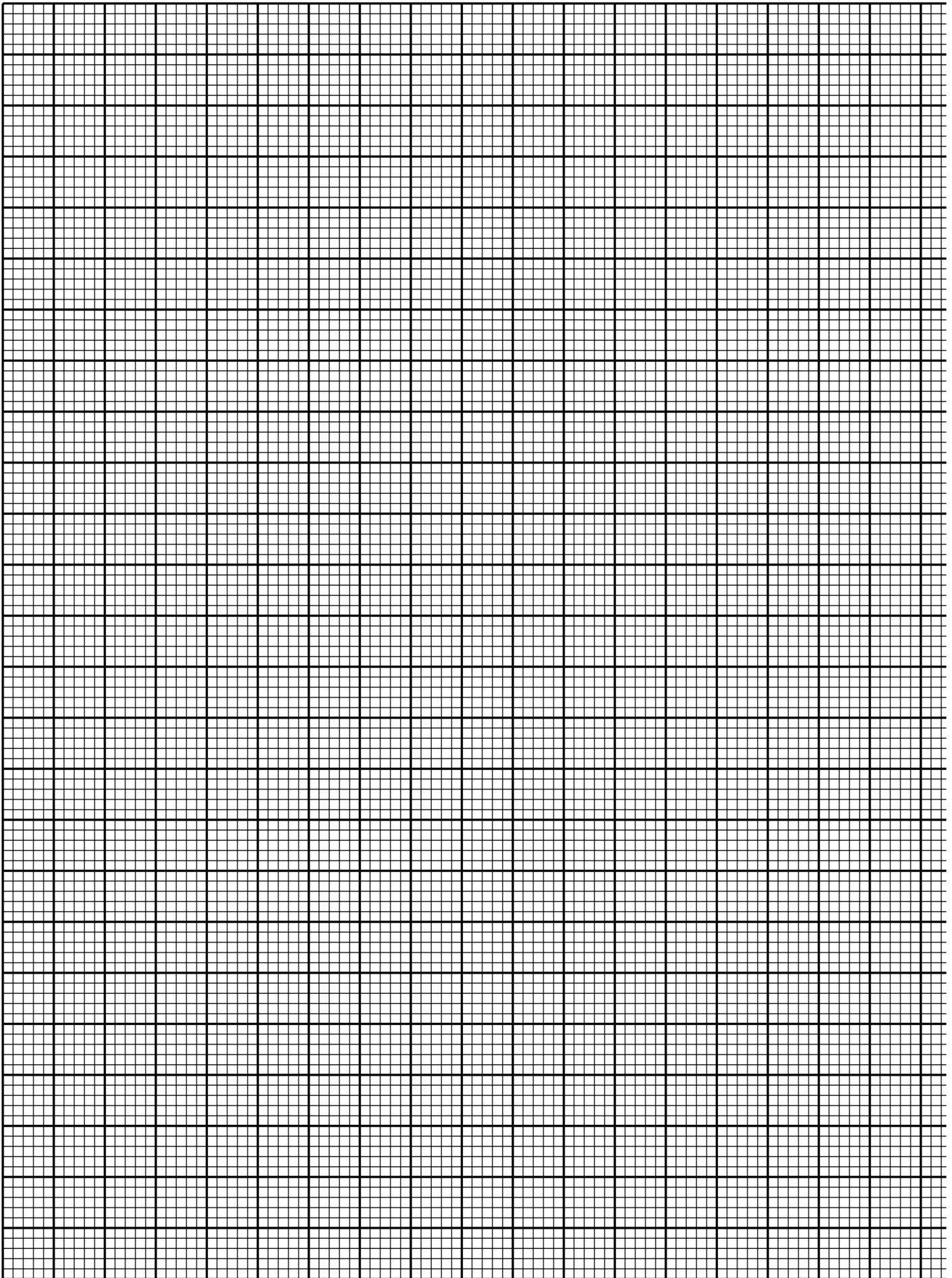
ii. A solution of lead nitrate contains 90g of the salt dissolved in 100g of water at 100°C. This solution is allowed to cool to 25°C

At what temperature will crystals first appear? (1mk)

What mass of crystals will be present at 25°C (1mk)

iii. Which of the **two** salts is more soluble at 30°C (1mk)

iv. Determine the concentration of lead nitrate in moles per litre when the solubility of the two salts are the same. **(Pb=207.0, O=16.0, K=39.0, N=14.0)** (3mks)