Name: .....Class.....

Candidate's signature…… Date……

Index number……...

233/1

CHEMISTRY.

Theory

Paper 1

Time: 2 Hours

April 2020

Kenya Certificate of Secondary Education

Instructions to Candidates

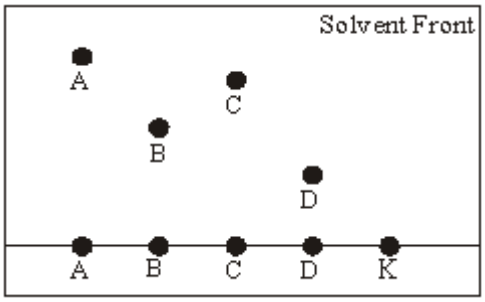
(a)Write your name and index number in the spaces provided above.
(b) Sign and write the date of examination in the spaces provided above
(c) Answer **ALL** the questions in the spaces provided in the question paper
(d) KNEC Mathematical tables and electronic calculators may be used for calculations
(e) All working **MUST** be clearly shown where necessary
(f) This paper consists of 13 printed pages
(g) Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing
(h) Candidates should answer the questions in English

For examiners' use only.

Questions	Max-score	Candidates score
1-29	80	

Turn over

1. The diagram below represents a paper chromatogram of pure A, B, C and D. K is a mixture that contains A and D only.



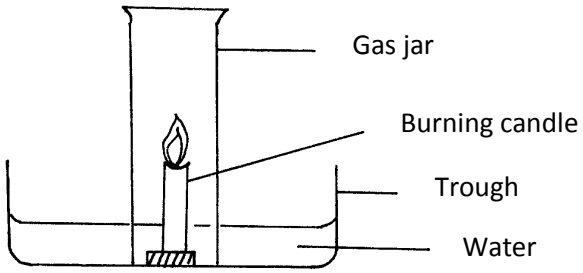
(i)Indicate on the diagram the chromatogram of K. (1mk)

(ii)Give a reason why A moves faster to the solvent front than B (1mk)

……

(iii) Indicate on the diagram the base line (1mk)

2 Peter used the set up below to investigate the percentage of oxygen gas in air.



a) With the help of a diagram, explain what was expected as her results. (2mks)

b) The percentage obtained was far from the theoretical value. State the main reason for the difference. (1mk)

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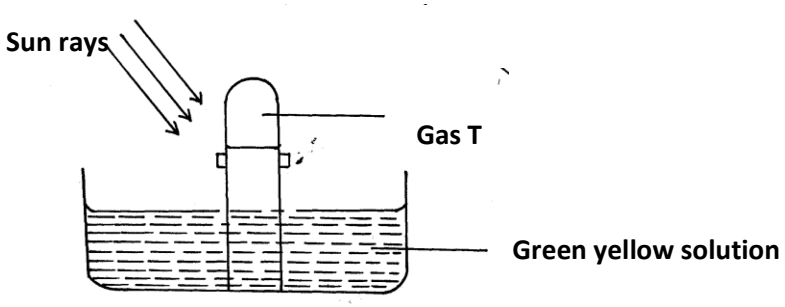
3.Chlorine gas was bubbled through water for sometime. The green yellow solution formed was poured into along glass tube and placed in the sun as shown in the diagram below:



(i) What compounds are in the yellow solution (1mk)

……

(ii) Write an equation to show how gas **T** is formed. (1mk)

……

4.Both ions Y^{2-} and Z^{2+} have an electron configuration 2:8:8

(i) Write the electron arrangement for

Y …….. (1 mk)

Z …….. (1 mk)

(ii) Draw the structure of atom Z given that it has 20 neutrons. (1mk)

5. The table below indicates the pH values of solutions labeled A,B,C,D and E.

Solution	A	B	C	D	E
pH value	5	13	2	10	7

Identify the solution

(i) Containing the highest concentration of hydrogen ions. (1 mk)

……

(ii) Which solution is likely to be acetic acid ? Give a reason. (1mk)

……

(iii) Which is likely to be common salt solution. (1 mk)

……

6. A dynamic equilibrium between Chromate(vi) and Chromium (III) ions is as shown below.

$$Cr_2O_7^{2-}{}_{(aq)} + 14H^+{}_{(aq)} \rightleftharpoons 2Cr^{3+}{}_{(aq)} + 7H_2O_{(l)}$$

(Orange) (Green)

State and explain the observation made when dilute sodium hydroxide solution is added to the equilibrium mixture. (3mks)

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……

……

7. 800g of a radioactive isotope decays to 50g in 100 days. Determine the half-life of the isotope. (2mks)

……

……

8.The table below shows results obtained from experiment carried out on a suspect salt solution M.

	Experiment	**Results**
I.	A few drops of Barium nitrate added to solution M	No white precipitate
II.	A few drops of lead (II) nitrate added to solution M.	White precipitate
III.	Ammonia solution added dropwise until in excess	White precipitate Colourless solution

(a) Identify the cation and anion present in solution M.

Cation (1 mk)

……

Anion (1 mk)

……..

b) Write an ionic equation for the formation of white precipitate in experiment II (1mk)

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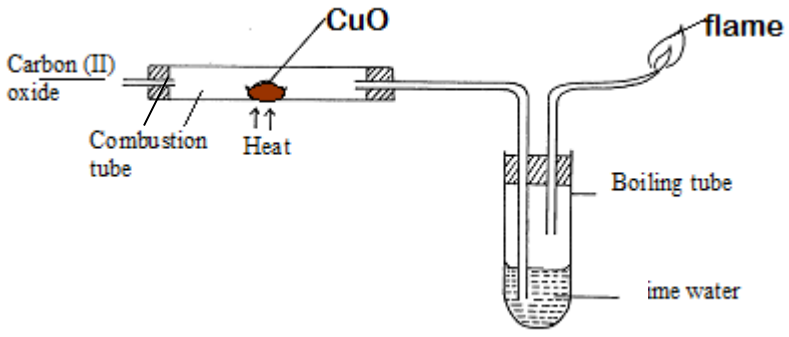
c) Write the formula of the Ion responsible for formation of colourless solution in experiment III (1mk)

……

9. Study the experimental set up of apparatus shown below.



(i) State two observations made in the set up as the experiment progressed. (1mk)

……

……

b) Using an equation; Explain the change that occurred in the boiling tube. (1mk)

……

10. . The table below shows solubilities of two salts M and N at different tempertarues. Study it and answer the questions that follow.

Temperature (^oC)	30	90
Solubility of M in g/100g of H_2O	25.0	64.0
Solubility of N in g/100g of H_2O	32.5	48.0

A mixture of 55g of salt M in 100g of water and 30g of salt N in 100g of water were cooled from 90^oC to 30^oC . Calculate the mass of salt that crystallize out. (2mks)

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……

……

11.A fixed mass of gas occupies $105cm^3$ at -14^0C and 650mm pressure. At what temperature will it have a volume of $15cm^3$ if the pressure is adjusted to 690 mm pressure. (2mks)

……

……

12.(a) Use the following half cell standard electrode potentials to answer the questions that follows

$A^{2+}_{(aq)} + 2e^- \longrightarrow A_{(s)}$ -0.76
$B^{2+}_{(aq)} + e \longrightarrow B_{(s)}$ -0.13
$C^{+}_{(aq)} + e \longrightarrow C_{(s)}$ +0.84
$F^{2+}_{(aq)} + 2e \longrightarrow F_{(s)}$ +0.34

(i).Select two half cells which when combined gives the largest emf (1mk)

……

(ii).Calculate the emf of the cell in (i) above (1mk)

……

……

(c).Write an equation for the oxidation process that occurs in B-cell (1mk)

……

13. A gaseous hydrocarbon was found to discolourise an acidified potassium manganate (VII) solution. When two moles of Q are burnt completely in air, six moles of Carbon (IV) oxide and six moles of water were formed.

a) Write the structural formula of Q (1 mk)

……

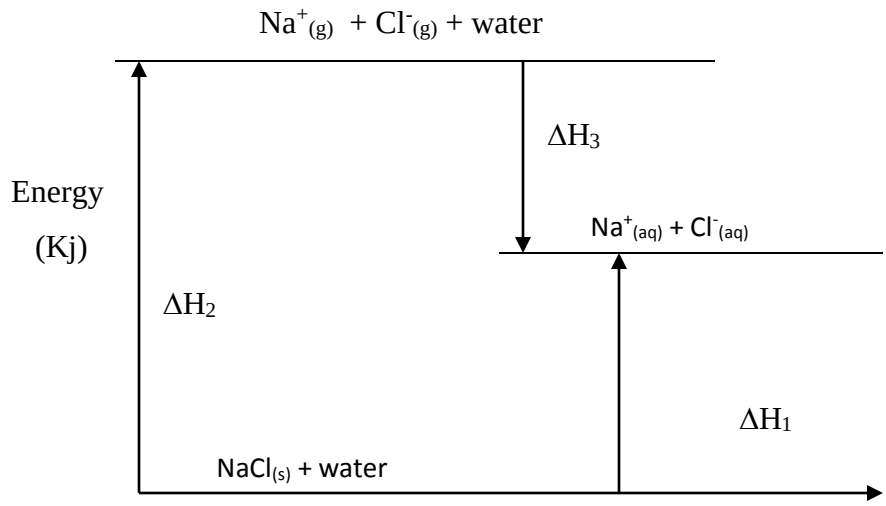
b) Name the homologous series to which Q belongs (1 mk)

……

c) Name one industrial source of Q (1 mk)

……

14.Study the energy level diagram below and answer the questions that follow.



(a).Name the energy changes labeled

ΔH_1 …… (½mk)

ΔH_3 …….. (½mk)

(b).Given the following energy values

$\Delta H_1 = +2kJ\ mol^{-1}$

$\Delta H_3 = -741\ kJ\ mol^{-1}$

Calculate the value of ΔH_2 (2mks)

……

……....

15. When marble chips is reacted with 1M hydrochloric acid, carbon (IV) oxide is evolved at moderate rate. If the marble chips is crushed into fine powder, the rate of evolution increases.

(i).Explain this observation (1mk)

……

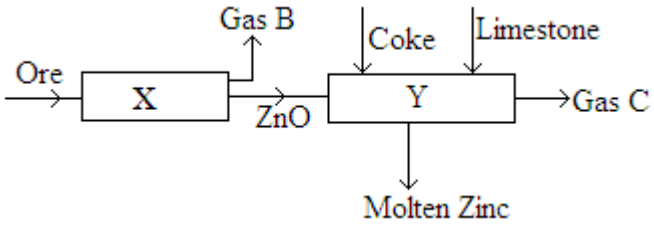
……

(ii).Give one way of increasing the rate of reaction without changing the chemical. (1mk)

……

……

16. Below is a simple flow chart showing extraction of zinc metal.



(i) **Name** the chamber X. (1mk)

……

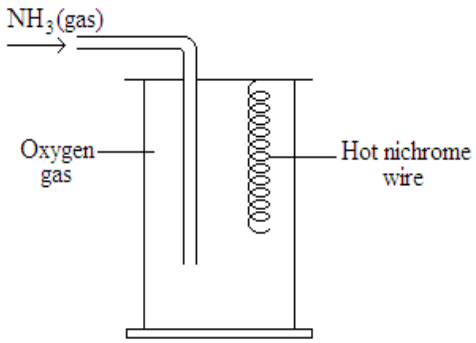
(ii) **Identify** substance B. (1mk)

……

(iii) **Write** balanced chemical equation to show what happens in chamber Y in which gas C is produced. (1mk)

……

17.The apparatus below was set up to show the catalytic oxidation of ammonia.



(i) **Write** an equation for the reaction that takes place in the gas jar. (1mk)

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……..

(ii) **Why** is it necessary to have hot nichrome wire in the gas jar. (1mk)

……

……

(iii) **State two** uses of ammonia. (1mk)

……

……

18.The following equation shows a reversible reaction.

$$H_{2(g)} + Br_{2(g)} \rightleftharpoons 2HBr_{(g)} \quad \Delta H^{q}_{c} = -74.4KJ$$

brown colourless

(a)**State** and explain the observation that can be made when:-

(i)Temperature is increased. (1½mks)

……

……

(ii)Pressure is reduced. (1½mks)

……

……

19. The following data refers to element y.

Isotope	A	B	C
Isotope mass	54	56	57
Percentage abundance %	6.0	92.0	2.0

a) Given that isotope C contains 31 neutrons in its nucleus.
Find;

(i) The number of protons in isotope B. (½ mk)

……..

(ii) The number of neutrons in isotope A. (½ mk)

……

b) Calculate the relative atomic mass of element Y. (2mks)

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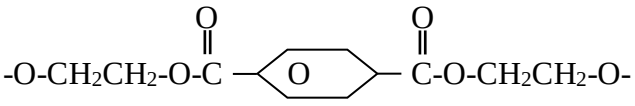
……..

……

20.The structure below is part of a structure of a polymer



a) Deduce the structures of the monomers. (1mk)

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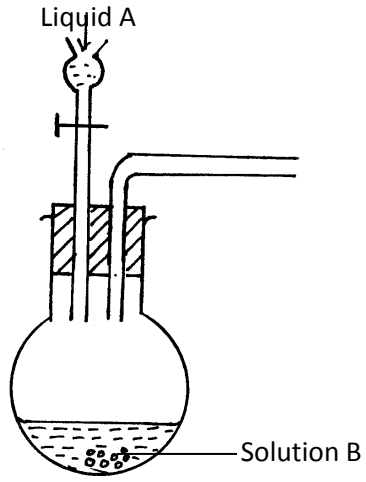
b) Name the type of polymerization process through which the polymer was formed.

(1mk)

……

21..The diagram below shows an incomplete set up of apparatus that may be used to prepare hydrogen sulphide gas.



a) Complete the set up to show how hydrogen sulphide is collected (1mk)

b) Name: liquid A ……. (½ mk)

Solid B …….. (½ mk)

c) Write an equation for the reaction taking place. (1mk)

……

22. Q grams of an acid Hx was dissolved in water and the resulting solution diluted to 250cm^3. 15cm^3 of the final solution was required to neutralize 25cm^3 of 0.1M potassium hydroxide solution. Determine the value of Q given that RMM of the acid is 63. (3mks)

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23. The equation for the combustion of pentane is

$$C_5H_{12(l)} + 8O_{2(g)} \rightarrow 5CO_{2(g)} + 6H_2O_{(g)} \quad \Delta H^q{}_c = -3520KJmol^-$$

a) If 140g of pentane was burned completely, calculate the amount of heat energy evolved. (C=12, H=1) (2mks)

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……

……

b) Explain why water gas (a mixture of carbon (II) oxide and hydrogen) is a better fuel compared to producer gas (a mixture of carbon II oxide and Nitrogen) (1mk)

……

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24. a) Explain why water molecule is capable of reacting with hydrogen ion (H^+) to form hydroxonium ion (H_3O^+). (1mk)

……

……

b) Using dots (**.**) and crosses (x) to represent electrons, show the bonding in hydroxonium ion (H=1 O=8). (1mk)

(c) With reference to carbon (IV) oxide, distinguish between covalent bonds and Van der Waals forces. (1mk)

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25. An aqueous potassium sulphate solution was electrolysed using platinum electrodes in a cell.

a) Name the products formed at the

(i) Cathode (½ mk)

……

(ii) Anode (½ mk)

……

b) How does the concentration of the electrolyte change during electrolysis. (1mk)

……

……

(c) Write the equation for the reaction that takes place at the anode. (1mk)

……

……

26.Boilers used for boiling hard water are normally covered with boiler scale after sometime.

a) What is the chemical name for the boiler scale? (1 mk)

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b) How is the boiler scale removed? (1 mk)

……

c) State any one advantage of using hard water. (1 mk)

……

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27. This question concerns the alkaline earth metals (group 2) of the periodic table.

Element	Atomic radius (nm)	Ionic radius (nm)
Beryllium	0.112	0.030
Magnesium	0.160	0.065
Calcium	0.197	0.094
Strontium	0.215	0.110
Barium	0.221	0.134

Account for the following

a) Ionic radius is smaller than atomic radius for each element. (1 mk)

……

……

b) Atomic radius increases from Beryllium to Barium (1 mk)

……

……

c) The radius of K^+ ion is greater than that of Ca^{2+} ion although both ions have the same electronic configuration. (1 mk)

……

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28 During a displacement reaction, excess iron powder was added to $25cm^3$ of 0.5M copper(II) sulphate solution. The temperature rose from 18.5°C to 33.0°C. Calculate the molar enthalpy of displacement of copper in copper (II) sulphate solution (specific heat capacity is 4.2 $Jg^{-1}K^{-1}$, Density of the solution = $1.0g/cm^3$) (3mks)

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……

29.Element Q reacts with dilute acids but not with cold water. Element R does not react with dilute acids. Elements S displaces element P From its oxide. P reacts with cold water. **Arrange** the four metals in order of their reactivity starting with the most reactive. (2mks)

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