

Name..... Index No...../.....

School..... Candidates Signature.....

Date.....

233/1
CHEMISTRY
Paper 1
(THEORY)
July/August 2014
TIME: 2 HOURS

**THE NAKURU DISTRICT SEC. SCHOOLS TRIAL
EXAMINATIONS - 2014**

Kenya Certificate of Secondary Education (K.C.S.E)

233/1
CHEMISTRY
Paper 1
(THEORY)
July/August 2014
TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES

- Write your name and Index Number in the spaces provided above.
- Sign and write date of examination in the spaces provided above.
- Answer **ALL** questions in the spaces provided.
- Mathematical tables and electronic calculators may be used.
- All workings **MUST** be clearly shown where necessary.

1. Sodium hydrogen carbonate reacts with water according to the equation below.
 $\text{NaHCO}_3(\text{s}) + \text{H}_2\text{O}(\text{l}) \longrightarrow \text{Na}^+(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$
Identify the base in the reaction and explain your answer (2 marks)

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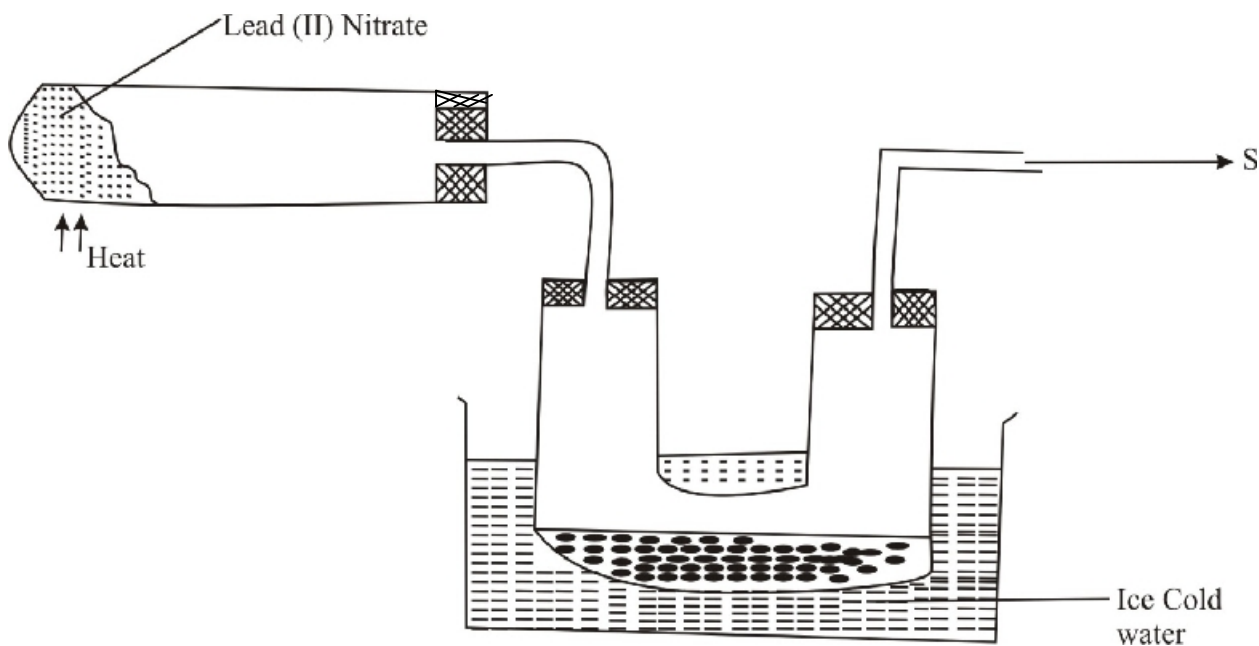
2. (a) Explain how you would show that graphite and diamond are both allotropes of carbon. (2 marks)

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- (b) Why is graphite used as a lubricant while diamond is used as an abrasive (2 marks)

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- 3 The set up below was used to prepare Nitrogen (IV) Oxide



(a)(i) Why is nitrogen (IV) oxide collected by this method shown (1 mark)

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(ii) What is the major constituent of the gas escaping at S (1 mark)

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(b) What is observed when burning magnesium is lowered in a gas jar full of nitrogen (IV) oxide (1 mark)

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4. When soap is added to hard water, lather does not form immediately, but lather eventually forms on addition of more soap. Explain

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5 Chlorine gas can be prepared by using the following reagents: Sodium chloride, concentrated sulphuric (VI) acid and potassium manganate (VII)

(a) What is the role of the following reagents in the reaction?

(i) Concentrated sulphuric (VI) acid (1 mark)

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(ii) Potassium manganate (VII) (1 mark)

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(b) Name the bleaching agent formed when chlorine gas is passed through cold and dilute sodium hydroxide solution? State one other use of the compound named. (2 marks)

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- 6 Determine the volume of hydrogen gas formed when excess zinc metal is added to 100cm³ of one molar hydrochloric acid (1 mole of gas occupies 24.0 litres at room temperature and pressure) (2 marks)

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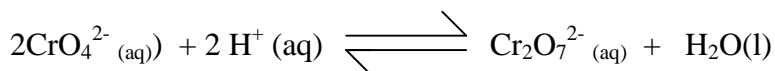
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- 7 An equilibrium exists between the reaction of chromate ions (CrO₄²⁻_(aq)) and dichromate ions (Cr₂O₇²⁻_(aq)) as represented by the equation



What would be the effect of adding aqueous sodium hydroxide solution have on the above on the equilibrium? Explain your answer (2 marks)

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- 8 A piece of phosphorus was burnt in excess air. The product obtained was shaken with a small amount of hot water to make a solution.

(i) Write an equation for the burning of phosphorus in excess air. (1 mark)

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(ii) The solution obtained in (i) above was found to a have a pH of 2.0. Give reasons for this observation (2 marks)

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- 9 Copper can be extracted from an ore called Malachite (CuCO₃.Cu (OH)₂). Explain how copper may be extracted from crushed ore. (2 marks)

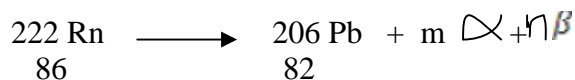
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10. Give two reasons why helium is used in weather balloons. (2 marks)

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11 (a) Radioactive radon isotope decays as shown below.



Determine the value of **m** and **n** (2 marks)

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(b) Give one harmful effect of exposure to radioactive emission (1 mark)

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12 The lattice energy for sodium chloride is +776Kj mol⁻¹ when sodium chloride is attracted to polar water molecules the energy released is 771 Kj mol⁻¹

(a) Draw an energy cycle diagram to illustrate energy changes when sodium chloride is dissolved in water (2 marks)

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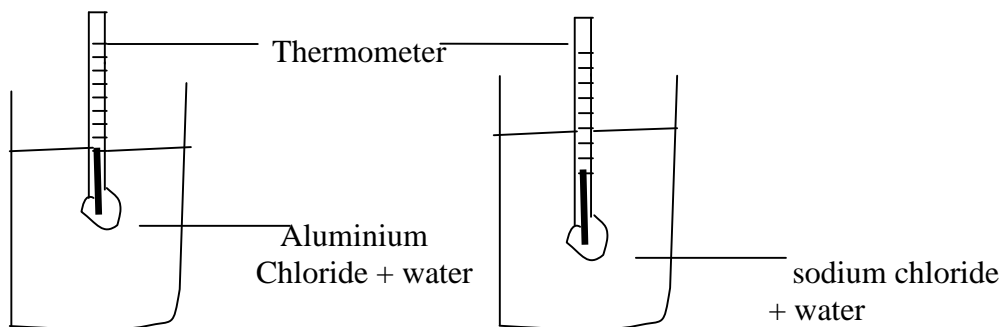
- (b) Use the energy cycle diagram above to calculate the molar enthalpy of solution for sodium chloride (2 marks)

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- 13 A student set-up the following apparatus to investigate some properties of the chlorides of period 3 elements.



- (a) State the observation made in set-up 1 and 2 (2 marks)

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- (b) What name is given to the chemical process taking place in set-up 1? (1 mark)

- 14 Calculate the volume of the gaseous product formed when 75cm^3 of oxygen gas was exploded in 75cm^3 of carbon(II) oxide gas. All volumes are measured at constant temperatures and pressure (2 marks)

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- 15 The table below shows some tests carried out on a sample of water in a school pond and results obtained recorded

Test	observation
I Addition of sodium hydroxide solution drop wise until excess	White precipitate which dissolves 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 the water (1 mark)

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- (b) Write the ionic equation for the reaction in test **III** above (1 mark)

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- (c) Write the formula of the complex ion formed in the test **(II)** above (1 mark)

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- 16 Ethanedioic acid (COOH)₂ is used instead of methanoic acid (HCOOH) to prepare carbon(II) oxide and carbon (IV) oxide in the laboratory as it is easily dehydrated by sulphuric (VI) acid to give equal volumes of the two gases.

- (a) Write an equation for the dehydration of ethenedioic acid. (1 mark)

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- (b) Explain how dry carbon(II) oxide can be gotten from the mixture of the two gases.(2 marks)

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- 17 Below is a list of potential differences obtained when metals **R, S, T, U** and **V** are used in the following electrochemical cell

Metal(s) /metal ions(aq) // Zn²⁺(aq) /Zn(s)

<u>Metal</u>	<u>E(volts)</u>
R	-1.10
S	-0.46
T	0.00
U	+0.45
V	+1.16

- (i) Identify the role of metal **T**. Explain (1 mark)

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- (ii) Which two of the above metals in the electrochemical cell would produce the largest potential difference (1 mark)

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- (iii) Which one of the metal above cannot be displaced by any of the other metals in the list? Explain. (1 mark)

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- 18 (a) Write a chemical equation to show what happens when excess carbon (IV) oxide gas is bubbled through lime water

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- (b) State two properties that makes carbon(IV) oxide gas suitable for use in a fire extinguisher. (2 marks)

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- 19 Give the IUPAC name of the following organic compounds (2 marks)

- (i) CH₃CH C CH₂CH₃
CH₃

(ii) HC C C HCH₃

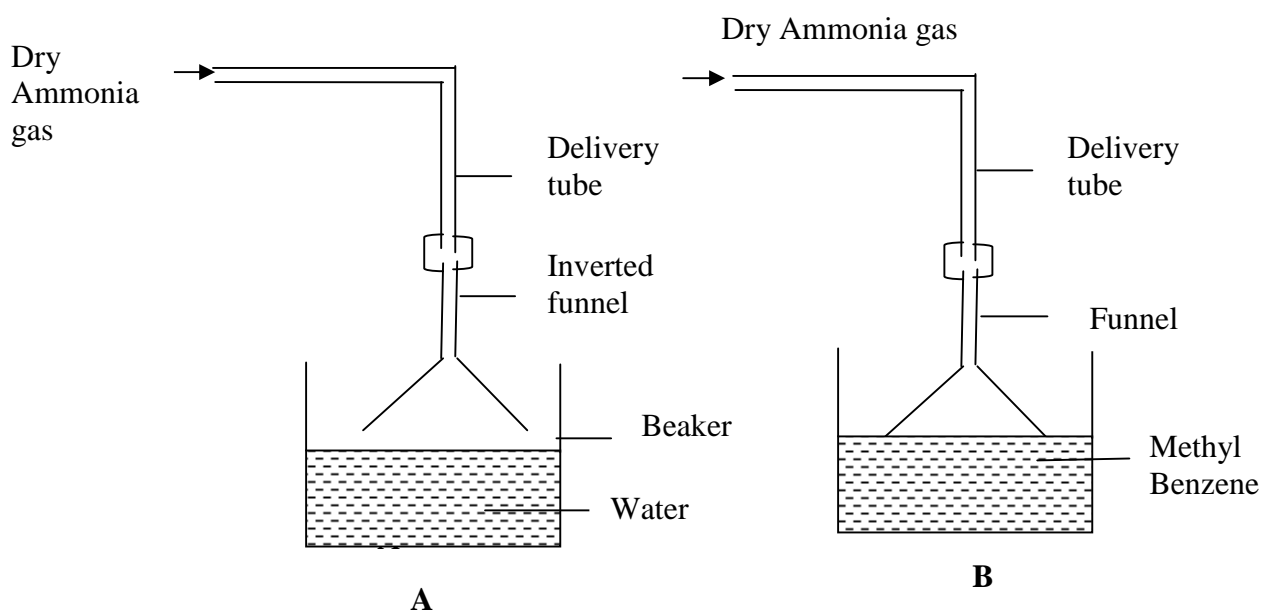
20 Explain in terms of structure and bonding why silicon (IV) oxide exists as a solid of high melting point while sulphur(IV) oxide exist as a gas. (2 marks)

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21 A form (IV) student set up the apparatus below in an experiment and recorded the observations



(i) State the observation made when both blue and red litmus papers were dipped in the resulting solution of experiment A and B. (1 mark)

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(ii) Explain your observations in (i) above (2 marks)

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22 (a) State two uses of solubility curves (1 mark)

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(b) The solubility of salt **A** at different temperatures is as shown below.

Temperature ($^{\circ}\text{C}$)	60	100
Solubility g/100g of water	40	48

(c) What mass of salt would saturate 150 g of water at 60°C (1 mark)

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(ii) Calculate the mass of salt **A** that crystallizes out when 150 g of water is saturated with salt **A** and cooled from 100°C to 60°C (2 marks)

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23 Five solutions **A**, **B**, **C** and **D** were tested to find their pH values. The results obtained were recorded as below.

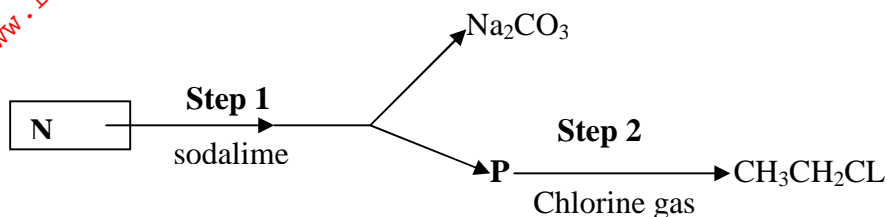
Solution	pH value
A	10
B	1
C	14
D	5

(a) Name the reagent used to measure the pH and describe how it is carried out (2 marks)

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- (b) Identify the solution which when warmed with ammonium chloride produces ammonia gas. (½ mark)

24 Study the reaction scheme below and answer the questions that follow.



- (a) Name substance **N** and **P**

N.....

P..... (1 mark)

- (b) Give the reaction conditions in step **I** and **II** (2 marks)

I.....

II.....

- (c) Write an equation for the reaction that took place in step **I** (1 mark)

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25 An element **Q** has the electronic arrangement 2.8.6 and a mass number of 32.

- (i) How many protons does element **Q** have (½ mark)

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- (ii) What is the number of neutrons in the nucleus of **Q**? (½ mark)

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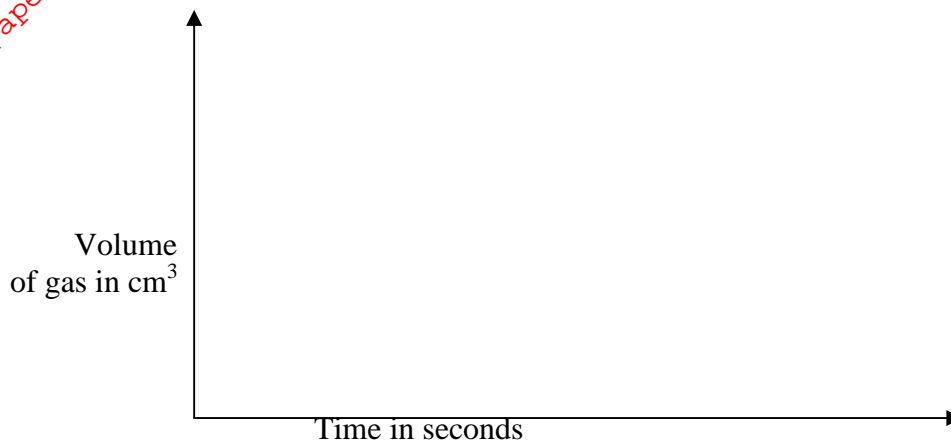
- (iii) What type of bond would be formed between **Q** and oxygen (½ mark)

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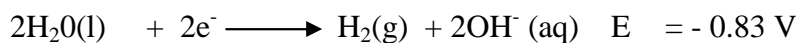
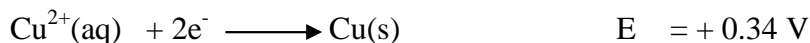
- 26 The table below gives three experiments on the reactions of excess sulphuric (VI) acid and 0.5 g of zinc done under different conditions. In each case the volume of gas was recorded at different time intervals

Experiment	Form of Zinc	Sulphuric (VI) acid solution
I	Powder	0.8 m
II	Powder	1.0 m
III	granules	0.8 m

On the same axis below sketch and label the three curves (I, II, III) that could be obtained from each results (3 marks)



- 27 The standard reduction potential of two half-cells are



Draw a labelled diagram of an electrochemical cell that can be constructed using the two half-cells. (3 marks)

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28 When pure water is heated at 1 atmospheric pressure at sea level, the temperature of the water does not rise beyond 100°C even with continued heating. Explain this observation. (2 marks)

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29 What is the name given to each of the following?

(a) Ability of aluminium metal to be drawn into a sheet

.....(1 mark)

(b) Minimum energy required for a reaction to start

..... (1 mark)