Name ..... **Index Number** ..... / .....

SCHOOL ..... **Candidate's Signature** .....

233/1

Date

CHEMISTRY

PAPER 1 (THEORY)

JULY/AUGUST 2013

TIME: 2HOURS

LENOCET EVALUATION TEST
KENYA CERTIFICATE OF SECONDARY EDUCATION

233/1

CHEMISTRY

PAPER 1 (THEORY)

TIME: 2HOURS

Instructions to candidates

1. Write your name and Index Number in the space provided above.
2. Answer **ALL** questions in the spaces provided in the question paper.
3. Mathematical tables and electronic calculators may be used.
4. **ALL** working **must** be clearly shown where necessary.

For Examiner's use only

Questions	Maximum Score	Candidate's Score
1 - 30	80	

1. (a) Write the electronic configuration of Calcium (atomic number 20) and magnesium (atomic number 12).

Calcium _____ ($^1/_2$ marks)

Magnesium _____ ($^1/_2$ marks)

(b) Why is calcium more reactive than magnesium? (2 marks)

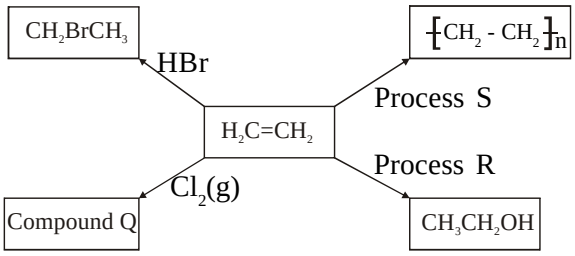
_____

_____

_____

_____

2. Study the scheme below and answer the questions that follow.



Name:

(i) The reagents used in process R. (1 mark)

_____

(ii) Process S (1 mark)

_____

(iii) Compound Q. (1 mark)

_____

3. A weighed sample of crystalline Sodium carbonate ($Na_2Co_3.nH_2O$) was heated in a crucible until there was no further change in mass. The mass of the sample reduced by 14.5%. Calculate the number of moles (n) of the water of crystallisation.
(Na = 23, O = 16, C = 12, H = 1) (3 marks)

4. (a) Give the name and formula of one chief ore of aluminium metal. (1 mark)

_____

_____

(b) Aluminium metal is extracted through electrolysis process. Write the equation of the reaction at the cathode during the process. (1 mark)

_____

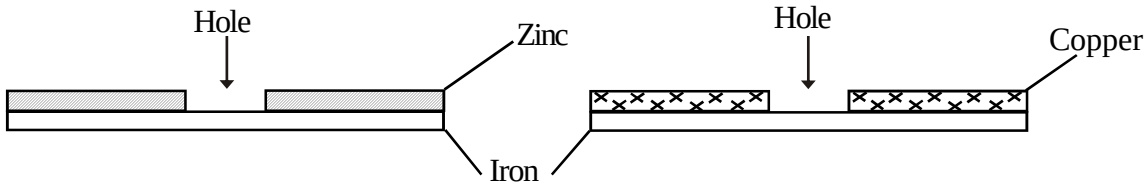
_____

(c) Why is it not advisable to store Sodium hydroxide solution in an aluminium container. (1 mark)

_____

_____

5. Below are cross - sections of two pieces coated with zinc and copper respectively.



Which piece would rust when the holes were filled with water and left for sometimes? Explain. (2 marks)

_____

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6. A dynamic equilibrium between diachromate and chromate ions is established as shown in the equation below.

$$Cr_2O_7^{2-}{}_{(aq)} + 2OH^-_{(aq)} \rightleftharpoons 2CrO_4^{2-}{}_{(aq)} + H_2O_{(l)}$$

(orange) (Yellow)

(a) What is meant by a dynamic equilibrium. (1 mark)

_____

_____

(b) State and explain the observation that would be made if a few pellets of sodium hydroxide are added to the equilibrium mixture. (2 marks)

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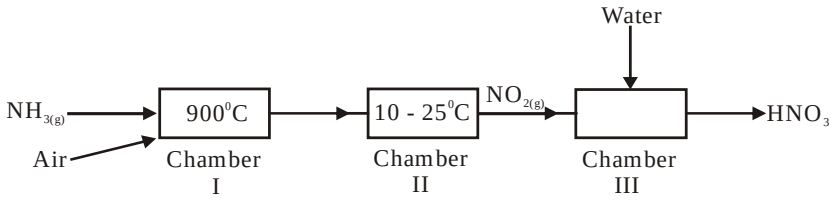
7. The scheme below show the industrial preparation of nitric acid.



(a) What is the oxidation state of nitrogen in;

(i) NH_3 _____ ($^1/_2$ marks)

(ii) HNO_3 _____ ($^1/_2$ marks)

(b) Write a balanced chemical equation for the reaction taking place in.

(i) Chamber I (1 mark)

_____

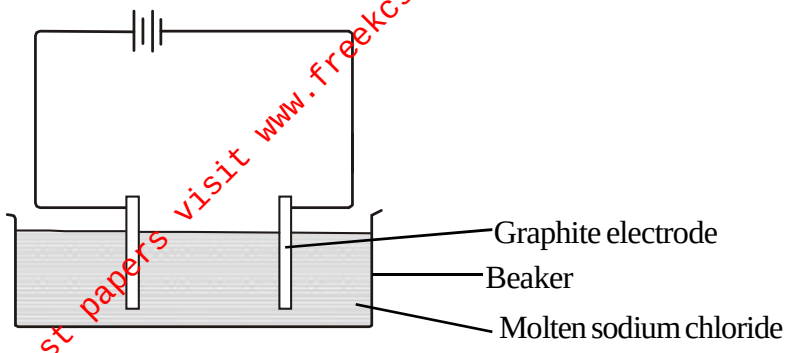
_____

(ii) Chamber II (1 mark)

_____

_____

8. The diagram below represents an experiment which was carried out by a student to investigate the effect of passing an electric current on molten sodium chloride.



(i) Molten Sodium chloride is a binary electrolyte. State the meaning of the term binary electrolyte. (1 mark)

_____

_____

(ii) State the observations made at the anode. (1 mark)

_____

_____

(iii) Write an equation to show what happens at the cathode. (1 mark)

_____

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9. Briefly explain how you would obtain a pure sample of lead chloride from a mixture of lead chloride and silver chloride. (3 marks)

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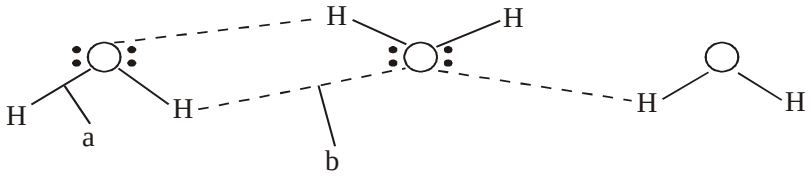
10. A given volume of Ozone (O_3) diffused from a certain apparatus in 96 seconds. Calculate the time taken by an equal volume of carbon (IV) Oxide (CO_2) to diffuse under the same conditions. (O = 16, C = 12) (3 marks)

11. The diagram below shows a structure of water molecules.



(i) Name the bonds labelled a and b. (1 mark)

(ii) Using dots (•) and cross (x) diagram, show the bonding in the compound phosphonium ion PH_4^+. (H = 1, P = 15) (2 marks)

12. Study the information in the table below and answer the questions that follow.

(The letters do not represent the actual symbols of the elements).

Substance	Melting point (^{0}C)	Boiling point (^{0}C)	Solubility in water	Dendity of room temperature g/cm^3
H	-117	78.5	Very soluble	0.8
J	-78	-33	Very Soluble	0.77×10^{-3}
K	-23	77	Insoluble	1.6
L	-219	-183	Slightly Soluble	1.33×10^{-3}

(i) Which substance would dissolve in water and would be separated from the solution by fractional distillation? Give a reason. (1 mark)

_____

_____

(ii) Which substance is a liquid at room temperature and when mixed with water, two layers would be formed. (1 mark)

_____

(iii) Which letter represents a substance that is a gas at room temperature and which can be collected over water. Explain (1 mark)

_____

_____

13. 3.4g of an element X on complete combustion produced heat which raised the temperature of 120cm^3 of water from 22^{0}C to 62^{0}C. Determine the molar heat of combustion of X. (Atomic mass of X =34. Density of H_2O = 1g/cm^3 (specific heat capacity of water = 4.2J/gk^{-1}) (3 marks)

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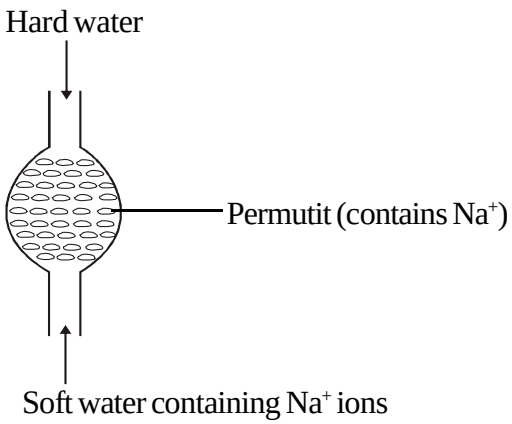
14. (a) The column below was used to soften hard water.



(i) Explain how the hard water was softened as it passed through the column. (1 mark)

_____

_____

(ii) After sometimes, the material in the column is not able to soften hard water. How can the material be re - activated. (1 mark)

_____

_____

(b) Give one advantage of using hard water for domestic purposes. (1 mark)

_____

_____

15. In an experiment, the quantity of electricity passed to deposit 1.2 grammes of metal Q from its salt was 3860 Coulombs. (RAM of Q = 120, 1 Faraday = 96500 Coulombs)

(a) How many Faradays of electricity are required to deposit 1 mole of Q? (2 marks)

_____

_____

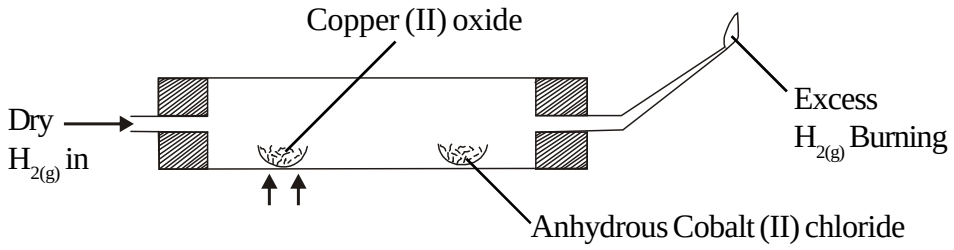
_____

_____

(b) One of the ions present in the solutions of salt Q has the formula Q^{y+}. What is the numerical value of Y. (1 mark)

_____

16. The set - up below was used to investigate the effect of dry hydrogen gas on hot Copper (II) Oxide powder.



Explain what is observed in the combustion tube during the experiment. (3 marks)

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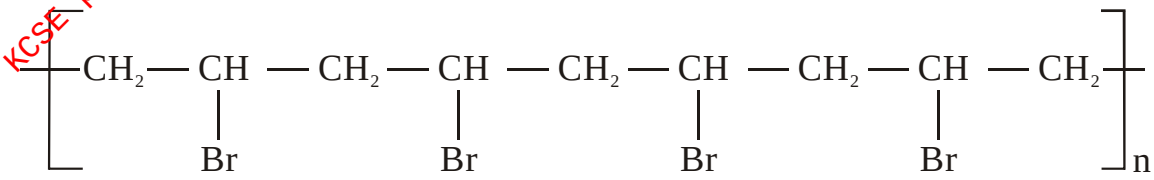
17. The table below gives the energy required to remove the outermost electrons for some group I elements.

Element	A	B	C	D
Energy KJ mol^{-1}	494	418	519	376

Arrange the elements in the order of their reactivity starting with least reactive. (2 marks)

_____

18. A polymer has the following structure.



(a) Draw the structural formula of the monomer. (1 mark)

(b) Determine the number of monomers in the polymer.
(C = 12, H = 1, Br = 80) (2 marks)

19. The table below gives the rate of decay for the radioactive element P.

Number of hours	mass (g)
0	384
270	48

(a) Calculate the half life of the radioactive element P. (2 marks)

_____

_____

_____

_____

_____

(b) Write a balanced equation for the decay of $^{238}_{92}U$ after it loses 2β - particles an 3∝ - particles to form a stable nuclide $^{a}_{b}X$ where a and b are whole numbers. (1 mark)

_____

_____

20. The following data gives PH values of solutions P, Q and R.

Solution	PH
P	13.6
Q	6.9
R	1.3

(i) Which solution will produce Carbon (IV) Oxide when reacted with marble chips. (1 mark)

_____

(ii) What would be the colour of solution P after adding a few drops of phenolphthalein. (1 mark)

_____

21. The table below shows the solubility of a salt at various temperatures.

Temperature	Solubility (g/100g water)
0	39
40	33
80	27
110	22

What would happen if a sample of saturated solution of the salt at 40^0C is heated to 80^0C? (2 marks)

_____

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_____

_____

22. Sulphuric acid is manufactured in large scale by the contact process. The basic reaction in the contact process is the catalytic oxidation of Sulphur (IV) Oxide.

(a) Name the catalyst used. (1 mark)

_____

(b) Write the equation for the reaction. (1 mark)

_____

_____

(c) State one large scale use of sulphuric acid. (1 mark)

_____

_____

23. The following two tests were carried out on chlorine water contained in two test tubes.

(a) A piece of blue flower was dropped into the first test tube. Explain why the flower was bleached. (2 marks)

_____

_____

_____

_____

(b) The second test tube was corked and exposed to sunlight. After a few days, it was found to contain a gas that rekindled a glowing splint. Write an equation for the reaction which produced the gas. (1 mark)

_____

_____

24. Describe how a solid sample of lead (II) chloride can be prepared using the following reagents. Dilute nitric acid, dilute hydrochloric acid and lead carbonate. (3 mark)

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_____

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25. 20.0cm^3 of a solution containing 4g per litre of sodium hydroxide was neutralised by 8.0cm^3 of dilute sulphuric acid. Calculate the concentration of sulphuric acid in moles per litre. (Na = 23, O = 16, H = 1) (3 marks)

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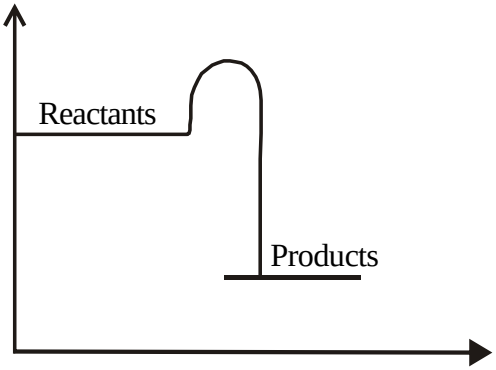
26. Ammonia can be converted to nitrogen (I) oxide as shown in the equation below.

$$4\,NH_{3(g)} + 5O_{2(g)} \rightleftharpoons 4NO_{(g)} + 6H_2O_{(l)}$$

The energy level diagram for the above reaction is as shown below.



(a) Explain how an increase in temperature would affect the yield of nitrogen (I) oxide. (2 marks)

_____

_____

_____

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(b) On the diagram, sketch the energy level diagram that would be obtained if the reaction is carried out in presence of a catalyst. (1 mark)

27. The grid below represents part of the periodic table. The letters do not represent the actual elements.

L							O	
P			Q	R			S	
U	V							

(a) Write the electronic arrangement for the ions formed by elements Q and S. (1 mark)

_____

_____

(b) Compare the melting points of P and U. Explain. (1 mark)

_____

_____

(c) Select the most reactive non - metal. Give a reason for your answer. (1 mark)

_____

_____

28. Use the information below to answer the questions that follow.

	E^{θ} Volts
$Zn^{2+}_{(aq)} + 2e^- \rightleftharpoons Zn_{(s)}$	- 0.76
$Al^{3+}_{(aq)} + 3e^- \rightleftharpoons Al_{(s)}$	- 1.66
$Fe^{2+}_{(aq)} + 2e^- \rightleftharpoons Fe_{(s)}$	- 0.44

Calculate the E^{θ} value for the electrochemical cell represented below. (1 mark)

$$Al_{(s)} \left| Al^{3+}_{(aq)} \right|\!\!\left| Fe^{2+}_{(aq)} \right| Fe_{(s)}$$

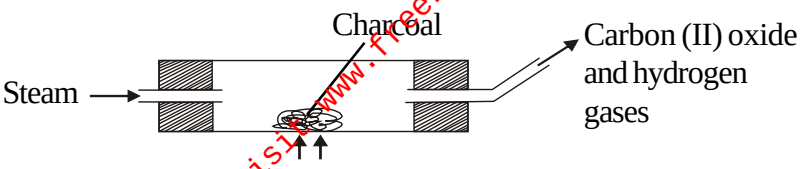
_____

_____

_____

_____

29. When steam was passed over heated charcoal as shown in the diagram below, hydrogen and carbon (II) oxide gases were formed.



(a) Write the equation for the reaction which takes place. (1 mark)

_____

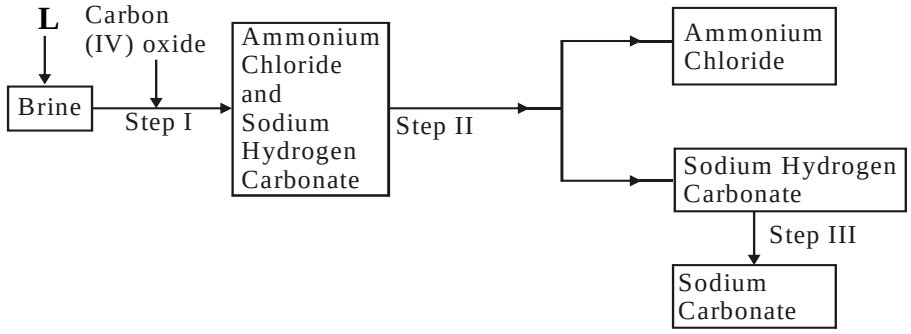
_____

(b) Name one use of carbon (II) oxide which is also a use of hydrogen gas. (1mark)

_____

_____

30. The simplified flow chart below shows some of the steps in the manufacture of sodium carbonate by the solvay process.



(a) Identify substance L. ($^1/_2$ marks)

_____

(b) Name the process taking place to step II. ($^1/_2$ marks)

_____

_____

(c) Write an equation for the process which takes place in step III. (1 mark)

_____

_____