NAME…………………..………………………………………… INDEX NO……........……………..…...

SCHOOL……………………………………………………. CANDIDATE'S SIGNATURE……..…..

DATE………...……………………………..

233/1
CHEMISTRY
(THEORY)
PAPER 1
JULY/AUGUST 2014
TIME: 2 HOURS

KURIA WEST SUB-COUNTY JOINT EXAMINATION - 2014

Kenya Certificate of Secondary Education
CHEMISTRY
PAPER 1
(THEORY)
TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES:

- *Write your **name** and **index number** in the spaces provided **above**.*
- ***Sign** and write the **date** of examination in the spaces provided **above**.*
- *Answer **all** the questions in the spaces provided.*
- *Mathematics tables and electronic calculators may be used.*
- *All working must be clearly shown where necessary.*

FOR EXAMINER'S USE ONLY:

Question	Maximum Score	Candidates Score
1 - 30	80	

*This paper consists of **12** printed pages.*
Candidates should check to ascertain that all the pages are printed
as indicated and that no questions are missing.
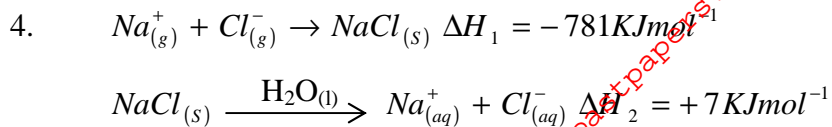
1   A certain element Y has atomic number 15 and mass number of 31.
     (a)   Calculate the number of neutrons in the element.   (1mk)

     _____

     (b)   Write the electron arrangement of the ion formed by element Y.   (1mk)

     _____

     (c)   How would the atomic size of the above element compare with another atom X whose atomic
            number is 11 and mass number 23? Explain.   (1mk)

     _____

     _____

     _____

2.   Explain why the pH of 1.0M hydrochloric acid is 1.0M while that of 1.0M ethanoic acid is 5.0. (2mks)

     _____

     _____

     _____

     _____

3.   In an experiment hydrogen sulphide was passed through 1m $CuSO_{4(aq)}$ in a boiling tube as shown in
     the diagram.
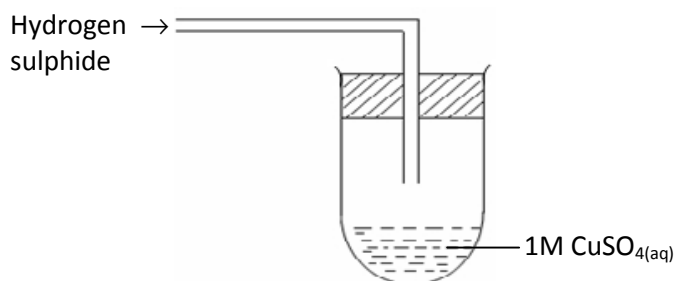
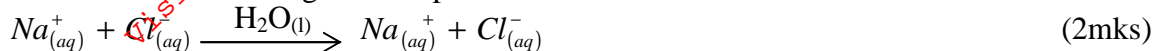   (a)   State the observation made in the boiling tube.   (1mk)

     _____

     _____

     (b)   Write the ionic equation for the above reaction.   (1mk)

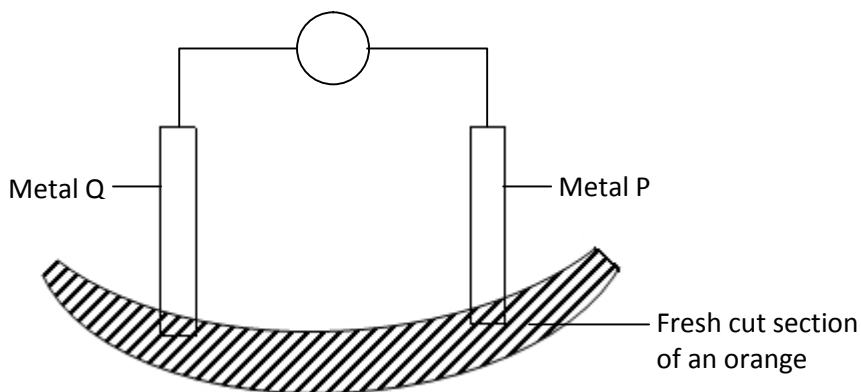   (c)   What precaution should be taken in carrying out this experiment? Give a reason? (1mk)

     _____

     _____

     _____

4. $Na^+_{(g)} + Cl^-_{(g)} \rightarrow NaCl_{(s)}$ $\Delta H_1 = -781 KJmol^{-1}$

$NaCl_{(s)} \xrightarrow{H_2O_{(l)}} Na^+_{(aq)} + Cl^-_{(aq)}$ $\Delta H_2 = +7 KJmol^{-1}$

(a)   What is the name of ΔH_1? (1mk)

_____

(b)   Calculate the heat change for the process
       $Na^+_{(aq)} + Cl^-_{(aq)} \xrightarrow{H_2O_{(l)}} Na^+_{(aq)} + Cl^-_{(aq)}$ (2mks)

5.   The set up **below** was used to show that metal **P** is more reactive than **Q**.

Metal Q —

Metal P

Fresh cut section
of an orange

(a)   Show the direction of flow of electrons on the diagram using an arrow. (1mk)

(b)   Explain your answer in (a) above. (1mk)

_____

_____

_____

6.   The graph **below** shows the amount of calcium carbonate and calcium chloride varying with time in the reaction.

$CaCO_{3(s)} + 2HCl_{(aq)} \rightarrow CaCl_{2(aq)} + H_2O_{(l)} + CO_{2(g)}$

Amount
(g)

Curve I

Curve II

Time(s)
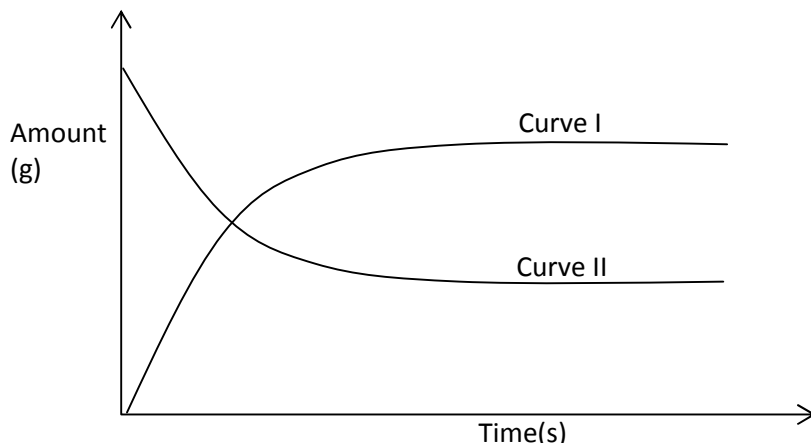
(a) Which curve shows the amount of calcium chloride varying with time? (1mk)

_____

(b) Explain why the two curves become horizontal after a given period of time. (1mk)

_____

_____

_____

(c) Sketch on the graph how curve II would appear if the experiment was repeated using a more dilute hydrochloric acid solution. (1mk)

7. The structure below represents two cleansing agents, L_1 and L_2.

$$L_1 \rightarrow R - CH_2 - CH_3$$
$$|$$
$$OSO_3Na^+$$

$$L_2 \rightarrow R - COONa^+$$
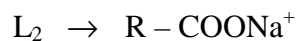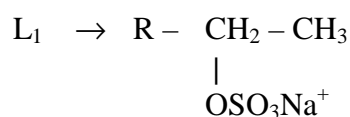
(i) Identify each of the two cleansing agents, L_1 and L_2.

L_1 _____ (½mk)

L_2 _____ (½mk)

(ii) State a disadvantage of each of the above cleansing agents.

L_1 _____ (1mk)

L_2 _____ (1mk)

8. 22.2cm³ of sodium hydroxide solution, containing 4.0g per litre of sodium hydroxide were required for complete neutralization of 0.1g of a dibasic acid. Calculate the relative formula mass of the dibasic acid (Na = 23.0, O = 16.0, H = 1.0). (3mks)

9.   Magnesium was burnt in air forming a white residue T. When put in a boiling tube with water effervescence was noticed and a colouress gas D with a characteristic pungent smell was evolved. The gas turned a wet red litmus paper blue.

   (a)   Identify
   (i)   Residue T.   (1mk)

   _____

      (ii)   Gas D.   (1mk)

   _____

   (b)   Write an equation for the liberation of gas D.   (1mk)

10.   (a)   Define half life of radioisotopes.   (1mk)

   _____

   _____

   _____

   (b)   X grammes of a radioactive isotope take 100 days to decay to 20g. If half life of the element is 25 days, calculate the initial mass X of the radioisotope.   (2mks)

11.   Element X contains isotopes with mass number 16 and 18 respectively existing in the ratio 1: 3, calculate the relative atomic mass of X.   (2mks)

12. The diagram **below** represent a set up that can be used to prepare and collect oxygen gas.
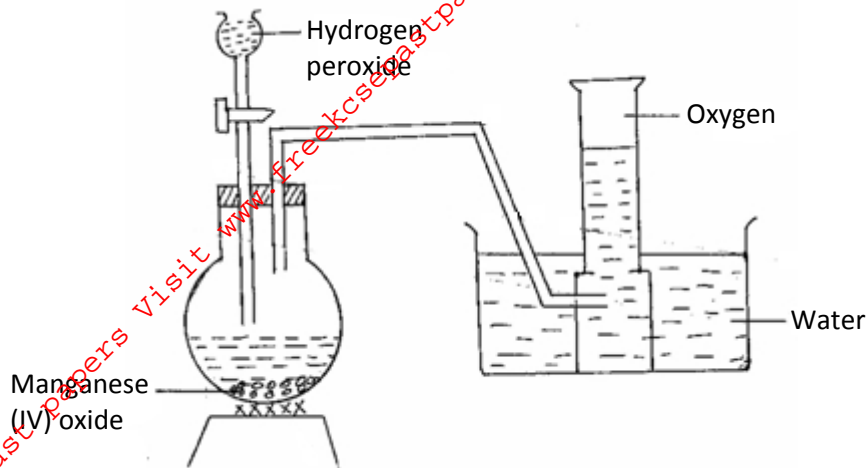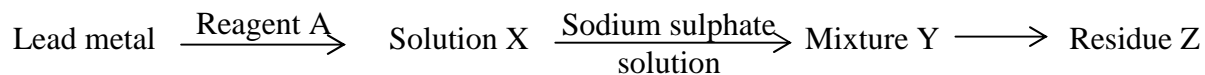

(a) Write an equation for the reaction that takes place. (1mk)

(b) What property of oxygen makes it possible for its collection as indicated in the diagram. (1mk)

_____

(c) Explain why it is important not to collect any gas for the first few seconds of the experiment. (1mk)

_____

_____

_____

13. The reaction **below** refers to the preparation of lead (II) sulphate starting with lead metal.

Lead metal $\xrightarrow{\text{Reagent A}}$ Solution X $\xrightarrow{\text{Sodium sulphate solution}}$ Mixture Y $\longrightarrow$ Residue Z
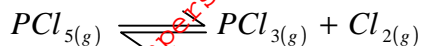
(a) Name the type of reaction between solution X and sodium sulphate solution. (1mk)

_____

(b) Write an ionic equation for the reaction in (a) above. (1mk)

(c)   Explain why it is not possible to prepare residue Z using lead metal and dilute sulphuric acid.
                                                                                                    (1mk)

_____

_____

_____

14.   Consider the following reaction at equilibrium.

$$PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$$

Complete the table **below** to show the effect of different factors on the position of equilibrium.
                                                                                                    (2mks)

|	Factor	Effect on equilibrium position
(i)	Decrease in pressure	
(ii)	Removing chlorine	
(iii)	Adding helium to the mixture	

15.   Study the information in the table below then answer the questions that follows.

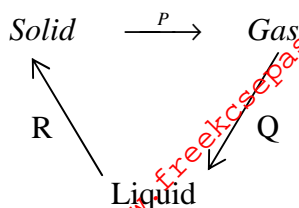| Bond	Bond energy (kJmol⁻¹
H – H	435
Cl – Cl	243
H - Cl	431

(a)   Calculate the enthalpy change for the reaction.
        $$H_{2(g)} + Cl_{2(g)} \rightarrow 2HCl_{(g)}$$ (2mks)

(b)   On the axis given **below** draw an energy level diagram for the reaction above.   (1mk)

Energy

Reaction Progress
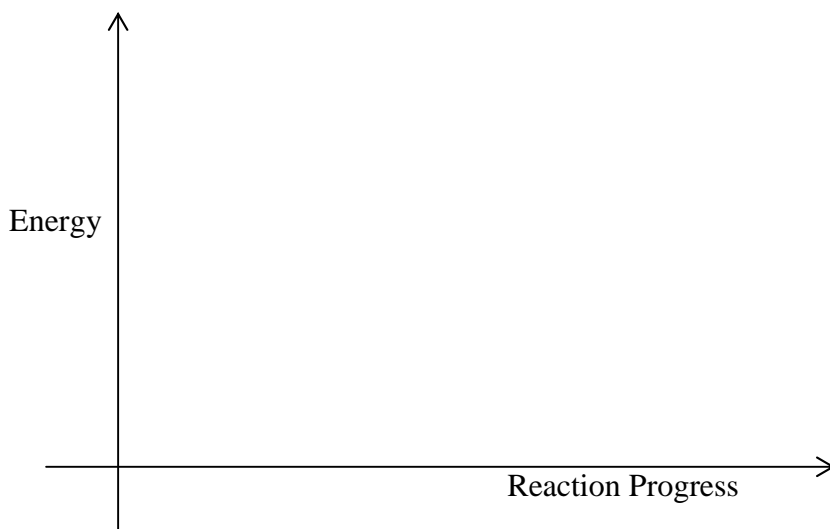
16. Matter exists in three states which can be related as shown in the diagram **below**.

$$Solid \xrightarrow{\quad P \quad} Gas$$

R ↗   ↘ Q

Liquid

(a) Name processes:
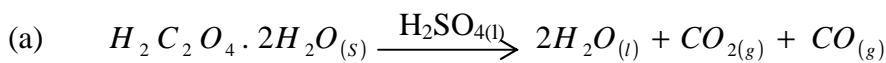
P: _____ (1mk)

R: _____ (1mk)

(b) Explain whether process **Q** is exothermic or endothermic. (1mk)

_____

_____

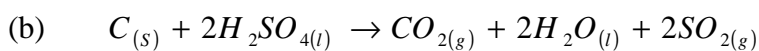_____

17. (a) State the Graham's law of diffusion. (1mk)

_____

_____

_____

(b) 200cm³ of nitrogen (I) oxide (N_2O) pass through a porous plug in 2 minutes 15 seconds. How long will it take the same volume of sulphur (IV) oxide (SO_2) gas to diffuse through the same plug under the same conditions. (N= 14, O = 16, S = 32). (3mks)

18. Write down the property of concentrated sulphuric (VI) acid shown in the following reactions.
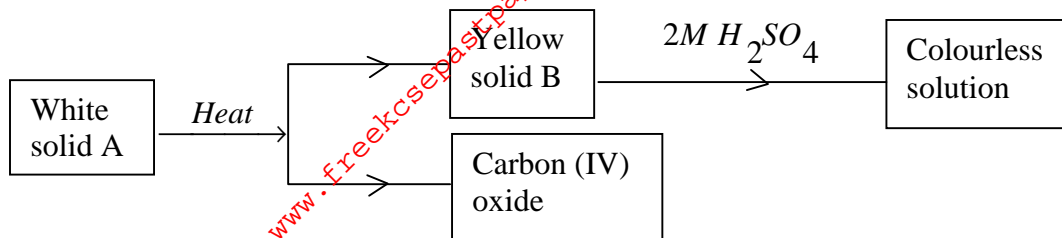(2mks)

(a) $H_2 C_2 O_4 . 2H_2 O_{(s)} \xrightarrow{H_2SO_{4(l)}} 2H_2 O_{(l)} + CO_{2(g)} + CO_{(g)}$

Property _____ (1mk)

(b) $C_{(s)} + 2H_2 SO_{4(l)} \rightarrow CO_{2(g)} + 2H_2 O_{(l)} + 2SO_{2(g)}$

Property _____ (1mk)

19. The scheme **below** represents some reactions starting with a white solid A.

```
┌──────────┐          ┌──────────┐   2M H₂SO₄   ┌──────────┐
│  White   │  Heat    │  Yellow  │──────────────→│Colourless│
│ solid A  │─────────→│ solid B  │               │ solution │
└──────────┘          └──────────┘               └──────────┘
                      ┌──────────┐
                      │Carbon(IV)│
                      │  oxide   │
                      └──────────┘
```
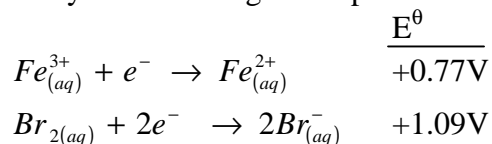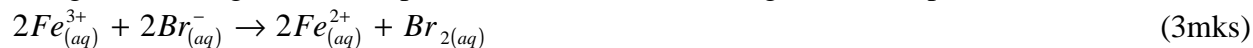
(a) Identify the solids **A** and **B**.

A _____ (1mk)

B _____ (1mk)

(b) Write an equation for the reaction between B and 2M sulphuric acid. (1mk)

20. Study the following redox potentials.

$$\begin{array}{ll} & E^{\theta} \\ Fe^{3+}_{(aq)} + e^- \rightarrow Fe^{2+}_{(aq)} & +0.77V \\ Br_{2(aq)} + 2e^- \rightarrow 2Br^-_{(aq)} & +1.09V \end{array}$$

Using the values given above, predict whether the following reaction is possible.

$$2Fe^{3+}_{(aq)} + 2Br^-_{(aq)} \rightarrow 2Fe^{2+}_{(aq)} + Br_{2(aq)}$$ (3mks)

21. (a) A saturated solution contains 7.5g of solute in 20cm³ of water. When the solution is cooled crystals begin to appear at 10°C. Calculate the solubility of the solute at 10°C. (2mks)

(b) What causes permanent water hardness? (1mk)

_____

_____

_____

22. When excess chlorine gas is bubbled through dilute sodium hydroxide solution, the resulting solution acts as a bleaching agent.

(a) Write an equation for the reaction between chlorine gas and sodium hydroxide solution. (1mk)

(b) Explain how the resulting solution acts as a bleaching agent. (2mks)

_____

_____

_____

_____

23. A, B, C, D are dyes present in a mixture C is more soluble than B, A is more soluble than C and D is the least soluble in a given solvent. Draw around-paper chromatogram showing how they would appear when separated using the solvent. (2mks)

24.   **Below** are PH values of some solutions.

Solution	Z	Y	X	W
PH	6.5	13.5	2.2	7.2

(i)   Which solution is likely to be

  I   Acidic rain _____ (½mk)

  II   Potassium hydroxide _____ (½mk)

(ii)   A basic substance V reacted with both solutions Y and X. What is the nature of V.(1mk)

_____

(iii)   Name **two** substances that show these characteristics in question (ii) above.   (1mk)

_____

_____

25.   Hydrogen gas was passed over hot copper (II) oxide in a combustion tube.
(a)   Write an equation for the reaction which took place.   (1mk)

(b)   What observations were made in the combustion tube?   (1mk)

_____

(c)   Name any other gas which could be used to reduce copper (II) oxide.   (1mk)

_____

26.   (a)   Element A and B have atomic numbers 6 and 1 respectively illustrate the type of bonding
   formed when the two elements combine.   (2mks)

_____

_____

(b)   Explain why solid sodium chloride does not conduct electricity while sodium chloride
        solution conducts.   (1mk)

_____

_____

_____

27. 'Dry ice' is preferred to ordinary ice as a refrigerant. Explain. (2mks)

_____

_____

_____

_____

28. State **one** use of argon which is also a use of nitrogen gas. (1mk)

_____

_____

29. An element P has a relative atomic mass of 88 when a current of 0.5 ampheres was passed through the fused chloride for 32..16 minutues, 0.44g of P were deposited at the cathode. Determine the charge on an ion of P. (IF = 96500 coulombs). (3mks)

30. Consider the equation.

$$NH_{3(g)} + H_2O_{(l)} \rightarrow NH_{4(aq)}^+ + OH_{(aq)}^-$$
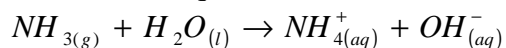
(a) Identify the acid and base in the above equation using Bronsted Lowry theory. (3mks)

Acid _____ (1mk)

Base _____ (1mk)

Reason (1mk)

_____

_____