Name: ……………………………… **Adm No**……..…. **Index No**…………………

School: ……………………………………………. **Class** ……………………

Date: ……………………

Signature: ………………

233/1

CHEMISTRY THEORY

PAPER 1

TIME: 2 HOURS

KASSU JET EXAMINATIONS

JUNE 2022

Instructions to Candidates

*(a) Write your **Name, Adm Number** 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/or electronic calculators may be used for calculations

*(e) All working **MUST** be clearly shown where necessary*

*(f) This paper consists of **12 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 the questions in English

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1 – 29	80	

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

1. Give one danger of abusing bhang **(1mark)**

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2. Give one reason why a conical flask is preferred during a titration experiment over a beaker

(1mark)

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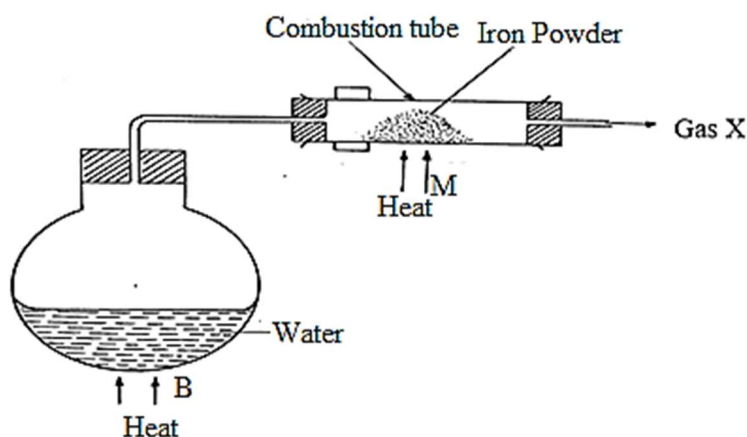
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3. The atomic number of iron is 26 and its mass number is 56. How many of each of the following particles is in Iron (III) ion?

   i.   Protons………………………………………………. **(½ mark)**
   ii.   Neutrons………………………………………………. **(1 mark)**
   iii.   Electrons………………………………………………. **(1mark)**

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

a) Between point B and point M which one should be heated first? Explain. **(1mark)**

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b) Write a chemical equation that occurs in the combustion tube **(1mark)**

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c) State and explain the observation made when gas X is passed over heated copper (II) oxide

(2 marks)

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5. Lead carbonate was heated strongly in a boiling tube. Write the equation for the reaction that occurred. **(1 mark)**

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6. A mixture consists of three solids: lead (II) carbonate, iron filings, and sodium carbonate. Describe how to obtain pure lead (II) carbonate from the mixture. **(3 marks)**

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7. Chlorine gas is prepared in the laboratory by reacting a mixture of Potassium manganate (VII) and substance H. when dry chlorine is passed over heated aluminium foil, a white solid S is formed.

    i.   Identify substances H and S **(1 mark)**

        H…………………………………………………………………………….
        S……………….…………………………………………………………...

    ii.   Name the drying agent used to dry chlorine gas **(1mark)**

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    ………………………………………………………………...………………………………

   iii. State the observation that will be made when chlorine is bubbled through a solution of Iron (II) chloride **(1mark)**

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8. Diamond and graphite are two allotropes of carbon. Explain how graphite is suitable for the use as a lubricant. **(1 mark)**

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9. The following is a section of a radioactive decay series. Study it and answer the questions that follows

$$^{220}_{86}Rn \xrightarrow{\quad x \quad} {}^{216}_{84}A \xrightarrow{\text{Process I}} {}^{212}_{83}Bi$$
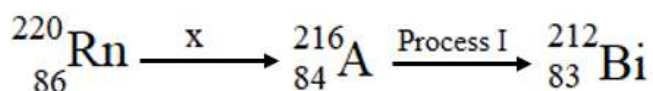
i.   Identify one characteristic of particle X   **(1mark)**

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ii.   Write the nuclear equation for process I   **(1mark)**

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10. You are provided with 200 cm³ of 0.5M lead (II) nitrate solution and 200 cm³ of 0.5M
    sodium chloride solution. Briefly describe how a dry sample of sodium nitrate crystals can be
    prepared   **(3 marks)**

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11. In an experiment, 120 cm³ of oxygen diffused through a porous pot in 20 seconds and 200
    cm³ of gas Y diffused through the same porous pot in 60 seconds. If the density of oxygen is
    1.4291 g/cm³, calculate the density gas Y.   **(2 marks)**

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12. A given mass of gas was placed in cylinder A as shown below and its volume and pressure
    measured at constant temperature as V_A and P_A respectively. The same mass was then placed
    into cylinder B and the piston pushed down as shown. The volume and the pressure exerted
    on the piston was also measured as V_B and P_B respectively.

Cylinder A   Cylinder B
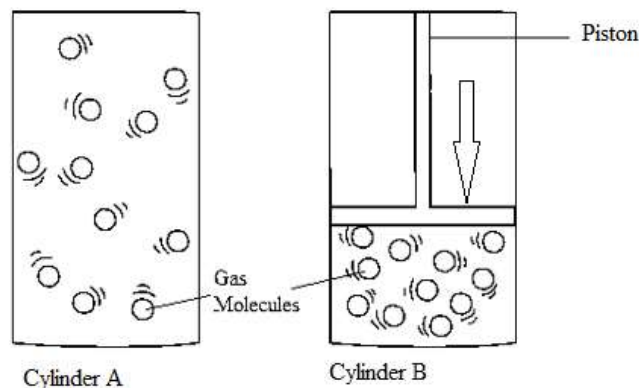
a. State the mathematical expression that gives the correct relationship between the pressure and volume of the gas in both cylinders A and B at constant temperature. **(1mark)**

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b. Give one application of gas laws. **(1mark)**

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13. When a certain hydrocarbon is burnt completely in excess oxygen, 3.08 g of carbon (IV) oxide and 0.72 g of water were formed. If the molecular mass of the hydrocarbon is 184, determine the molecular formula of the hydrocarbon. (C=12, H=1) **(3 marks)**

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14. If 25.0cm^3 of 0.1M H_2SO_4 solution neutralised a solution containing 1.06g of anhydrous sodium carbonate in 250cm^3 of solution, calculate

a. The molarity of sodium carbonate (Na=23, O=16, C=12) **(1 ½ marks)**

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b. Volume of sodium carbonate solution used   **(1 ½ marks)**

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15. The solubility of salt W is 80g/100g of water at a temperature of 90^0C. A solution containing 84g of the salt was cooled to 50^0C.

a) Define solubility   **(1mark)**

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b) Calculate the total mass of crystals present if the solubility of salt W at 50^0C is 25g/100g of water   **(1 mark)**

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c) Calculate the molarity of the solution at 50^0C   **(1 mark)**

(R.F.M of W=174.5)

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16. Given the equation for the reaction below

$$NH_3 \text{ (g)} + H_2O \text{ (l)} \rightleftharpoons NH_4^+ \text{ (aq)} + OH^- \text{ (aq)}$$
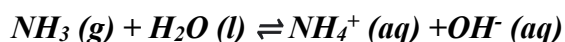
a. State the Bronsted-Lowry definition of a base   **(1 mark)**

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b. Identify the base in the backward reaction   **(1 mark)**

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17. Magnesium and aluminium are both metals. In terms of structure and bonding, how does the melting point of their respective chlorides compare?   **(3 marks)**
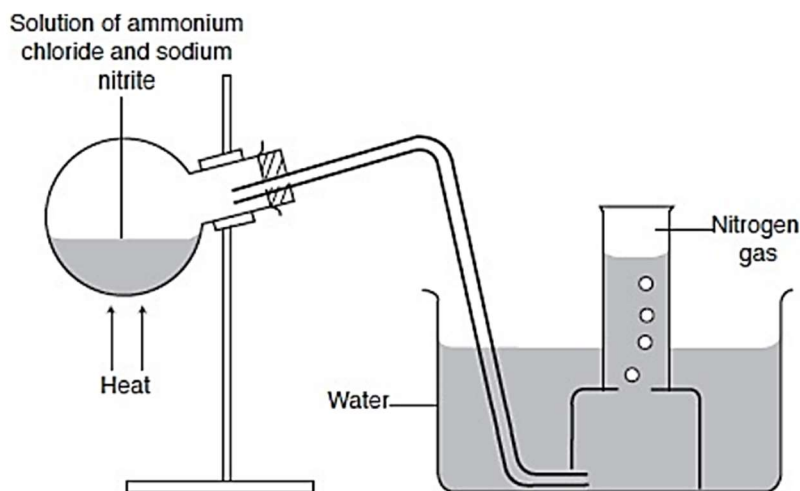
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18. The setup below shows laboratory preparation of nitrogen gas.

Solution of ammonium chloride and sodium nitrite

Heat

Water

Nitrogen gas

a. Write the equation for the reaction in which nitrogen gas is produced **(1 mark)**

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b. What property makes nitrogen gas to be collected as shown above **(1 mark)**

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c. Nitrogen gas is used in storage of semen under artificial insemination. Explain. **(1 mark)**

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19. The structure below represents two cleansing agents Q and P.

Q- **RCOO⁻Na⁺**

$Q\text{-}\quad RCOO^-Na^+$

P- **ROSO₃⁻Na⁺**

$P\text{-}\quad ROSO_3^-Na^+$

a. Give one advantage and one disadvantage of using agent Q **(2marks)**
Advantage

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Disadvantage

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20. The flow chart below shows some of the chemical properties of organic compounds starting with ethanol. Use it to answer the questions that follow.
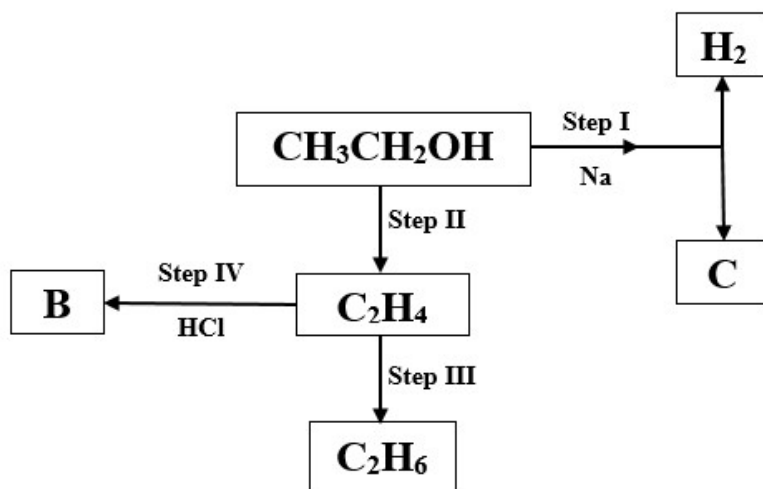
i.   Name the type of reaction in;   **(1 mark)**
     a) Step II

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     b) Step IV

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ii.   Write the equation for the reaction in step I   **(1 mark)**

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iii.   Give the structural formula and IUPAC name of compound B   **(1 mark)**
     Structural formula

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     IUPAC name   **(½ mark)**

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iv.   State the **major** industrial application of the reaction in step III   **(1 mark)**

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21. The general formula for a homologous series of a group organic compounds is $C_nH_{2n+1}OH$.
     I.   Give the name of the structural formula of the fourth member of the series

i.   Name   **(1 mark)**

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ii.   Structural formula   **(1 mark)**

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   II.   Write the equation for the reaction between the molecule in (I) above and Propanoic
          acid   **(1 mark)**

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22. I. The table below lists data relevant to the formation of $MgCl_2$ solution.

Enthalpy change	Value (kJ/mol)
$\Delta H_{solution}(MgCl_{2(s)})$	-160
$\Delta H_{lattice}(MgCl_{2(s)})$	-2526
$\Delta H_{hydration}(Mg^{2+}{}_{(g)})$	-1890

Using the information provided, calculate the molar heat of hydration of chloride ions,
$\Delta H_{hydration}$ $(Cl^-{}_{(g)})$ **(3 marks)**

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II. Given that enthalpy of hydration of $Ca^{2+}{}_{(g)}$ is **-1562 kJ/mol**, suggest a reason why the
enthalpy change of hydration of $Mg^{2+}{}_{(g)}$ as shown in the table above is higher than the
enthalpy change of hydration of $Ca^{2+}{}_{(g)}$ **(1 mark)**

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23. Petrol is a mixture of hydrocarbons. One of the hydrocarbons in petrol is octane, C_8H_{18}.
   a. Name the two products formed when octane is burnt in excess air.   **(1 mark)**

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b. More petrol can be made by cracking less useful petroleum fractions
   i. Define the term ***cracking***. **(1 mark)**

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   ii. Write the equation for the cracking of dodecane, $C_{12}H_{26}$ to form ethene and one other hydrocarbon **(1 mark)**

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   iii. Give the name of the hydrocarbons homologous series to which ethene belongs **(1 mark)**

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24. A powder is suspected to be containing sulphite ions. Given, 2M nitric acid, dilute barium nitrate solution, Acidified potassium manganate (VII) reagents and other necessary laboratory apparatus, describe how one can confirm the presence of the ions. **(3 marks)**
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25. Ethanoic acid reacts with ethanol to form a product that has a pleasant smell called an ester and water. When the reaction is at an equilibrium, a few drops of concentrated sulphuric acid were added, followed by warming.
    a. What is the effect of adding concentrated sulphuric acid on;
       i. The position of the equilibrium of the mixture? **(1 mark)**
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       ii. The yield of the ester **(1 mark)**
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    b. The forward reaction in the equilibrium is referred to as esterification. What is the name of the reverse reaction? **(1 mark)**
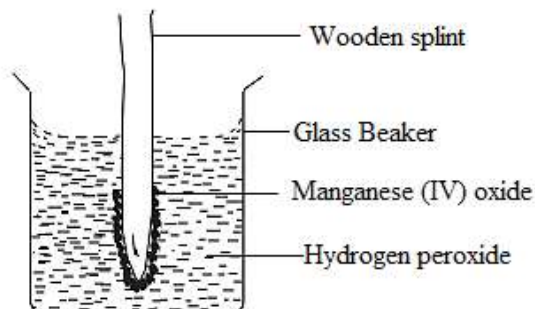   …………………………………………………………………………………………
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c. Explain the effect of rise in temperature on the yield of products of a reaction with a molar enthalpy change of *-92kJ/mol.* **(2 marks)**

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26. A wet wooden splint was dipped in manganese (IV) oxide powder and then soaked in hydrogen peroxide solution as shown below.
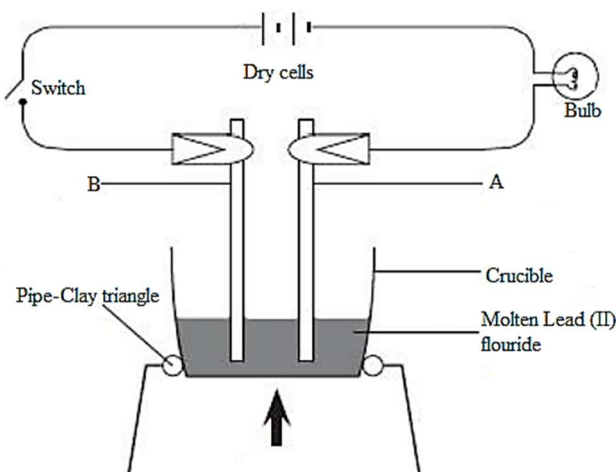

i. State and explain the observation that was made **(2 marks)**

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ii. Write the equation for the reaction that occurred **(1 mark)**

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27. The setup below shows the process of electrolysis of molten lead (II) fluoride. Use it to answer the questions that follow.

a. Identify the electrodes labelled A and B **(1 mark)**

A…………………………………………………………………………………………

B…………………………………………………………………...………………………

b. Indicate the direction of flow of electrons on the diagram **(1 mark)**

c. State and explain the observation made on electrode B **(2 marks)**

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d. Give any one application of electrolysis **(1 mark)**

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28. The graphs J, K and L below shows the general trend in the properties of period 3 elements (Na to Cl). Use them to answer the questions that follow.
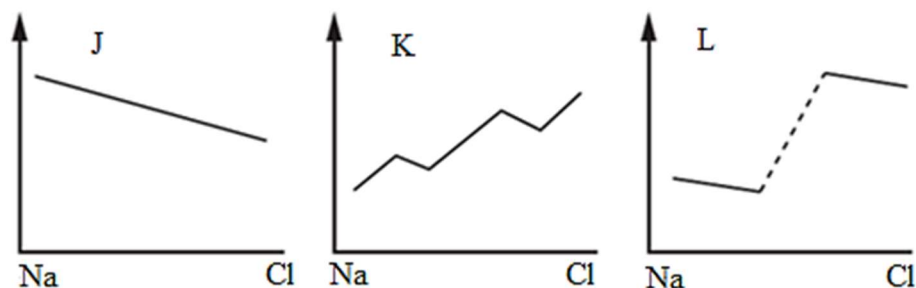
Select a graph that represents the variation in;

a. Ionic radius. **(½ mark)**

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b. Atomic radius. Explain. **(1½ marks)**

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29. Aluminium objects do not need protection from corrosion while Iron objects must be protected from corrosion. Explain. **(2 marks)**

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