

Name ..... Index Number .....

233/1  
CHEMISTRY  
Paper 1  
Nov. 2016  
2 hours

Candidate's Signature .....

Date .....



**THE KENYA NATIONAL EXAMINATIONS COUNCIL**  
**Kenya Certificate of Secondary Education**  
**CHEMISTRY**  
**Paper 1**  
**(THEORY)**  
2 hours

**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 silent non-programmable electronic calculators may be used.
- (e) All working must be clearly shown where necessary.
- (f) **This paper consists of 16 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 Examiner's Use Only**

| Question | Maximum Score | Candidate's Score |
|----------|---------------|-------------------|
| 1-29     | 80            |                   |

1. A student investigated the effect of an electric current by passing it through some substances. The student used inert electrodes and connected a bulb to the circuit. The table below shows the substances used and their states.

| Experiment | Substance            | State    |
|------------|----------------------|----------|
| 1          | Potassium carbonate  | Solid    |
| 2          | Copper (II) sulphate | Solution |
| 3          | Sugar                | Solution |
| 4          | Lead (II) iodide     | Molten   |

- (a) In which experiment did the bulb not light? (1 mark)

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- (b) Explain your answer in (a) above. (2 marks)

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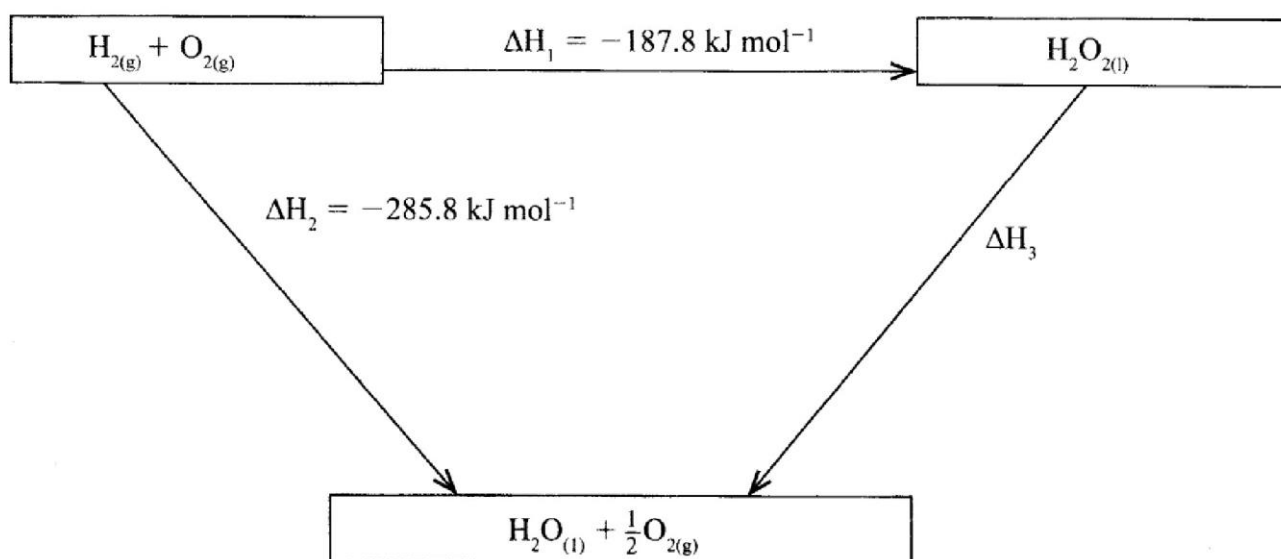
2. An alkanol has the following composition by mass: hydrogen 13.5%, oxygen 21.6% and carbon 64.9%.

- (a) Determine the empirical formula of the alkanol. (C = 12.0, H = 1.0, O = 16) (2 marks)

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- (b) Given that the empirical formula and the molecular formula of the alkanol are the same, draw the structure of the alkanol. (1 mark)

3. The figure below shows an energy cycle.



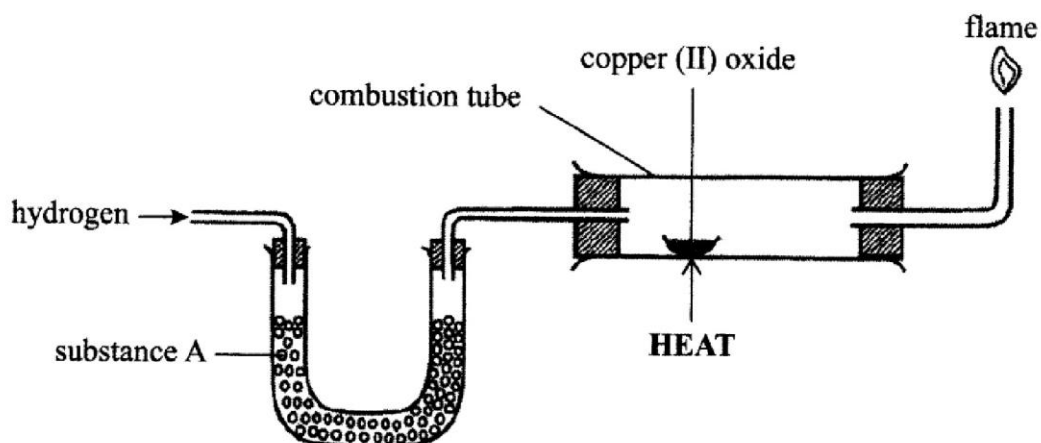
- (a) Give the name of the enthalpy change  $\Delta H_1$ . (1 mark)

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- (b) Determine the value of  $\Delta H_3$ . (2 marks)

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4. The set up below was used to investigate the reaction between dry hydrogen gas and copper (II) oxide.



- (a) Name substance A. (1 mark)

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- (b) State the observation made in the combustion tube. (1 mark)

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- (c) Explain the observation made in (b) above. (1 mark)

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5. Starting with sodium metal, describe how a sample of crystals of sodium hydrogen carbonate may be prepared. (3 marks)

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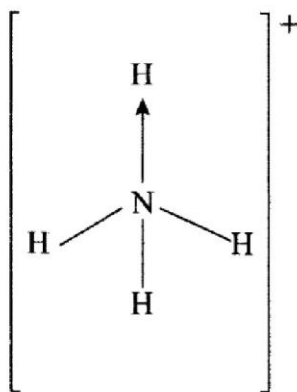
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6. Ammonium Ion has the following structure.

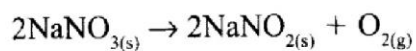


Label on the structure the:

- (a) Covalent bond (1 mark)
- (b) Coordinate (dative) bond (1 mark)



7. When 8.53 g of sodium nitrate was heated in an open test tube, the mass of oxygen gas produced was 0.83 g. Given the equation of the reaction as:



Calculate the percentage of sodium nitrate that was converted to sodium nitrite  
(Na = 23.0, N = 14.0, O = 16.0)

(3 marks)

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8. Aluminium is both malleable and ductile;

(a) What is meant by?

(i) Malleable

(½ mark)

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(ii) Ductile

(½ mark)

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(b) State **one** use of aluminium based on;

(i) Malleability

(½ mark)

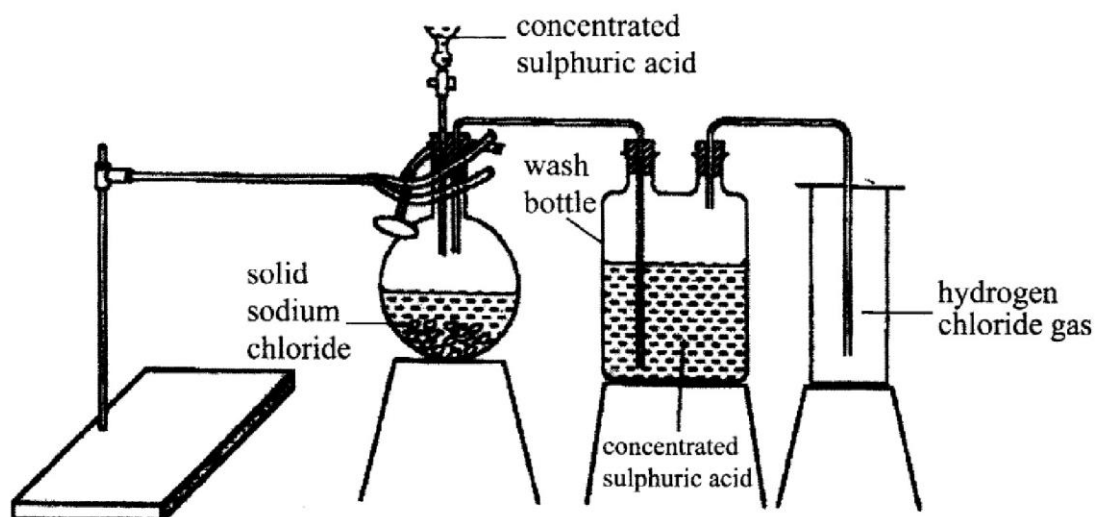
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(ii) Ductility

(½ mark)

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9. The diagram below represents the set up that was used to prepare and collect hydrogen chloride gas in the laboratory.



(a) State the purpose of concentrated sulphuric acid in the wash bottle.

(1 mark)

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(b) Write an equation for the reaction between dry hydrogen chloride gas and heated iron.

(1 mark)

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10. Iron (III) oxide was found to be contaminated with copper (II) sulphate. Describe how a pure sample of iron (III) oxide can be obtained. (3 marks)

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11. Complete the nuclear equation below.



- (b) The half life of  ${}_{53}^{131}\text{I}$  is 8 days. Determine the mass of  ${}_{53}^{131}\text{I}$  remaining if 50 grammes decayed for 40 days. (2 marks)

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- (c) Give **one** harmful effect of radioisotopes. (1 mark)

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12. During an experiment, chlorine gas was bubbled into a solution of potassium iodide.

(a) State the observations made. (1 mark)

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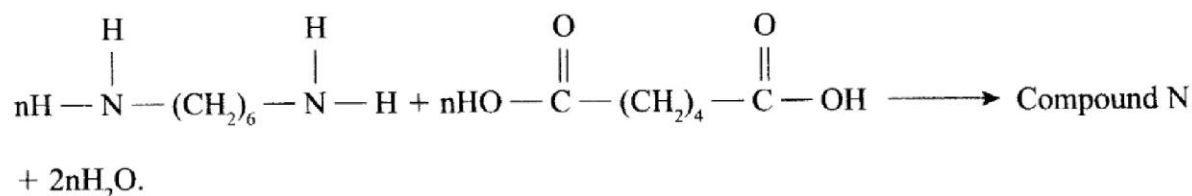
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(b) Using an ionic equation, explain why the reaction is redox. (2 marks)

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13. (a) Draw the structure of compound N formed in the following reaction. (1 mark)



(b) Give **one** use of compound N. (1 mark)

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14. When fuel burns in the internal combustion engine at high temperature, one of the products formed is nitrogen (II) oxide.

(a) Write the equation for the formation of nitrogen (II) oxide. (1 mark)

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(b) Give a reason why nitrogen (II) oxide is not formed at room temperature. (1 mark)

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- (c) Describe how formation of nitrogen (II) oxide in the internal combustion engine leads to gaseous pollution. (2 marks)

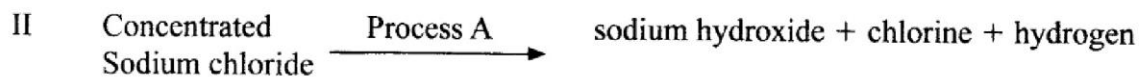
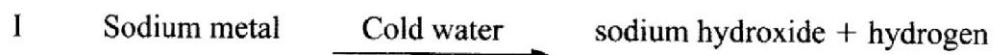
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15. Sodium hydroxide can be prepared by the following methods; I and II



- (a) Name **one** precaution that needs to be taken in method I. (1 mark)

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- (b) Give the name of process A. (1 mark)

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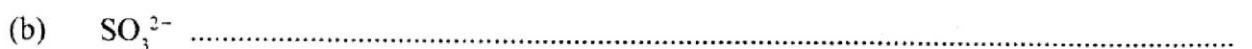
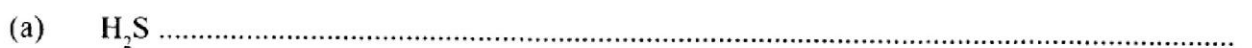
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- (c) Give **one** use of sodium hydroxide. (1 mark)

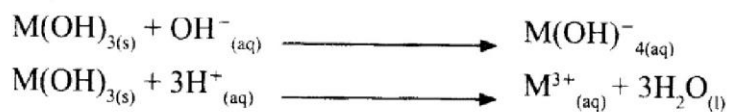
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16. The atomic number of sulphur is 16. Write the electron arrangement of sulphur in the following? (2 marks)



17. A compound whose general formula is  $M(OH)_3$  reacts as shown by the equation.



- (a) What name is given to compounds which behave like  $M(OH)_3$  in the two reactions. (1 mark)

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- (b) Name **two** elements whose hydroxides behave like that of M. (2 marks)

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18. A water trough, aqueous sodium hydroxide, burning candle, watch glass and a graduated gas jar were used in an experimental set up to determine the percentage of active part of air. Draw a labelled diagram of the set up at the end of the experiment. (3 marks)

19. In an experiment on rates of reaction, potassium carbonate was reacted with dilute sulphuric (VI) acid.

- (a) What would be the effect of an increase in the concentration of the acid on the rate of the reaction? (1 mark)

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- (b) Explain why the rate of reaction is found to increase with temperature. (2 marks)

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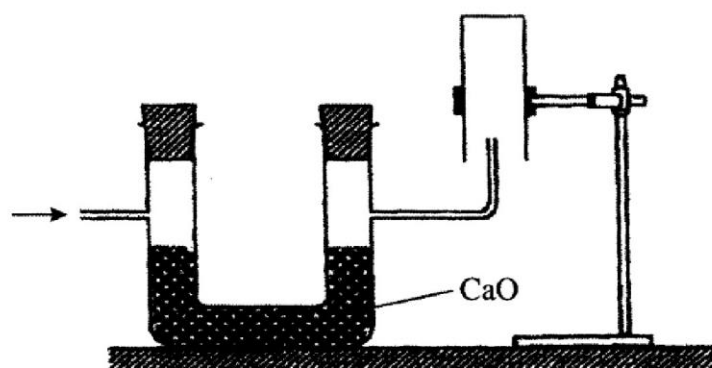
20.  $60 \text{ cm}^3$  of oxygen gas diffused through a porous partition in 50 seconds. How long would it take  $60 \text{ cm}^3$  sulphur (IV) oxide gas to diffuse through the same partition under the same condition? (S = 32.0, O = 16.0) (3 marks)

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21. Draw and name the isomers of pentane.

(3 marks)

22. The set up below was used to collect a dry sample of a gas.



Give **two** reasons why the set up cannot be used to collect carbon (IV) oxide gas. (2 marks)

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23. Given the following substances: wood ash, lemon juice and sodium chloride.

(a) Name **one** commercial indicator that can be used to show whether wood ash, lemon juice and sodium chloride are acidic, basic or neutral. (1 mark)

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(b) Classify the substances in (a) above as acids bases or neutral. (2 marks)

| Acid | Base | Neutral |
|------|------|---------|
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24. Describe how a solid sample of potassium sulphate can be prepared starting with 200 cm<sup>3</sup> of 2M potassium hydroxide. (3 marks)

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25. Charcoal is a fuel that is commonly used for cooking. When it burns it forms two oxides.

(a) Name the **two** oxides (2 marks)

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(b) State **one** use of the two oxides. (1 mark)

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26. Hydrogen sulphide is a highly toxic and flammable gas. It is normally prepared in a fume chamber.

(a) Name **two** reagents that can be used to prepare hydrogen sulphide in the laboratory. (1 mark)

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- (b) One of the uses of hydrogen sulphide is to produce sulphur as shown in the following equation.



Identify the reducing agent in this reaction and give a reason for your answer. (1 mark)

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- (c) Other than production of sulphuric (VI) acid. State **one** commercial use of sulphur. (1 mark)

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27. Describe an experimental procedure that can be used to extract oil from nut seeds. (2 marks)

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28. A mixture contains ammonium chloride, Copper (II) oxide and sodium chloride. Describe how each of the substances can be obtained from the mixture. (3 marks)

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29. When a student was stung by a nettle plant, a teacher applied an aqueous solution of ammonia to the affected area of the skin and the student was relieved of pain. Explain. (2 marks)

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