KAPSABET HIGH SCHOOL

233/2 - **CHEMISTRY** - **Paper 2**

2 Hours

NAME……………………………………ADM…………….CLASS………

2022 TRIAL 2 JULY INTERNAL EXAMINATION

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

Kenya Certificate of Secondary Education
CHEMISTRY
Paper 2
THEORY
2 hours

Instructions

Write your name, Index number and class in the spaces provided above.
*Answer **ALL** the questions in the spaces provided.*
*Mathematical tables and silent electronic calculators may be used.*
*All working **MUST** be clearly shown where necessary.*

For Examiner's use only

Question	Maximum Score	Candidate's Score
1	**11**	
2	**12**	
3	**12**	
4	**12**	
5	**11**	
6	**11**	
7	**11**	
Total	**80**	

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*This question paper has **10** printed pages.*
Confirm that all the pages are printed as indicated and
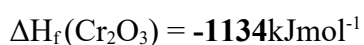***No** questions are missing.*

1. a) Consider the following reaction:
$A_{2(g)} + B_{2(g)} \rightleftharpoons 2AB_{(g)}$, $\Delta H = +75$ kJ
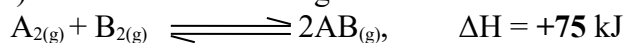
Sketch an energy level diagram showing the relative activation energies for the catalysed and uncatalysed reactions using the axes below.   (2mks)

Energy (kJ)

Reaction path
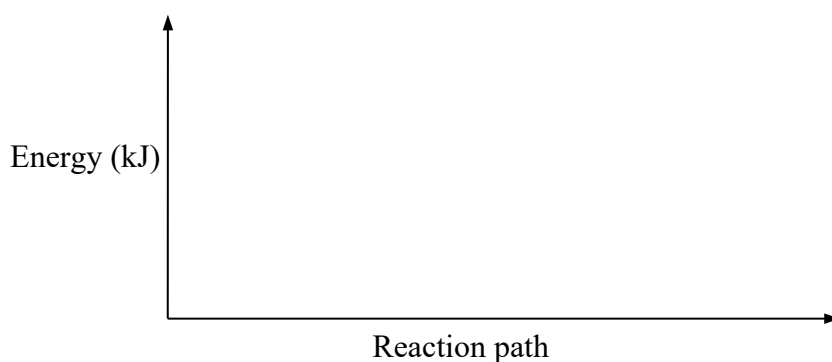
b) Given that; $\Delta H_f (Al_2O_3) = -1590$ kJmol^{-1}

$\Delta H_f(Cr_2O_3) = -1134$kJmol^{-1}

Calculate the heat of reaction for; $2Al_{(s)} + Cr_2O_{3(s)} \rightarrow Al_2O_3 + 2Cr_{(s)}$ **(2mks)**

c) The following data was obtained during an experiment

Mass of ethanol burnt   = 0.2g
Mass of water in the calorimeter   =   200g
Specific heat capacity of water   = 4.2 jg^{-1}k^{-1}
Initial temperature of water   =   23.5 ^{0}C
Final temperature of water   =   28.0 ^{0}C

i) **How** was the mass of ethanol that burnt determined?   (1mk)

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     ii) **How** much heat was required to raise the temperature of water from 23.5 ^{0}C to 28.0^{0}C? (2mks)

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     iii) Two assumptions were made in calculating the enthalpy of combustion for ethanol. **State them.** (1mk)

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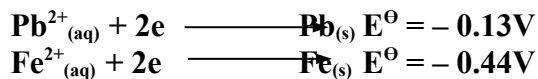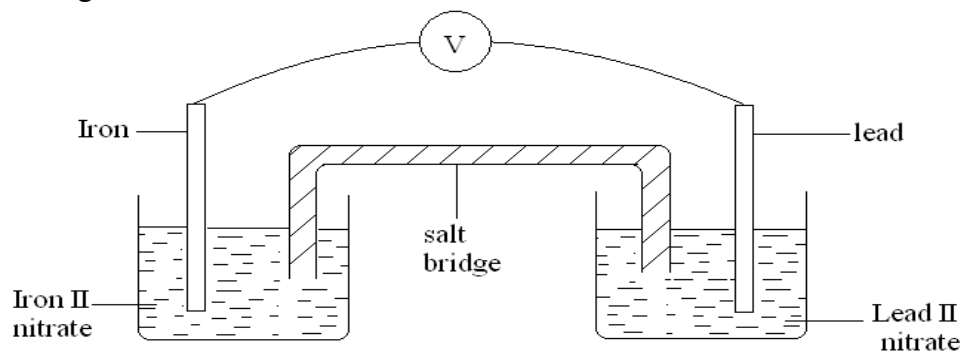...

     iv) **Determine** the molar enthalpy of combustion of ethanol.(C= 12,H=1, O=16) (2mks)

     v) **Write** a thermochemical equation for the combustion of ethanol given the accurate value for enthalpy of combustion is – 1368 kJmol^{-1}. (1mk)

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2. Two half cells were connected as shown to form a voltaic cell. The reduction potentials are given.

$$Pb^{2+}_{(aq)} + 2e \longrightarrow Pb_{(s)} \quad E^\Theta = -0.13V$$
$$Fe^{2+}_{(aq)} + 2e \longrightarrow Fe_{(s)} \quad E^\Theta = -0.44V$$

  a) **Calculate** the e.m.f of the cell. (1mk)

  b) **Sodium chloride is used as the salt bridge. State the** two functions of the salt bridge. (2mks)

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    c) **Show** the direction of the electron flow in the external circuit.   (1mk)

    d) The e.m.f of the cell will reduce with time. Give a reason for this.   (1mk)

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    e) During electrolysis of water acidified with Sulphuric acid, two gases were produced at the electrodes:

        i) **State** which ions are preferentially discharged at the electrodes. **Explain** with aid of half ionic equations.
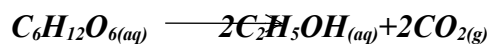   Anode.   (2mks)

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        Cathode.   (2mks)

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        ii) **Calculate** the volume of the gases at s.t.p produced when a current of 0.025A is passed for 4 hours.   (1 Faraday=96500C)   (3mks)

3. a) The fermentation of glucose is catalysed by enzymes from yeast. Yeast is added to aqueous glucose, the solution starts to bubble and becomes cloudy as more yeast cells are formed.

      $C_6H_{12}O_{6(aq)} \longrightarrow 2C_2H_5OH_{(aq)}+2CO_{2(g)}$

 The reaction is exothermic. Eventually the fermentation stops when the concentration of ethanol is about 12%.
 (i) On a large scale, the reaction mixture is cooled. Suggest a reason why this is

 necessary.   (1mk)

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 (ii) Why does the fermentation stop? Suggest one reasons.   (1mk)

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(iii) What technique is used to concentrate the aqueous ethanol? (1mk)

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b) A compound X contains carbon, hydrogen and oxygen only. X contains **54.54**% of carbon by mass, **9.09**% of hydrogen by mass and **36.37**% of oxygen by mass. (C=12, O=16, H=1)

    (i)   Determine the empirical formula of compound X. (2mks)

    (ii)   Compound X has a relative molecular mass of 88. Draw the structural formula of compound X. (2mks)

c) The table below gives formulae of three organic compounds A, B and C

Compound	Formulae
A	$C_2H_4O_2$
B	C_2H_6O
C	C_2H_6

Giving a reason in each case, select the letter(s) which represent a compound that
   i)   Decolourises acidified potassium manganate (VII). (1mk)
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   ii)   .Gives effervescence with sodium hydrogen carbonate. (1mk)
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   iii)   Undergoes substitution reaction with chlorine gas. (1mk)

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d) The following is a small reaction of polystyrene polymer. Study it and answer the questions that follow.
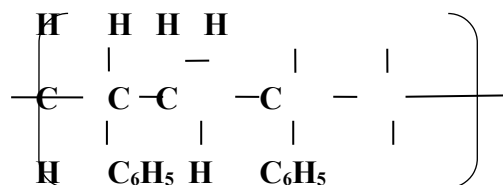
(i) Draw the structure of the monomer unit of polystyrene.   (1mk)

(ii) Calculate the number of monomers used to form the polystyrene of relative molecular mass of 18096.   (H = 1, C = 12)   (1mk)

4. An experiment was carried out using magnesium ribbon and dilute hydrochloric acid of different concentrations. The time needed to produce $50cm^3$ of the gas for every experiment was recorded in a table.

Concentration of HCl (moles per litre)	2.0	1.75	1.50	1.25	1.00	0.75	0.50	0.25
Time (seconds)	8.8	10.0	11.7	14.0	17.5	18.7	35.0	70.0
$\dfrac{1}{time}$ (Sec^{-1})								

a)   Complete the table above for $^1/_{time}$.   (4mks)
b)   Plot a graph of rate i.e $^1/_{time}$ against concentration.   (3mks)

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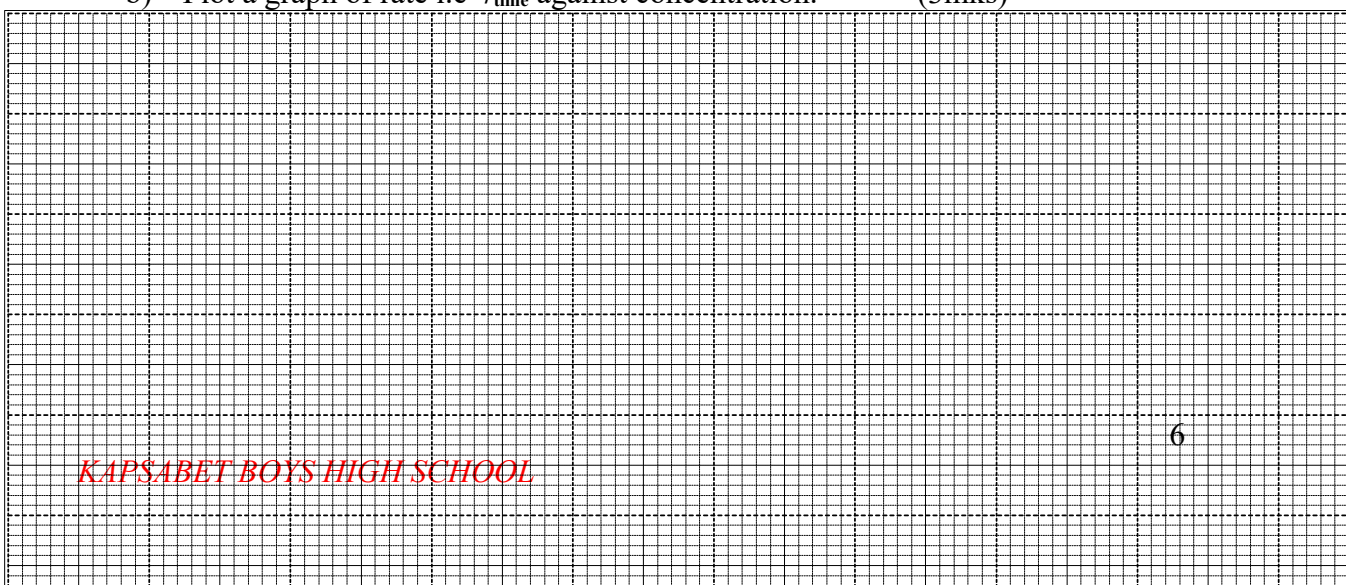
c) From your graph determine the concentration needed to produce 50cm^3 of hydrogen gas when time is 15.0 seconds (1mks)

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d) From your graph state the relationship between the rate of reaction and concentration. Give a reason. (1mk)

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e) A state of equilibrium between dichromate (vi) and chromate ions is established as shown below

$$Cr_2O_7^{2-}{}_{(aq)} + 2OH^-{}_{(aq)} \rightleftharpoons 2CrO_4^{2-}{}_{(aq)} + H_2O_{(l)}$$
Orange   **(Yellow)**
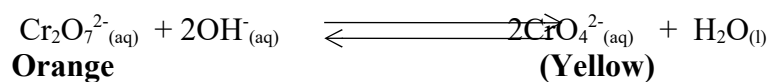
i) What is meant by dynamic equilibrium? (1mk)

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ii) State and explain observation made, when a few pellets of Hydrochloric acid are added to equilibrium mixture (2mks)

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5. I) The table below shows properties of some elements represented by symbols W,X,Y and Z. Study the information in the table and answer the questions that follows

Element	No. Of protons	Atomic radius(nm)	Boiling point ^{0}C
W	2	0.93	-269
X	10	1.31	-246
Y	18	1.54	-186
Z	36	1.89	-152

a) Write down the electron arrangement for elements W and X (1mk)

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b) In which group of the periodic table are the elements in the table above? Give the name of the group (2mks)

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c) Explain why the atomic radius of W is smaller than that of X (1mk)

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d) state one use of element X (1mk)

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II. The section below represents part of the periodic table. Study it and answer the questions that follow. The letters are not the actual symbol of the elements.

					Q				
X				B	H		M	T	
Y			A					V	

Z							S	

a) **Select** the least reactive non-metal. (1mk)

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b) **Which** of the elements has the greatest tendency of forming covalent compounds in nature? **Explain** your choice. (1mk)

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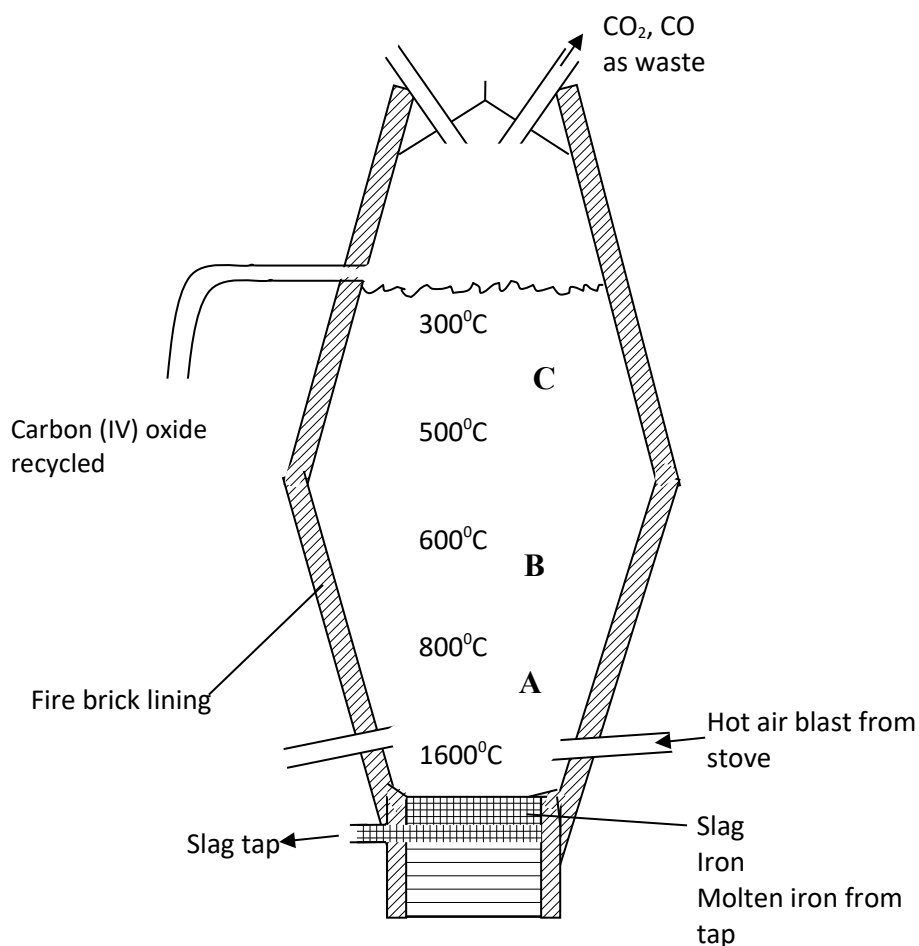
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c) **Explain** why the atomic radius of **T** is smaller than that of **M**. (2mks)

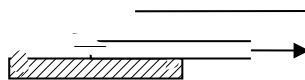……………………………………………………………………………………….…….

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d) Compare the electrical conductivity of element X and B. (2mks)

6. Extraction of iron involves two main processes, smelting and refining. Below is the blast furnace which is used to smelt iron from its ore.

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a) (a) (i) The chief ore is Haematite. Name one other ore used in extraction of iron (1 mark)

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(ii) Name the reducing agent in the process. **(1mk)**

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(i) What is the role of the hot air blast in the process? **(2mks)**

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(b) Write equations for the reactions that take place at the region marked A, B and C. **(3mks)**

A…………………………………………………………………………………

B…………………………………………………………………………………

C …………………………………………………………………………………

(c) What is the purpose of limestone in the extraction process? **(1mk)**

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(d) Write equations to show how impurities are removed from the ore. **(2mks)**

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(e) State one environmental effect of the process. (1mk)

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7. a) Read the following passage and answer the questions.

A salt K was heated with slaked lime (calcium hydroxide). A colourless gas L with a characteristic smell and turns red litmus paper blue was evolved. A large quantity of this gas was passed through an inverted filter funnel into Copper(II)sulphate solution, and a deep blue solution M was obtained.

a) Identify gas L (1mk)

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      b) What is K most likely to be?   (1mk)

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      c) Write an equation for the reaction between K and slaked lime   (1mk)

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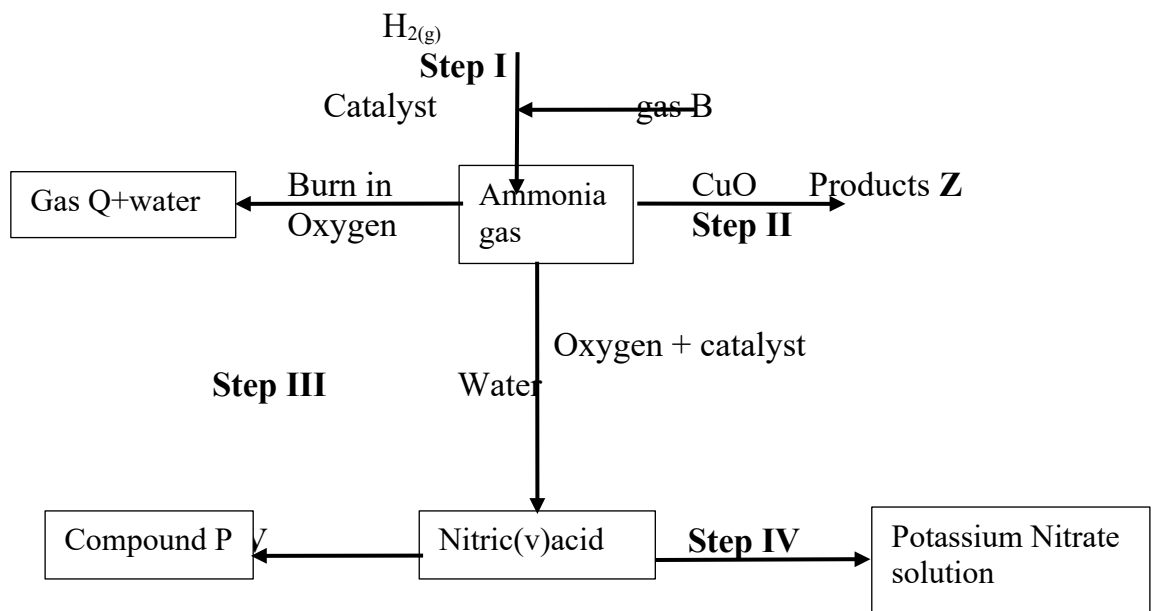
      d) Write an ionic equation for the reaction with copper(II) sulphate forming the
deep blue solution   (1mk)

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b) Study the flow chart below and answer questions that follow:

$$NH_3$$

     (i)   State **one** source of gas B   (1mk)

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     (ii)   Name the catalysts used in;   (1mk)
               a) Step I

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               b) Step III

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     (iii)   Write chemical equations for reactions in;   (3mks)
               a) Step I

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               b) Step II

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               c) Step V

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     (iv)   Identify any other gas that can be used instead of Ammonia in
           step II   (1mk)

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     (v)   State one use of gas Q   (1mk)

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