Name………………………………………………Adm.No…………Class.......................

Candidate’s Signature……………………………….

**MOMALICHE 3 CYCLE 7 JOINT EXAMINATION TEST**

*(The Kenya Certificate of Secondary Education)*

**233/1**

**CHEMISTRY**

**Paper 1**

**FORM 4**

**November 2021**

**Instructions to Candidates**

1. ***Write your name and index number in the spaces provided above.***
2. ***Answer all the questions in the spaces provided.***
3. ***All working must be clearly shown.***
4. ***Non-programmable silent electronic calculators and KNEC mathematical tables may be used.***

**For Examiner’s Use only**

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| --- | --- | --- |
| **Questions** | **Maximum score** | **Candidates score** |
| **1 - 27** | **80** |  |

***This paper consists of 12 printed pages. Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.***

1. 120 cm3of oxygen gas diffused through a porous partition in 50 seconds. How long would it take 80cm3 of Sulphur (IV) oxideto diffuse through the same partition under the same conditions? (S=32.0, 0=16.0) (3mks) .......................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................
2. The flow chart represents a series of reactions . Study it and answer the questions that follow.

Ethanoic acid G Sodium ethanoate Soda Gas J

lime

1. Identify substances G and J (2mks)

G...................................................................................................................

J...................................................................................................................

1. Write a chemical equation for the formation of J. (1mk)

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1. At 200C, NO2 and N2O4 gases exist in equilibrium as shown in the equation below.

2NO2(g)  N2O4(g) ΔH = -VE

Brown Pale yellow

State and explain the observation that would be made when.

(a) The syringe containing the mixture is immersed in ice-cold water. (2mks)

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(b) The volume in the gaseous mixture in the syringe is reduced. (2mks)

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1. A student suspected a given sample of water contains sulphate ions. Describe how he can show the presence of the sulphate ions in the water sample. (2mks) ......................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................
2. In the industrial manufacture of nitric (v) acid the first step is catalytic oxidation of ammonia gas.

(a) What is the name of the catalyst used. (1mk)

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(b) Write the equation for the catalytic oxidation of ammonia gas. (1mk)

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c) State one use nitric acid. (1mk) ..................................................................................................................................................................................................................................................................................

1. Explain why boiling point of ethanol is higher than that of dimethylether. (Relative molecular mass of both of them is 46). (2mks)

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1. When 94.5g of hydrated barium hydroxide Ba(OH)2.n H2O were heated to a constant mass, 51.3g of anhydrous barium hydroxide were obtained. Determine the value of **n.**

(Ba=137, O=16,H=1) (3mks)

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1. Study the diagram below and answer the questions that follow.

(a) What do Δ H1 and Δ H2 represent (2mks)

i) Δ H1 ...........................................................................................................................

ii) Δ H2 ..........................................................................................................................

(b) Give an expression for heat of solution in terms ofΔ H1, ΔH2 and Δ H3. (1mk)

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1. 6.84g of aluminium sulphate were dissolved in 300cm3 of water. Calculate the molar concentration of sulphate ions in the solution. (R.M.F=342) (3mks) ........................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................
2. Study the information given in the table below and answer the questions that follow.

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| --- | --- |
| Bond | Bond energy (KJ mol) |
| C-H | 413 |
| Br-Br | 193 |
| C-Br | 280 |
| H-Br | 365 |

(a) Calculate the Enthalpy changes for the reaction below (2mks)

CH4 (g) + Br2 (g) CH3Br (g) + HBr (g)

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(b) State whether the reaction is exothermic or endothermic. Explain (1mk)

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1. A certain mass of a metal E reacted with excess dilute hydrochloric acid at 250C. The volume of hydrogen gas liberated was measured after every 30 seconds. The results were represented as shown in the graph below. (1mk)

Volume

(cm2)

Time (sec)

1. Name one piece of apparatus that may be used to measure the volume of gas liberated. (1mk)

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1. I) On the same axis , sketch the curve that would be obtained if the experiment was repeated at 350C. (1mk)

ii)Explain the shape of your curve in b( i) above. (2mks)

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1. a)Why is hydrogen not readily used as a fuel? (1mk)

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1. a) State Charles’ Law. (1mk)

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b) A certain mass of a gas occupies 150cm3 at 281K and 109.41kPa. What will be its temperature if its volume is reduced by 16 cm3 at 101.325kPa. (2mks)

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1. 3g of iron reacted with hydrogen chloride gas at S.T.P. Calculate the volume of the hydrogen chloride gas used. (Fe=56, Molar gas volume at s.t.p=22.4dm3) (2mks) ....................................................................................................................................................................................................................................................................................

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1. Under certain conditions , chlorine gas reacts with sodium hydroxide to form sodium hypochlorite.

a)Name the conditions under which sodium hydroxide reacts with chlorine to form sodium hypochlorite. (1mk)

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b) State one use of sodium hypochlorite . (1mk)

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16. (a) Distinguish between isotopes and allotropes (2mks)

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(b) An element X has RAM of 69.39. Given that the element has two isotopes of masses 60.15 and 70.15. Calculate the relative abundance of each isotope (3mks)

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17. A student has a mixture of anhydrous aluminium chloride and zinc sulphate. Which is the simplest method of separation? (1mk)

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(a) Name any two reactants required for the production of ammonia. (1mk)

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(b) State the observation in the beaker (1mk)

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(c) Write ionic equation for the reaction in the beaker (1mk)

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19. The compound HCLO decomposes according to the following equation .

5HClO(aq) 2Cl2(g) + H+ (g) + ClO3- (aq)+ 2H2O(l)

Deduce the oxidation states of chlorine in the following species.

i) HClO (1mk)

ii) ClO3- (1mk)

20. The set-up below was used to prepare dry sample of Oxygen gas

(a) (i) Complete the diagram to show how the gas was collected (1mk)

(ii) Identify the following

I. Solid H....................................................................................................(1mk)

II. Solid J...................................................................................................... (1mk)

(b) Write an equation for the reaction that occurred in the flask between solid **H** and water. ......................................................................................................................................... (1mk)

21. The table below gives the solubility of salt L and K at 100C and 800C. Solubility in g/100g water

Salt At 100C At 800C

L 60 75

K 20 32

When an aqueous mixture containing 80g of L and 10g of K in 100g water at 800C was cooled to 100C,crystallization occurred.

(a) What is crystallization (1mk)

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(b) Determine the mass of the crystals formed (1mk)

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(c) Name the method of separation (1mk)

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22. The table below gives elements represented by letters T,U,V,W,X,Y and their atomic numbers . (Letters are not the actual symbols.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Element | T | U | V | W | X | V |
| Atomic number | 12 | 13 | 14 | 15 | 16 | 17 |

a i) How does the atomic radius of V compare with that of X? Explain. (2mks)...............................................................................................................................

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ii) Give the formula of the compound that could be formed between U and X. (1mk)

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b) i) Arrange the species T,T- and T+ in increasing order of size. (1mk)

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ii) Which of the ions X2+ and X2- is the most stable ? Explain. (2mks)

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23. (a) What would be observed in sulphur IV Oxide is bubbled through acidified potassium. chromate VI (1mk)

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(b) In an experiment, sulphur (IV) Oxide was dissolved in water to form solution M.

(i) State the observation made if a few drops of barium chloride solution immediately added to solution M (1mk)

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(ii) Identify the spectator ions from the reaction b(i) above (1mk)

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24. Copper-64 has a half life of 12.8days.

a) What is meant by the term half life (1mk)

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b) What mass of a copper-64 will be left after 51.2 days starting with 20 g of the isotopes .............................................................................................................................(2mks)

c) Give one use of radioactive isotopes in medicine (1mk)

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25. a) Zeolites (Na2X) is a complex compound used to soften hard water in the ion-exchange methods according to the equation below.

Ca 2+ (aq) +Na2X (aq) CaX(s)  + 2Na+ (aq)

After sometimes the Zeolites get exhausted and ceases to soften water. Write a reaction to show how Zeolite is regenarated. (1mk)

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26. Name the particle responsible for electrical conductivity on;

a) Molten magnesium metal (1mk)

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b) Molten magnesium chloride (1mk)

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27. Carbon is one of the elements that exhibit allotropy

1. Define the term allotrophy (1mk)

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ii) Name two allotropes of carbon (1mk)

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iii) Which allotrope of carbon is a good conductor of electricity. Explain. (2mks)

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