Name: ....Index: ....

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233/1
CHEMISTRY
Theory
Paper 1
July/August, 2018
Time: 2 Hours

FORM FOUR MID-YEAR EVALUATION EXAMINATION
Kenya Certificate of Secondary Education (KCSE)
Chemistry (Paper 1)

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 all the questions in English***

For examiners' use only.

| Questions	Max-score	Candidates score
1-31	80	

Turn over

1. a) Name the process used to separate two solids both soluble in the same solvent when the solids are both present in the mixture   (1 mark)

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    b) Sodium chloride is neither deliquescent nor hygroscopic. Explain why common salt left on a table overnight becomes wet   (2 marks)

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2. The diagram below shows effect of surface area on the rate of reaction
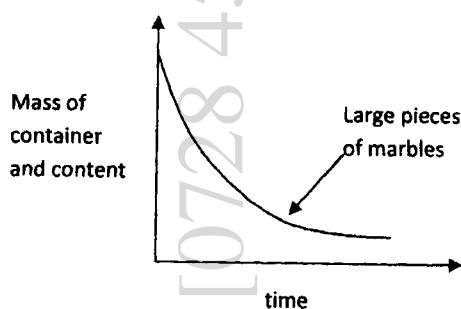
On the same diagram sketch the graph that would be obtained if smaller pieces of marble were used. Explain your answer using the kinetic theory of matter   (2 marks)

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3. Below are cross - sections of two pieces coated with zinc and copper respectively.
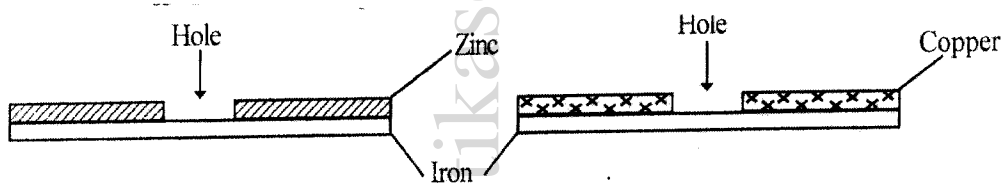
Which piece would rust when the holes were filled with water and left for sometimes? Explain.   (2 marks)

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4.	Name three sub – atomic particles found in an atom and state where they are found.

(3 marks)

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5.	Use the information in the table below to answer the questions that follow

Element	Atomic Radii (nm)	Tonic radii nm
D	0.231	0.133
E	0.181	0.099
F	0.160	0.065
G	0.195	0.114

a)	Are the members in this group likely to be conductor or non – conductors?

(1 mark)

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b)	Which element would have the lowest atomic number? Explain.	(1 mark)

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6.	When an electric current was passed through molten substances M and N in different containers the observations in the table below were made

Molten M	Conduct electric current and is not decomposed
Molten N	Conduct electric current and a gas is formed at one of the electrodes

Suggest the type of bonding present in;

a)	Substance M

(1 mark)

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b)	Substance N

(1 mark)

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7. Use your knowledge of structure and bonding to explain why carbon dioxide is a gas at room temperature and pressure, whereas silicon (IV) oxide is a solid. (2 marks)

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8. You are provided with three black powders known to be copper (ii) oxide, manganese (iv) oxide and iron (ii) sulphide. How would you distinguish between the three using hydrochloric acid only. (3 marks)

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9. Hydrogen sulphide gas was lighted in a gas jar using the arrangement shown below.
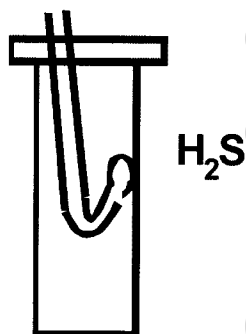
    a) State what was observed if acidified potassium manganate (VII) is poured into the gas jar and shaken. (2 marks)

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    b) Write an equation for combustion of hydrogen sulphide in air. (Excess) (1 mark)

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10. The following were the results obtained in an experiment to determine solubility of potassium nitrate at room temperature.

    Mass of evaporating dish 14.32g

    Mass of evaporating dish + solution = 35.70g

    Mass of evaporating dish + salt =18.60g

a). What is solubility? (1 mark)

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b). Calculate the solubility of potassium nitrate from the specimen results

(2 marks)

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11. The empirical formula of a hydrocarbon is (CH_2). It has a density of $0.001167g/cm^3$ at room temperature and pressure. (Molar gas volume at r.t.p is $24dm^3$)

a) Determine the molecular formula of the hydrocarbon (2 marks)

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b) Draw the structural formula of the hydrocarbon (1 mark)

12. Sodium hydroxide pellets were accidentally mixed with sodium chloride. 17.6g of the mixture were dissolved in water to make one litre of solution. $100cm^3$ of the solution was neutralized by $40cm^3$ of

0.5M sulphuric (VI) acid.

(i) Write an equation for the reaction that took place. (1 mark)

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(ii) Calculate:

I. Number of moles of the substance that reacted with sulphuric (VI) acid.

(2 marks)

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II. Number of moles of the substance that would react with sulphuric (VI) acid in one litre of solution. (1 mark)

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III. Mass of the unreacted substance in one litre of solution.
(H=1, Na=23, Cl=35.5, O=16).

(2 marks)

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13. Two gases X and Y have relative densities 1.98 and 2.90 respectively. They diffuse under the same conditions

a) How do their rate of diffusion compare? (2 marks)

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b) Determine the relative molecular mass of X given that the relative molecular mass of Y is 64. (1 mark)

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14. A mass of 2.5g of acid HX was dissolved in water and the resulting solution was diluted to a total of $250cm^3$, $15cm^3$ of the final solution was required to neutralize $25.0cm^3$ of 0.1M aqueous potassium hydroxide. Calculate the relative molecular mass of the acid

(3 marks)

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15. The set up below was used to investigate a chemical property of carbon. Study it and answer the questions that follow.

Boiling tube
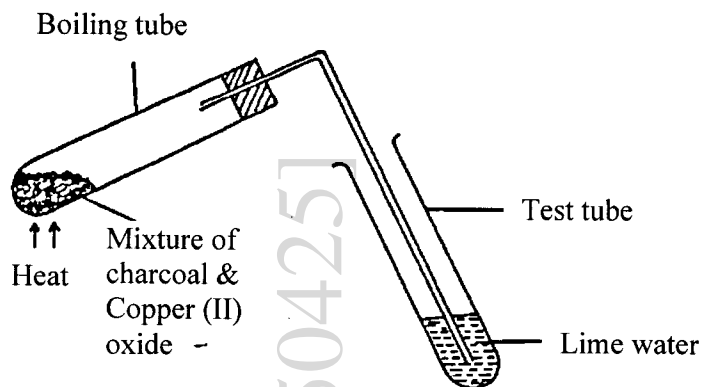
a) What observations were made on heating the mixture?   (2 marks)

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b) What is the industrial application of carbon in terms of property investigated?
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16. 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)

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     (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)

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17. 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.

— Graphite electrode
— Beaker
— Molten sodium chloride
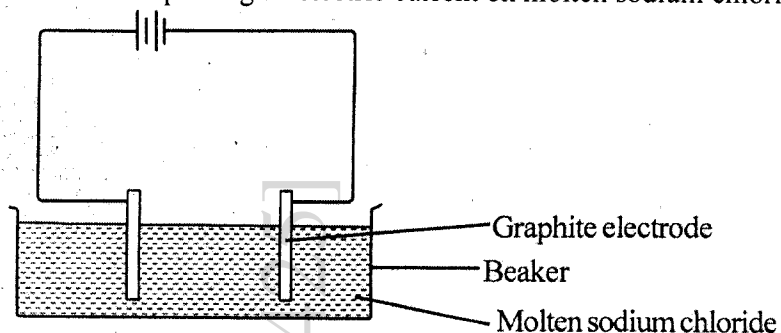
(i) Molten Sodium chloride is a binary electrolyte. State the meaning of the term binary electrolyte. (1 mark)

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

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

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18. a) Give a reasons why ethanoic acid has a higher boiling point than ethanol which has the same number of Carbon atoms (1mark)

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b) Draw the structural formula of ethanoic acid (1 mark)

19. RCOO – Na^+ and RCH_2OSO_3 – Na^+ represent two types of cleansing agents

a) Name the class of cleansing agent to which each belongs (1 mark)

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b) Which one of the two cleansing agents is likely to polute the environment? Explain.
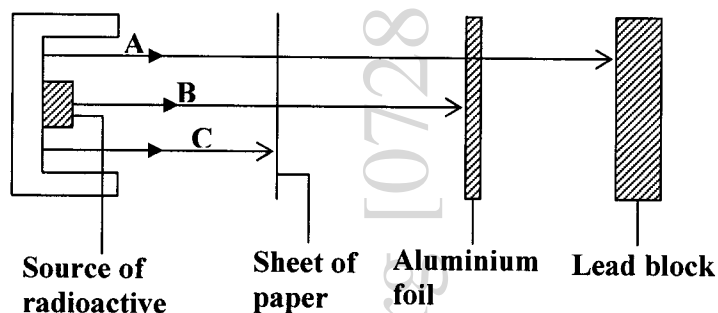
(2 marks)

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20. a) State three differences between chemical and nuclear reactions. (3 marks)

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b) Study the figure below and answer the questions that follow

Identify the radiations A, B and C (3 marks)

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21. A volume of $80cm^3$ of a mixture of propane (C_3H_8) and oxygen were ignited in an experiment. The products were cooled and passed through an aqueous sodium hydroxide. The final volume was reduced by $30cm^3$.

a) Write the equation for the combustion of propane (1 mark)

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b) Determine the volume of;
   i) The component of the original mixture (2 marks)

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   ii) Residual oxygen (1mark)

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

Ethanol is formed as shown below

$2C_{(s)} + 3H_{2(g)} + ½ O_{2(g)} \longrightarrow C_2H_5OH_{(l)}$
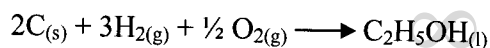
ΔH_c carbon $= -393kJmol^{-1}$
ΔH_c Hydrogen $= -286kJmol^{-1}$
ΔH_c ethanol $= -1368kJmol^{-1}$

Draw the energy cycle diagram and for the formation and combustion of ethanol and calculate the heat of formation of ethanol (3 marks)
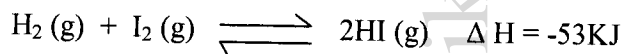
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23. Consider the reversible reaction below

$H_2 (g) + I_2 (g) \rightleftharpoons 2HI (g) \quad \Delta H = -53KJ$

Explain how each of the following factors would affect the concentration of hydrogen iodide
a) Increase in temperature (1 mark)

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b) Adding helium gas (1 mark)

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24. Samples of air taken from industrial areas are found to contain small amounts of carbon monoxide.

(i) Explain how this carbon monoxide is formed. (2 marks)

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(ii) State why carbon monoxide should not be inhaled. (1 mark)

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25. Magnesium sulphate and lead (II) sulphate are examples of salts. A student prepared magnesium sulphate crystals starting with magnesium carbonate. The student carried out the experiment in four steps.

Step 1   The student added excess magnesium carbonate to a small volume of dilute sulphuric acid until no more magnesium carbonate would react.

Step 2   The student filtered the mixture.

Step 3   The student heated the filtrate obtained from step 2 until it was saturated.

Step 4   The student allowed the hot filtrate to cool to room temperature and then removed the crystals which formed.

(i) How did the student know when the reaction had finished in step 1? (1 mark)

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(ii) Name the residue in step 2. (1 mark)

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(iii) Explain why magnesium sulphate crystals form during step 4. (1 mark)

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26. Describe how a student could prepare the ester methyl-ethanoate in a school laboratory. In your description give
- the names of the two starting organic chemicals,
- the essential reaction conditions needed,
- a chemical equation for the reaction. (4 marks)

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