MASENO SCHOOL MOCK – 2022

Kenya Certificate of Secondary Education

233/2   **Paper 2**

CHEMISTRY
(Theory)
Sept. 2022 – 2 Hours

Name …………………………………………..…Admission Number …………………

Class …………………Date …………………...Candidate's Signature………………....

Instructions to candidates

a) Write your name and Admission Number in the spaces provided above.
b) Write your class, date of examination and sign in the spaces provided above.
c) Answer all the questions in the spaces provided.
d) Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.
e) The paper consists of **14** printed pages.

MASENO SCHOOL MOCK COMMITTEE – 2022

QUESTION 1 (12 marks)

(a) The table shows information about some elements (Letters are not the actual symbols of the elements)

Element	K	M	N	P	Q	R	S	T
Atomic number	11	12	13	14	15	16	17	18

(i) Write the electronic arrangement of the most stable ion of Q. (1 mark)

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(ii) Identify the strongest reducing agent. Explain. (2 marks)

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(iii) Name the type of structure and bond type present in element P in its pure elemental form.

(1 mark)

Structure type : ……………………………………..…………………………………………….

Bond type : ………………………………………………………..………………………

(iv) Give two reasons why the oxide of element M has a higher melting point than the oxide of

element K. (1 mark)

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(b) The grid below is part of the periodic table. Use it to answer the questions that follow. The letters are

not the actual symbols of the elements.

							H	X	
M	V		W	Z			Y	U
T								

(i) How do the ionization energies of elements M and T compare? Explain. (1 mark)

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(ii)   The chloride of element W was dissolved in water and solid sodium carbonate added to the resulting solution. Explain the observation made.   (2 marks)

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(iii)   Compare the ionic radius of the ions formed by elements M and V.   (2 marks)

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(iv)   State one use of element T.   (1 mark)

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(v)   Write a chemical equation for the reaction between element V with cold water. (1 mark)

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QUESTION 2 (13 marks)

(a) Hydrogen chloride gas was prepared and reacted with aluminium turnings as shown below.
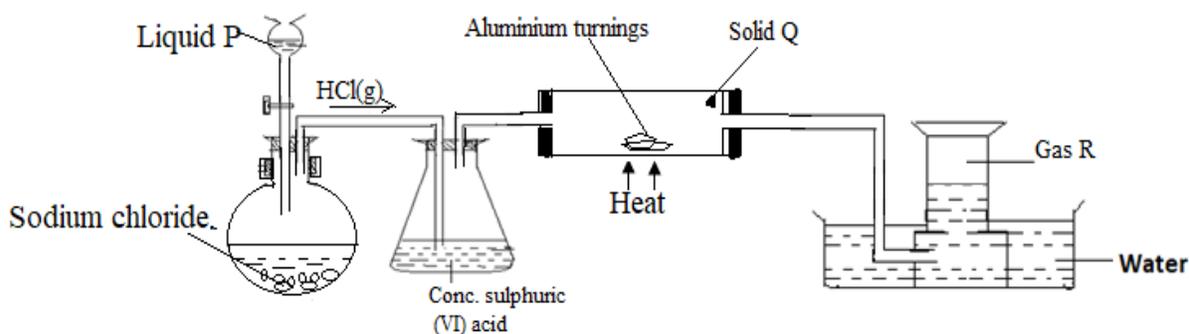
(i)   Name liquid P.   (1 mark)

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(ii)   State the confirmatory test for gas R.   (1 mark)

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(iii)   Explain why **solid Q** collects further away from the heated aluminium.   (1 mark)

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(iv)   Sodium chloride also known as rock salt is preferred to any other chloride in the

         preparation of hydrogen chloride gas. Give a reason.   (1 mark)

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(v)   Explain why blue litmus paper changes to red when dipped in water in the trough at the end

         of the experiment.   (1 mark)

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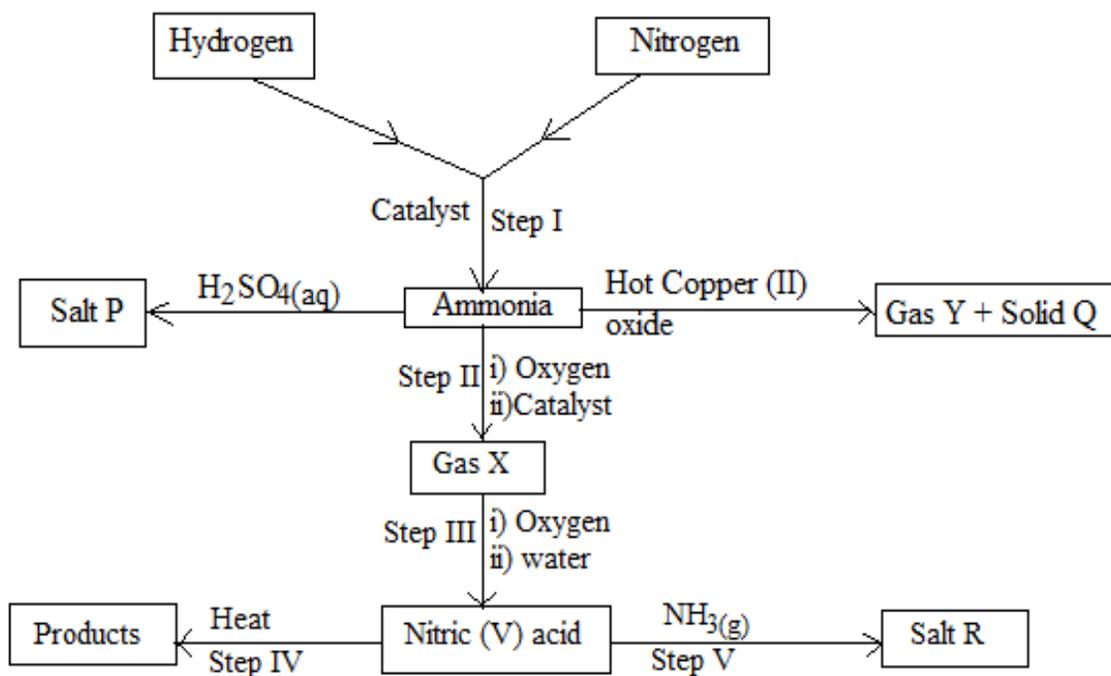
(vi)   A part from manufacture of hydrochloric acid, state another use of hydrogen chloride gas.

                                                                          (1 mark)

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(a) Study the flow chart below.

(i)   Give one condition other than the use of the catalyst that would favour the reaction in step I.   (1 mark)

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(ii)   Write a chemical equation for the reaction in step III.   (1 mark)

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(iii) What is the main source of hydrogen gas used in step I?   (1 mark)

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(iv)   Concentrated nitric (v) acid is usually transported in containers made of aluminium and not copper. Explain.   (1 mark)

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(v)   Name the type of reaction that takes place when ammonia gas reacts with hot copper (II) oxide.   (1 mark)

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(vi)   If 200cm^3 of ammonia gas measured at room temperature and pressure reacted completely with the hot copper (II) oxide, calculate the mass of solid Q formed. (Cu=64, Molar gas volume at r.t.p = 24dm^3)   (2 marks)

QUESTION 3 (12 marks)

(a) The flow diagram below is a summary of the process involved in the preparation of a detergent. Study it and answer the questions that follow.
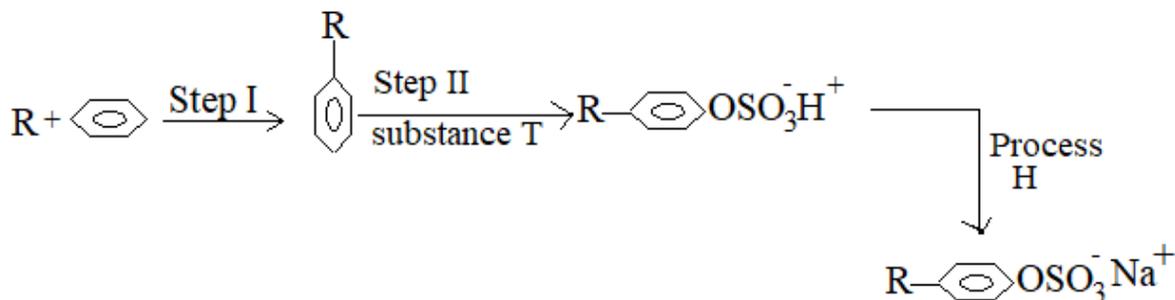
(i)   What is a detergent.   (1 mark)

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(b) (i) Give the IUPAC name of the starting material, substance R reacted with benzene. (1 mark)

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(ii)   Identify substance T used in step II.   (1 mark)

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(iii)   Name process H.   (1 mark)

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(iv)   Give the condition necessary for the reaction in step I to occur.   (1 mark)

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(v)   Write the equation for the reaction which takes place when the detergent prepared above is
         added to water drawn from a borehole.   (1 mark)

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(vi)   Give one advantage that the detergent prepared above has over soapy detergent.

                                                                               (1 mark)

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(c) The general structure of the detergent prepared above is:

$$R\text{—}\langle\bigcirc\rangle\text{OSO}_3^-\text{Na}^+$$

Describe how the detergent removes dirt from a garment stained with grease.   (2 marks)

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(d) Nylon 6,6 is a polymer formed when two different monomers M and N are made to join forming
    the long chain molecule shown below with the loss of water molecules.

(i)   Name the process that leads to the formation of the above structure.   (1 mark)

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(ii)   Draw the structural formula of the monomer M and N from which the above polymer is
        made.   (1 mark)
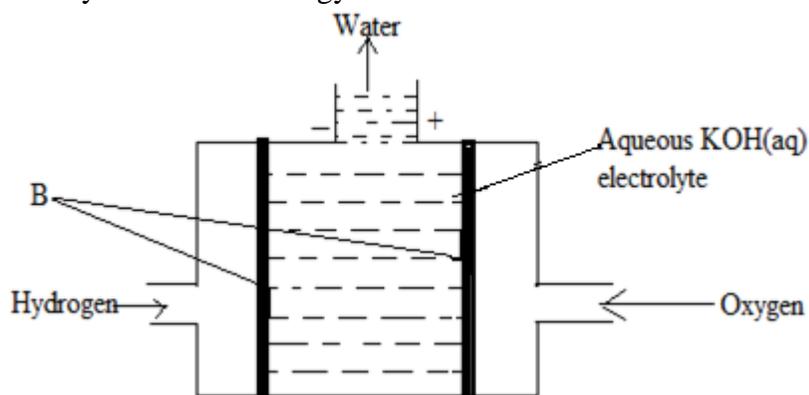
        Monomer M   Monomer N

(iii)   Give one environmental problem associated with the use of the polymer shown above.

                                                                                      (1 mark)

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QUESTION 4 (13 marks)

(a) The set up below shows an electrochemical cell that can be used to convert the chemical energy of a
    fuel directly to electrical energy.

(i)   Name the part labelled B.   (1 mark)

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(ii)   Write the overall cell reaction in the above hydrogen /oxygen cell.   (1 mark)

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(iii)   Give one of the uses of standard electrode potentials.   (1 mark)

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(b) State one advantage of secondary cells over primary cells.   (1 mark)

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(c) Below is a list of potential difference obtained when metals P, Q, R, S and T are used in the following electrochemical cell. Metal(s)/metal ions(aq)//Copper (II) ions(aq)/copper(s).

Metal	E°(volts)
P	-1.10
Q	-0.46
R	0.00
S	+0.45
T	+1.16

(i)   Identify metal R. Explain.   (2 marks)

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(ii)   Which two of the above metals in an electrochemical cell would produce the largest potential difference.   (1 mark)

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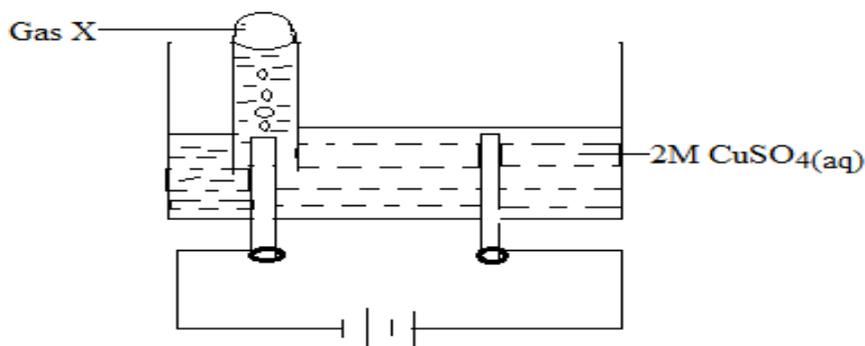(iii)   Calculate the electromotive force of the cell chosen in (ii) above.   (1 mark)

(iv)   Which of the metals above cannot be displaced by any of other metals from the solution of its ions? Explain.   (2 marks)

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(d) The set-up below was used during the electrolysis of $100cm^3$ of 2M copper (II) sulphate solution using inert electrodes.

A current of 4A was passed through $100cm^3$ of 2M copper(II) sulphate solution for 2 hours 20 minutes. Calculate the amount of copper in the remaining solution after the experiment. **(Cu=63.5, 1F=96500C)**

(3 marks)

QUESTION 5 (12 marks)

(a) What is meant by the term molar enthalpy of formation? (1 mark)

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(b) Use the following standard enthalpies of combustion of graphite, hydrogen and propane.

ΔHc (graphite)   = -393kJ/Mol

ΔHc (H₂ (g))   = -286kJ/Mol

ΔHc (C₃H₈(g))   = -2219kJ/mol

(i)   Write the equation for the formation of propane. (1 mark)

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(ii)   Draw an energy cycle diagram that links the heats of formation of propane with its heat of combustion and the heats of combustion of graphite and hydrogen.   (2 marks)

(iii)   Calculate the standard heat of formation of propane.   (2 marks)

(c) Propane and butane are constituents of cooking gas. Which one produces more energy per mole on combustion? Explain.   (2 marks)

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(d) Other than the enthalpy of combustion, state two factors which should be considered when choosing a fuel.   (2 marks)

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(e) The molar enthalpies of neutralization for dilute hydrochloric acid and dilute nitric(V) acid are -57.2kJ/mol while that of ethanoic acid is 55.2kJ/mol. Explain this observation.   (2 marks)

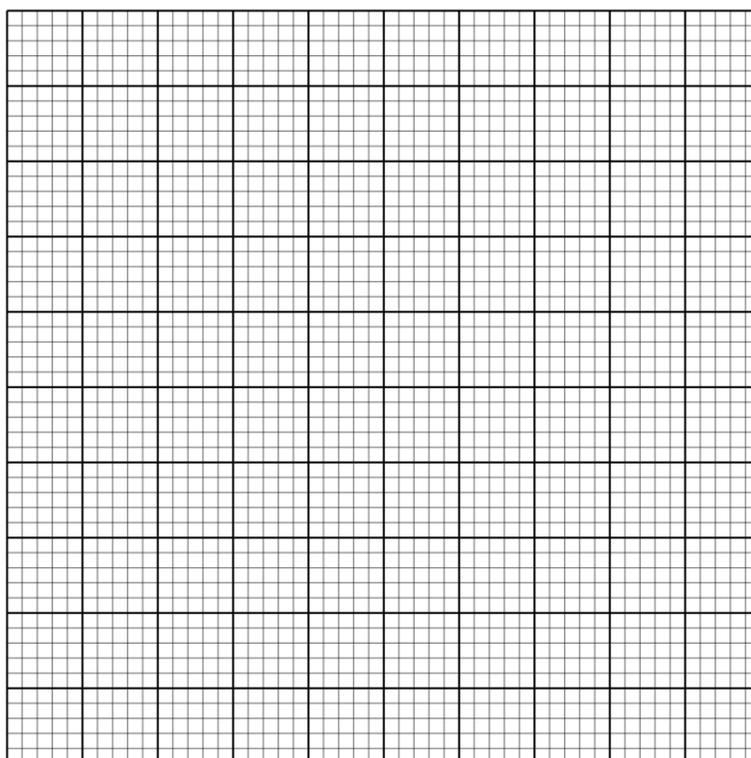…………………………………………………………………………………………………

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QUESTION 6 (8 marks)

The table below shows the solubility of salt X and Y at various temperatures.

Temperature(◦C)	0	15	25	35	45	55	65	75
Solubility of X in 100g of water	12	26	38	53	72	98	124	155
Solubility of Y in 100g of water	35.0	35.8	36.2	36.6	37.0	37.4	38.0	38.0

(i)   By using the same axes, plot graphs of solubility of salt X and Y against temperature.

(3 marks)

(ii)   At what temperature are the solubilities of X and Y the same.   (1 mark)

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(iii)   What mass of salt Y will saturate 35g of water at 70 °C?   (2 marks)

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(iv)   Name the method of separation that would be used to obtain the two salts from a mixture of their

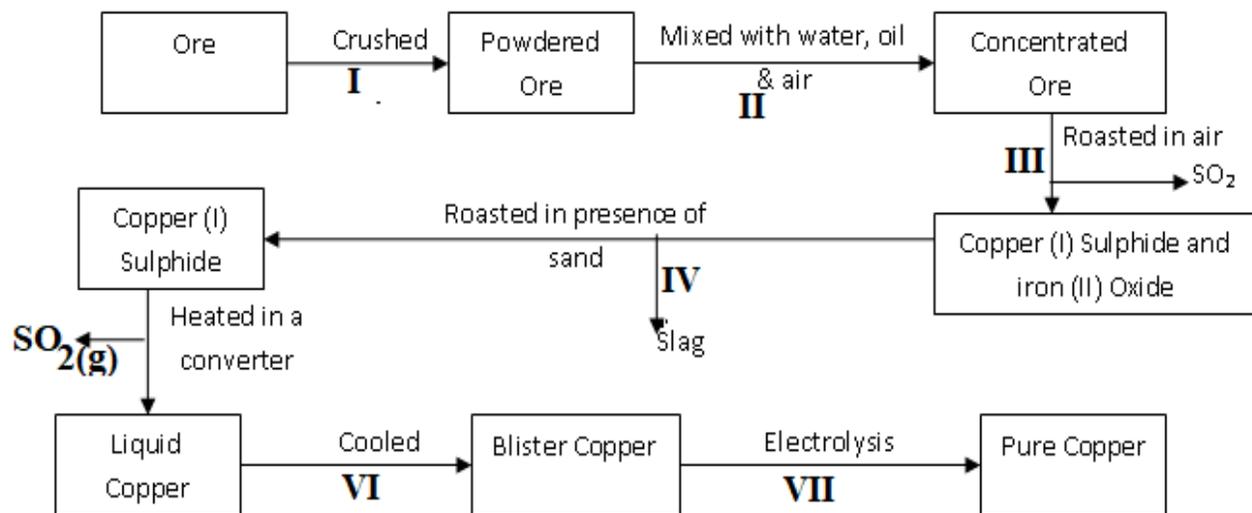solution   (1 mark)

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(v)   State one application of the method named in (iv) above.   (1 mark)

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QUESTION 7 (10 marks)

The diagram below is a flow chart for the extraction of copper. Study it and answer the questions that
follow.

(a) Write the formula of the major ore of copper metal.   (1 mark)

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(b) Name **process II.**   (1 mark)

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(c) Give an equation for the reaction that occurs in **stage III.** (1 mark)

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(d) With the aid of an equation, explain what happens in stage **IV.** (2 marks)

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(f) Write half-cell equations occurring at the anode and cathode in **stage VII**. (2 marks)

Anode: …………………………………………………………………………………………

Cathode: …………………………………….…………………………………………………

(g) Draw a simple diagram showing the set-up that is used in electrolytic purification of copper.

(2 marks)

(h) State one way in which environmental pollution can be prevented during extraction of copper metal. (1 mark)

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