Name _____   Adm No. _____

Candidate's Signature _____

Date _____

233/1
CHEMISTRY
PAPER 1
THEORY
2016
2 HOURS

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Kenya Certificate of Secondary Education
CHEMISTRY
PAPER 1
THEORY
2 HOURS

INSTRUCTIONS TO CANDIDATES

(a) Write your name and admission 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.
(d) Mathematical tables and silent electronic calculators may be used
(e) All working MUST be clearly shown where necessary.

FOR EXAMINER'S USE ONLY

QUESTIONS	MAXIMUM SCORE	CANDIDATE'S SCORE
1 – 30	80	

This paper consists of 13 printed pages

Turn Over

1.   In terms of structure and bonding explain why diamond is used in making drill bits.   (2 marks)

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2.   Name the process that takes place when:
      (a) Natural fats or oils are hydrolysed using alkalis.   (½ mark)

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      (b) Sulphur is added to natural rubber and heated to form cross-links.   (½ marks)

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      (c) $Fe^{2+}_{(aq)}$ changes to $Fe^{3+}_{(aq)}$ (½ marks)

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3.   (a) When hydrogen and iodine are heated in a sealed container, equilibrium is reached
      with the product hydrogen iodide.

            $H_{2 (g)} + I_{2 (g)} \rightleftharpoons 2HI_{(g)}$; $\Delta H = -9.6$ kJ mol^{-1}

            Predict the effect of the following on this equilibrium
      m: (2 marks)
            Increasing the temperature

_____

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            Increasing the pressure

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4. A coin is analysed by dissolving it in nitric (V) acid. To the resulting solution an excess
    of aqueous ammonia is added and the mixture is filtered. A brown precipitate remains in the filter
    paper and a deep blue solution is obtained as the filtrate. Which metals does the coin
    contain?   (2 marks)

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5. (a) State the observations made at the end of the experiment when a mixture of iron powder
        and sulphur is heated in a test tube.   (1 mark)

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    (b) Crude oil contains sulphur. What would be the effect to the environment of using fuel
        containing sulphur.   (1 mark)

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6. A sample of river water is suspected to contain zinc and sulphate ions. Describe how the
    presence of zinc ions and sulphate ions can be established.   (3 marks)

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7. (a) State Charles' law.   (1 mark)

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(b) A given sample of oxygen gas occupies $16cm^3$ at 7^0C and 335 mmHg pressure.
At what temperature will it occupy $10cm^3$ at a pressure of 670 mmHg?   (2 marks)

8.   The data given below was recorded when metal M was completely burnt in air. M is
      not the actual symbol of the metal. (R.A.M; M = 56, O = 16)
          Mass of empty crucible and lid = 10.240g
          Mass of crucible, lid and metal M = 10.352g
          Mass of crucible, lid and metal oxide = 10.400g

(a) Determine the mass of;
      (i) Metal M   (½ mark)

              (ii) Oxygen   (½ mark)

(b) Determine the empirical formula of the metaloxide.   (2 marks)

9. When Xcm^3 of a solution of 0.15M magnesium nitrate were reacted with excess ammonium carbonate, the mass of magnesium carbonate formed was 8.4g.
(a) Write the ionic equationfor the reaction that took place. (1 mark)

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(b) Calculate the value of X. (C = 12.0, Mg = 24.0, O = 16.0) (2 marks)

10. Bromine reacts with iron to form iron (III) bromide whereas iodine reacts with iron to form iron (II) iodide. Explain. (2 marks)

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11. Four solutions of pH 7, 2, 8.5 and 13 were reacted with calcium turnings. In which of the solutions would hydrogen gas be produced. Explain each case. (3 marks)

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12. The diagram below shows a structure of water molecules.
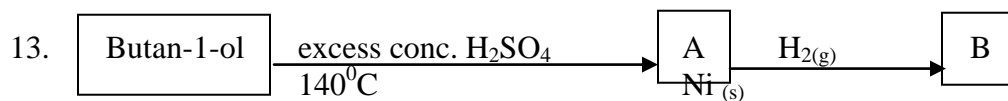H H X H Y H H H O O O

(a) Name the bonds.

X _____ (½ mark)

Y _____ (½ mark)

(b) Using dot (.) and cross (x) diagram, show the bonding in the compound
phosphonium ion, pH_4^+. (P = 15.0, H = 1.0)   (2 marks)

13. | Butan-1-ol | excess conc. H_2SO_4 → | A | $H_{2(g)}$ → | B |
     140^0C $Ni_{(s)}$

(a) Draw two structures of isomers of compound A.   (2 marks)

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(b) Give two products formed when B is burnt in excess oxygen.   (1 mark)

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14. An excess of zinc powder was added to $100cm^3$ of 0.5M copper (II) sulphate solution and the temperature changed from 20^0C to 26.5^0C. Calculate the molar heat of reaction given that the specific heat capacity of water = $4.2 \text{ J g}^{-1} \text{k}^{-1}$ and the density of the solution is 1gcm^{-3}. (3 marks)

15. The ionization energies for three elements A, B and C are shown in the table below.

Element	A	B	C
Ionization energy (kJmol^{-1})	492	520	415

(a) What is meant by ionization energy? (1 mark)

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(b) Which element is the strongest reducing agent? Give a reason. (1 ½ marks)

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16. Starting with $50cm^3$ of 2.8M sodium hydroxide, describe how a sample of pure sodium sulphate crystals can be prepared. (3 marks)

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17. Excess hydrogen gas was passed over heated copper (II) oxide in a combustion tube.
(a) State the observation made in the combustion tube at the end of the experiment.   (1 mark)

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(b) Write an equation for the reaction that took place in the combustion tube.   (1 mark)

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(c) Name one industrial use of hydrogen.   (1 mark)

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18. Boilers used for boiling hard water are normally covered with boiler scale after sometime.
(a) What is the chemical name for the boiler scale?   (1 mark)

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(b) How is the boiler scale removed?   (1 mark)

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(c) State any one advantage of using hard water.   (1 mark)

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19. The table below show the tests carried out on a sample of water and the results obtained.

I	Tests	Observations
	Addition of sodium hydroxide solution drop wise until in excess	White precipitate which dissolved in excess
II	Addition of excess aqueous ammonia	Colourless solution obtained
III	Addition of dilute hydrochloric acid followed by barium chloride	White precipitate

(a) Identify the anion present in water. (1 mark)

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

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(c) Write the formula of the complex ion formed in II. (1 mark)

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20.   In the industrial preparation of oxygen, state
       (a) How dust particles are removed from air. (1 mark)

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(b) Why carbon (IV) oxide removed before the mixture is cooled to -25^0C. (1 mark)

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21.   The below show the mass spectrum of element
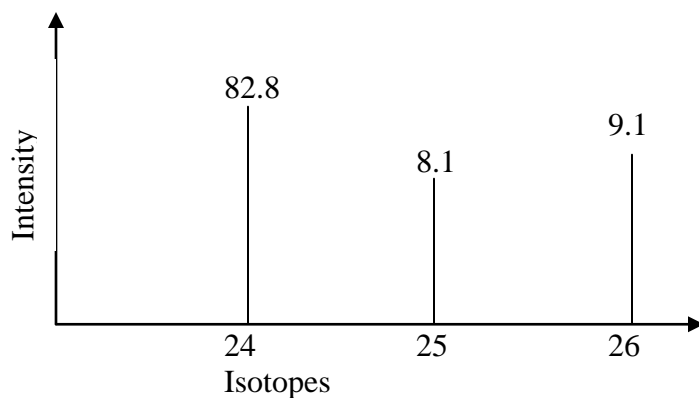
Calculate the relative atomic mass (R.A.M) of Q. (3 marks)

22. (a) Name two ores of zinc metal. (1 mark)
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(b) What is the role of coke in the smelting furnace during industrial extraction of zinc.   (1 mark)
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23. The diagram below shows a set-up for the laboratory preparation of dry chlorine gas.
Conc. Hydrochloric acid MnO_2

(a) Complete the diagram above to show how dry chlorine gas is collected. (2 marks

(b) Give one precaution that the student must observe when carrying out this experiment. (1 mark)

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24.   Zinc oxide reacts with both acids and alkalis.
       (a) Write the equation for the reaction between zinc oxide and :
            (i) Dilute hydrochloric acid.   (1 mark)

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            (ii) Sodium hydroxide solution.   (1 mark)

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       (b) What property of zinc oxide is shown by the reactions in (a) above?   (1 mark)

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25.   Explain how the rates of diffusion for equal quantities of nitrogen and oxygen compare
       under the same conditions. (N = 14; O = 16) Show your working.   (3 marks)

26.   Explain why group II elements are generally less reactive than group I elements.   (2 marks)

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27.   (a) Radium 226, whose atomic number is 88, undergoes beta decay to form a new element X.
Write an equation for this change.   (1 mark)

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(b) Given 1g of $^{214}_{84}$Po; how much of it would be left after 3×10^{-4} seconds.
(Half life Po $= 1.5 \times 10^{-4}$ seconds)   (1 mark)

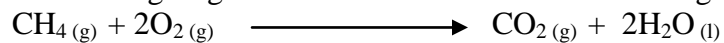(c) Give one difference between nuclear and chemical reactions.   (1 mark)

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28.   Use the bond energies given below to calculate the heat change of reaction.   (3 marks)
$$CH_{4\,(g)} + 2O_{2\,(g)} \longrightarrow CO_{2\,(g)} + 2H_2O_{(l)}$$

Bond   Bond energy (kJmol^{-1})
C – H   413
O = O   498
C = O   740
O – H   464

29. Calculate the volume o sulphuric acid of 0.2M concentration needed to neutralize completely $25.0cm^3$ of potassium hydroxide solution whose concentration is 0.5M.　　(3 marks)

30. Use the half cell reactions and standard electrode potentials given below to show that chlorine can displace iodine from a solution containing iodide ions.　　(3 marks

Half-cell equation　　　　　　　　　　　E^θ(Volts)

$Cl_{2\,(g)} + 2e^- \longrightarrow 2\,Cl^-_{(aq)}$　　　　+ 1.36

$I_{2\,(s)} + 2e^- \longrightarrow 2\,I^-_{(aq)}$　　+ 0.54.