**Name**..... ..... .... ..... **Index number** ..... ...... .

**Class** ..... ..... **Adm no**..... ... ..... **Candidate's signature** ..... ..

233/1
**CHEMISTRY**
Paper 1
**THEORY**
July 2016
**2 Hours**

Kenya Certificate of Secondary Education
**CHEMISTRY**
Paper 1
**TH EORY**

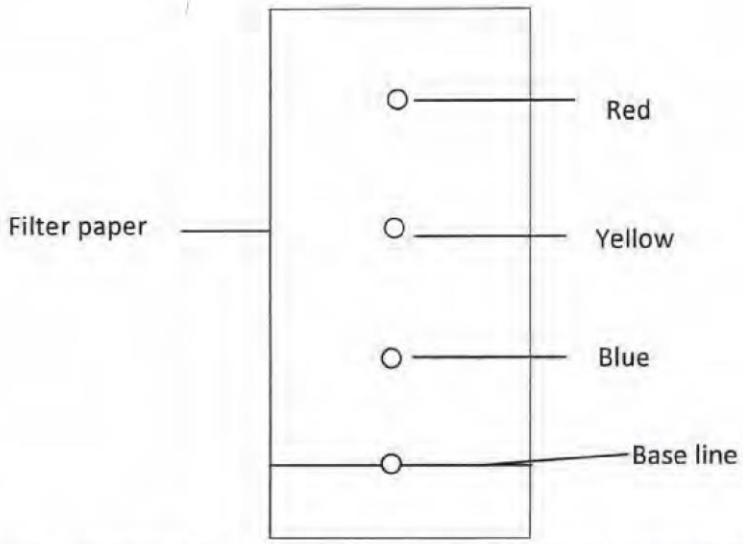
**Instruction to Candidates**

- ! Write your name, index number class and admission number in the spaces provided
- ! Sign and write the date of examination in the spaces provided.
- ! Answer **all** the questions in the spaces provided.
- ! Mathematical tables and silent electronic calculators may be used.
- ! All working **must** be clearly shown where necessary.
- ! This paper consist of 17 printed pages
- ! Candidates should check the question paper to ascertain that all the pages are printed as indicated and no questions are missing.
- ! Candidates should answer the questions in English.

**For Examiner's Use Only**

| Questions | Maximum Score | Candidates Score |
|---|---|---|
| 1-29 | 80 | |

1. The chromatogram below shows the constituents of ink in sample M using methylated spirit as the solvent




(a) Describe how you would obtain a solid sample of the red pigment from the chromatogram above. (2marks)

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(b) State one property of the red dye. (1mark)

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2. State and explain the observation that would be made when a gas jar of sulphur (IV) oxide is inverted over a gas jar of hydrogen sulphide. (2marks)

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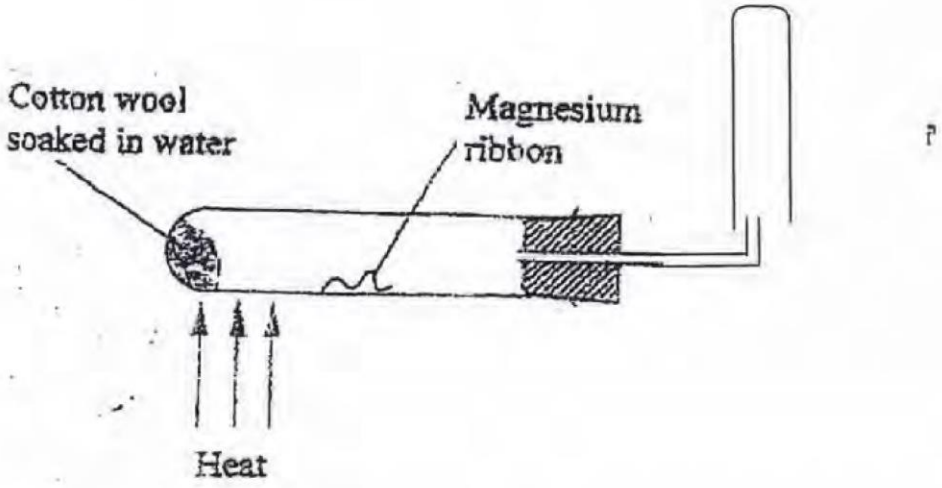
**3.** When magnesium is reacted with steam, it reacts rapidly forming a white solid and hydrogen gas.




(a) What property of hydrogen gas makes it to be collected as shown above. (1mark)

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(b) How would you show that the gas collected is hydrogen gas? (1mark)

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(c) When copper turnings were used instead of magnesium ribbon, hydrogen gas was not produced. Explain. (1mark)

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**4.** Draw **three** and **name** the apparatus used in the laboratory for measuring accurate volume of liquids.

(3marks)

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**5.** When a hydrated sample of calcium sulphate $CaSO_4.X\ H_2O$ was heated until all the water was lost, the following data was recorded.

Mass of crucible =30.296g

Mass of crucible + hydrated salt =33.111g

Mass of crucible + anhydrous salt =32.781g

Determine the empirical formula of the hydrated salt.

(RFM $CaSO_4$ =136 , $H_2O$ =18 ) (3marks)

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**6.** Starting with Zinc oxide describe briefly how a pure sample of zinc carbonate can be prepared in the laboratory. (3marks)

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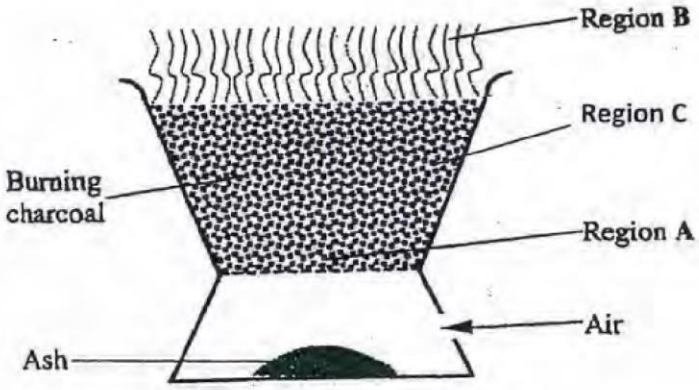
**7.** The diagram below represents a charcoal burner. Study it and answer the questions that follow




Write equations for the reactions taking place at ; (3marks)

A.....

B.....

C.....

**8.** In qualitative analysis, identification of sulphate ions can be represented by the equation below:

Sulphate ions + barium ions + hydrochloric acid ⟶ white precipitate

(a) Give the name of the white precipitate. (1mark)

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(b) Explain why dilute hydrochloric acid is used in sulphate ion test

(1 mark)

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**9.** The table below gives the atomic and ionic radii of elements A, B and C. Study it and answer the questions that follow.

| Element | Atomic radius (nm) | Ionic radius (nm) |
|---|---|---|
| A | 0.133 | 0.078 |
| B | 0.090 | 0.120 |
| C | 0.157 | 0.098 |

(a)Which elements are metals? Explain. (1mark)

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(b) The metals in (a) above belong to the same group of the periodic table. Which one is the most reactive? Explain. (1mark)

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**10.** Chlorine gas is bubbled into an aqueous solution of potassium iodide

(a) State the observation that would be made. (1mark)

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(b) Write a balanced chemical equation for the reaction that occurred. (1 mark)

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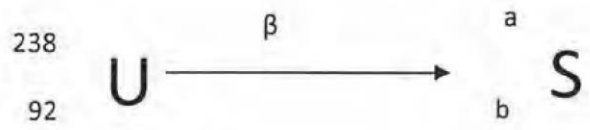
**11.** Below is part of a nuclear equation




(i) Determine the values of **a** and **b**

a..... ($^1/_2$mark)

b..... ($^1/_2$mark)

(ii) An element **Q** has a half- life of 12 years .What fraction of **Q** will remain after 36year (2marks)

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**12.** A certain chemical reaction takes place twice as quickly if their temperature is raised by 10°C. If a particular reaction takes 32 minutes at 20°C, how long does it take if the temperature is raised to 50°C. Explain why the reaction is faster. (3marks)

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**13.** $100cm^3$ of a mixture of ethane and excess oxygen were ignited. The final volume was cooled and bubbled through aqueous sodium hydroxide. The volume reduced by 32 $cm^3$. Calculate:-

(a) Composition of the original mixture. (2marks)

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(b) Volume of the excess oxygen. (1mark)

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**14.** Elements **A** and **B** have atomic numbers **6** and **8** respectively.

(a) Give the formula of the compound formed when **A** and **B** combine. (1mark)

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(b)Use dots (•) and crosses (x) to show bonding in the compound formed in (a) above. (1mark)

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(c) What type of structure will be formed when **A** and **B** combine. (1mark)

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**15.** (a) State Le- Chateliar's principle (1mark)

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(b) The equilibrium reaction of phenolphthalein indicator in water may be represented as follows

$$Hph_{(aq)} + H_2O \rightleftharpoons H_3O^+_{(aq)} + Ph^-_{(aq)}$$

Colourless Red

State and explain the observations that would be made when a few drops of nitric(V) acid is added to the equilibrium mixture (2marks)

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**16.** 1.0 g of an alloy of aluminium and copper was reacted with excess dilute hydrochloric acid. 840 $cm^3$ of hydrogen gas was produced at s. t. p. Calculate the percentage of aluminium in the alloy. (Al=27, Molar Gas Volume is 22400 $cm^3$).

(3marks)

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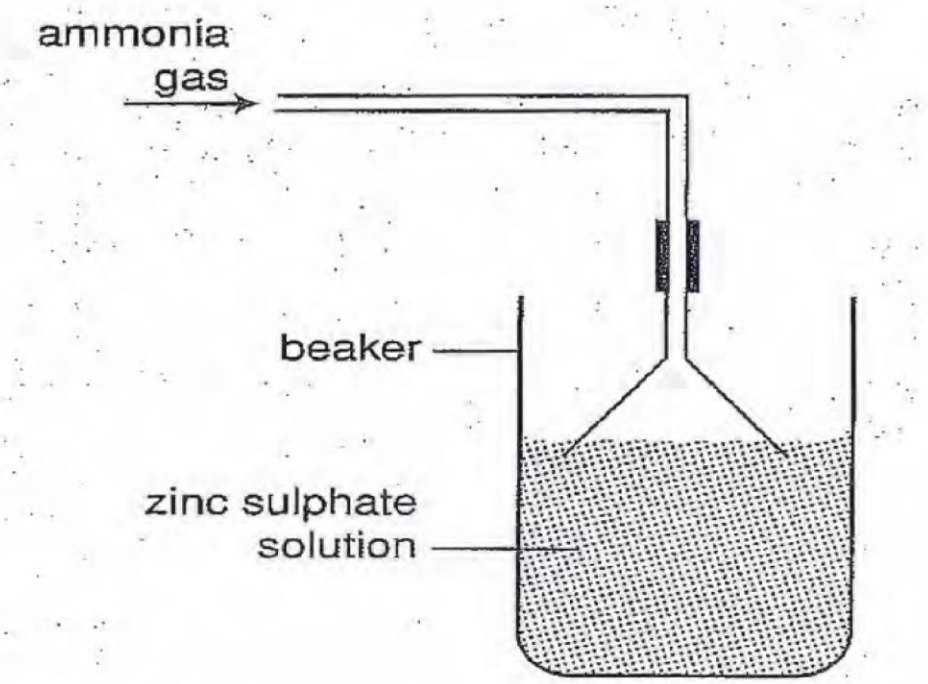
17. A student prepared ammonia gas and allowed it to pass into a solution of zinc sulphate as shown in the set- up below.




(a) State and explain the observations that were made in the beaker after sometime. (2marks)

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(b) Write the formula of the complex ion formed in the beaker. (1mark)

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**18.** A solution of ammonia gas in water turns red litmus paper blue while a solution of ammonia in methylbenzene does not. Explain. (2marks)

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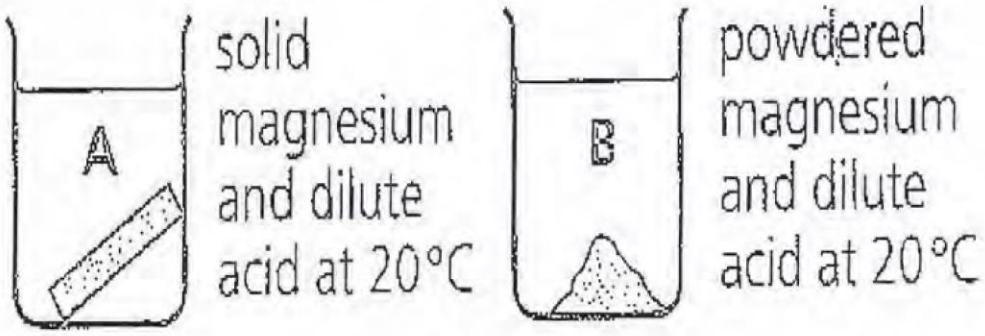
**19.** A student set-up the apparatus below to study how magnesium reacts with dilute hydrochloric acid.




The same mass of magnesium and the same volume of hydrochloric acid was used in each experiment. In which set-up did the reaction take a short time? Explain (2marks)

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**20.** (a) Determine the oxidation number of phosphorous in the compound $H_3PO_4$. (1mark)

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(b) Study the following equation.

$$Mg\,(s) + 2H_2O\,(l) \longrightarrow Mg\,(OH)_2\,(aq) + H_2\,(g)$$

Which species has undergone oxidation? Explain (1 mark)

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(c) Use the cell representation below to answer the question that follow

$$Cr_{(s)} / Cr^{3+}{}_{(aq)} // Fe^{2+}{}_{(aq)} / Fe_{(s)}$$

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

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**21.**(i) A radioactive substance emits three different particles. Name the particle with highest mass (1mark)

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(ii) Find the values of $Z_1$ and $Z_2$ in the nuclear equation below (1mark)

$$^{Z_1}_{92}U + {}^{1}_{0}n \longrightarrow {}^{94}_{38}Sr + {}^{140}_{Z_2}Xe + 2\,{}^{1}_{0}n$$

$Z_1$ .....

$Z_2$ .....

(iii) What type of nuclear reaction is represented in b(i) above (1mark)

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(iv) Give one harmful effect of isotopes (1mark)

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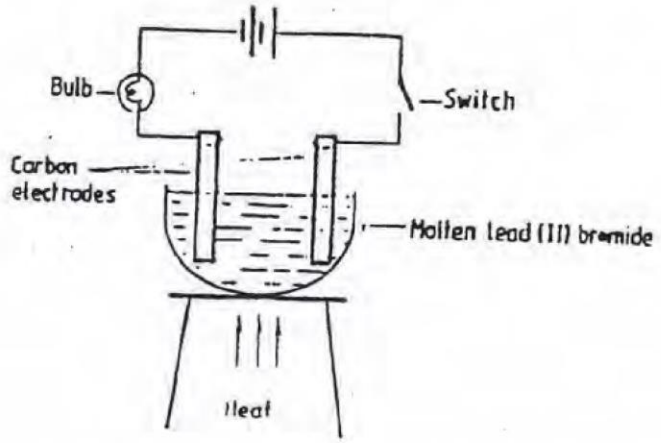
**22.** Study the set-up below and answer the questions that follow




State and explain the observations that would be made when the circuit is completed (3marks)

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**23.** (i) Define Solubility (1mark)

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(ii) The solubility of sodium nitrate at 90°C is 50g in 100g of water and at 15°C its solubility is 25g in 100g of water. 120g of a saturated solution of sodium nitrate is cooled from 90°C to 15°C. Calculate the mass of sodium nitrate crystals that would be formed at 15°C. (2marks)

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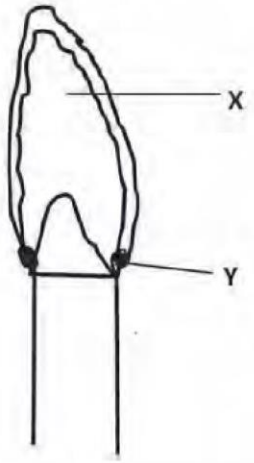
**24.** The diagram below represents a type of flame produced by a Bunsen burner




(a) Name the type of flame above (1mk)

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(b) Give a reason for your answer (1mark)

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(c) State the colour of the parts of the flame labeled **X** and **Y** (1mark)

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**25.** Give the systematic names of the following compounds

(a) $CH_3CH_2CH_2CH_2OH$ (1mark)

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(b)$CH_3CH_2CH_3$ (1mark)

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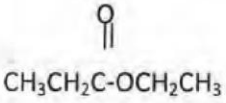
(c ) (1mark)



**26.** Use the data below to calculate the enthalpy change for the reaction below. (3marks)

$$CH_{4g)} + 2\ O_{2\,(g)} \longrightarrow 2\ CO_{2\,(g)} + 2\ H_2O_{(l)}$$

| **Bonds** | **Energy Kj** |
|---|---|
| C-H | 414 |
| O=O | 497 |
| C=O | 803 |
| H-O | 464 |

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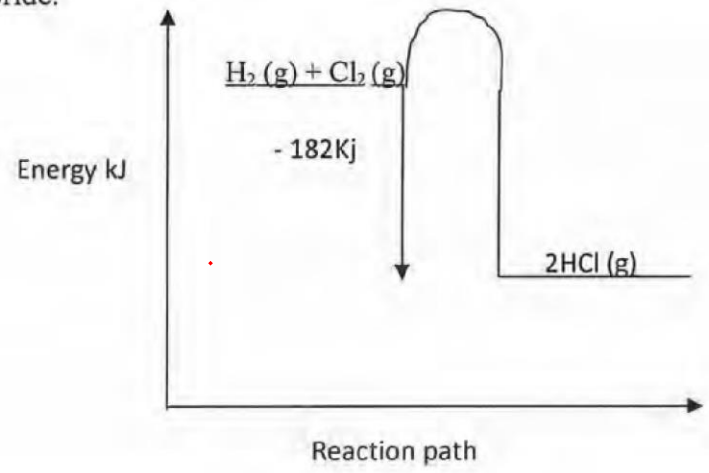
**27.** Use the energy profile below to calculate the molar enthalpy of formation of hydrogen chloride. (1mark)

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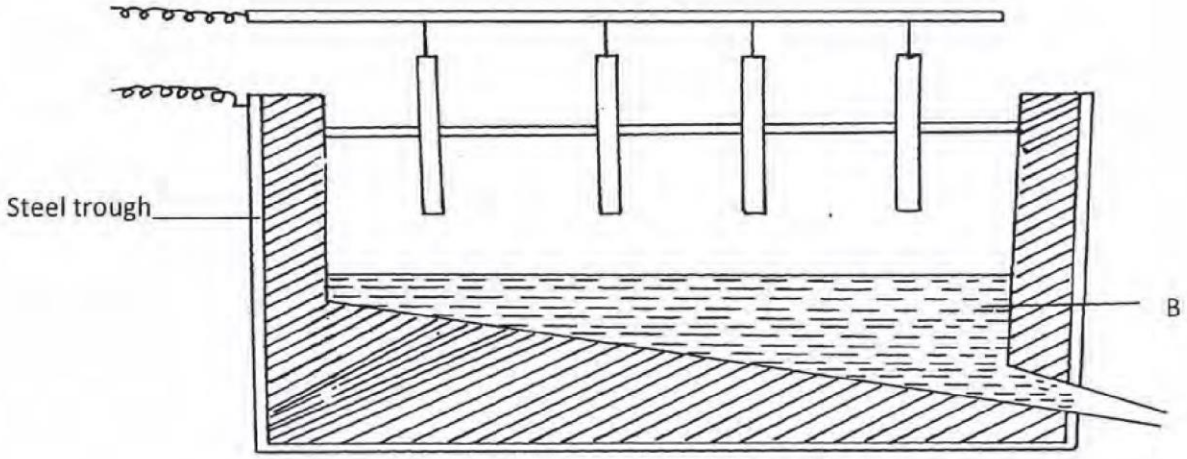
**28.** The diagram below represents the second stage in extraction of aluminium metal




(i) Write the formula of bauxite (1mark)

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(ii) How is the ore (bauxite) concentrated before it is electrolyzed (1mark)

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(iii)What is the purpose of dissolving electrolyte B in molten cryolite ($Na_3AlF_6$) (1mark)

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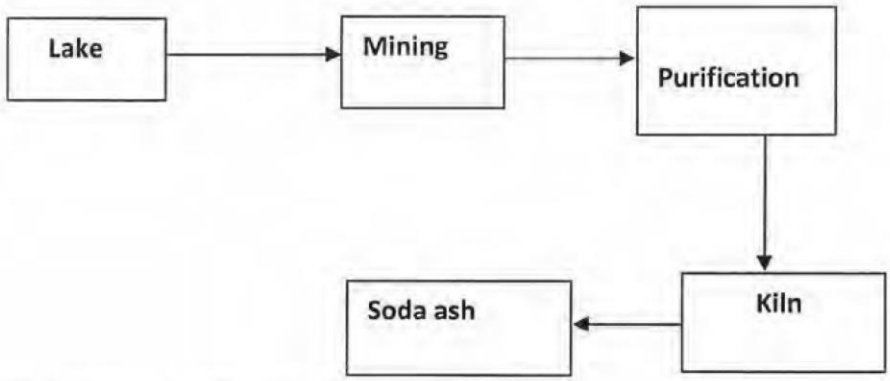
**29.** The flow chart below shows the soda ash manufacturing process at Lake Magadi. Study it and answer the questions that follow.




(a) Give the formula of trona (1mark)

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(b) Name **two** other salts found in the lake (1mark)

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(c) State **one** use of sodium hydrogen carbonate (1mark)

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