Name ....

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P525/2
CHEMISTRY
Paper 2
MARCH 2023
$2\frac{1}{2}$ hours.

Uganda Advanced Certificate of Education

CHEMISTRY

Paper 2

Time: 2 hours 30 minutes.

INSTRUCTIONS TO CANDIDATES:

- *Attempt **five** questions including **three** questions from section **A** and any **two** questions from section **B**.*

- *Begin each question on a fresh page.*

- *Mathematical tables and graph papers are provided.*

- *Non programmable scientific electronic calculators may be used.*

- *Where necessary, use the following values;*

  - *1 mole of gas occupies 22.4dm^3 at stp; molar gas constant (**R**) is 0.0821 atm dm^{3}K^{-1}.*
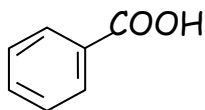
Turnover

1. (a) (i) Describe the main steps involved in the determination of the relative

    atomic mass of bromine using a mass spectrometer.   (05mks)

    ii) The naturally occurring isotopes of Bromine, are Br-79 and Br -81.
        The relative atomic mass of bromine is 79.9. Calculate the relative
        abundance of the isotopes of bromine.   (2 ½ mks)
    b) Distinguish between **nuclear fusion** and **nuclear fission**.   (02mks)

    c) The table shows the kinetic data that were obtained for radioactive decay
        of radioactive krypton.

Time (minutes)	20	40	60	80	100	120
Activity	92	85	78	72	66	61

    Plot a graph of log_{10} (activity) against time.   (04mks)

    d) Using the graph in (c) above, determine the;

    i)   original activity of krypton   (01mk)

    ii)   decay constant   (02mks)

    iii) value of half-time of krypton   (1 ½ mks)

    iv)   fraction of krypton that remained after 200 minutes.   (02mks)

2. Synthesise the following organic compounds indicating in each case the optimum

    conditions for the reactions.

    a) CH_3CH_2Br to $HOCH_2CH_2OH$ (4 ½ mks)

    b)   COOH   to   I   (03mks)
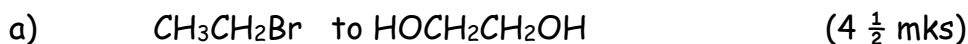
c) $HC \equiv CH$ to C_6H_5COOH (05 marks)

d) $CH_2 = CH_2$ to CH_3COCH_3 (4 ½ mks)

e) $CH_3CH = CH_2$ to $CH_3CH_2CH_2COOH$ (03marks)

3.   (a). Ethanoic acid is a weak acid.
       (i). Explain what is meant by the term a weak acid (01 mark)

       (ii). Calculate the pH of a 0.05M ethanoic acid solution.
                    (Ka for ethanoic acid is 1.8×10^{-5} $moldm^{-3}$)   (02marks)

(b). (i). Explain what is meant by the term "**buffer solution**". (01 mark)
(ii). Discuss the action of an acidic buffer solution. (04 marks)

(c). a solution was made by dissolving 7.2g of ethanoic acid and 12.0g of sodium ethanoate to make 1 litre of solution. Calculate the pH of the solution. State any assumption made. (03 marks)

(d). (i) What is an **acid – base indicator** (01 mark)
 (i) Give an example of an acid – base indicator and describe how it functions (03 marks)

(e)Draw a graph to show pH changes when a strong acid is titrated with a weak Base (01 mark)
    (ii). Explain the shape of the graph in c(i)   (04 marks)

4.   Carbon, Silicon, germanium, tin, and lead are elements of group (IV) of the periodic table. Describe the reactivity of the elements with
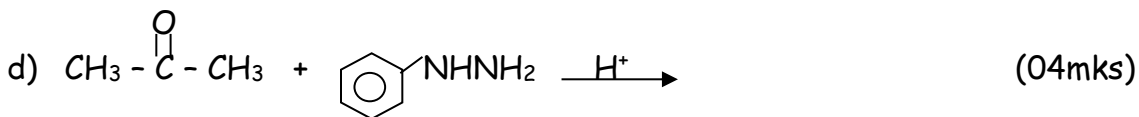
a.) Water.   *(06 marks)*

b.) Sodium hydroxide.   *(06 marks)*

d.) Acids.   *(08 marks)*

SECTION B

5. Complete each of the following reaction, equation(s) and in each case, outline a mechanism for the reaction.

a) CH_3CHCH_3 Conc. H_2SO_4 $(4 \frac{1}{2}$ mks)
        OH 170^OC

b) ⬡ + Br_2 $Fe_{(s)}$ (04mks)
                 heat

c) ⬡—$C \equiv CH$ Excess HBr $(4 \frac{1}{2}$ mks)

d) $CH_3 - \overset{O}{\overset{\|}{C}} - CH_3$ + ⬡—$NHNH_2$ H^+ (04mks)

e) ⬡—CH_3 Cl_2/u.v light   (03mks)
                boil

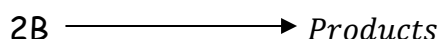6. (a). State what is meant by the following terms
   (i)order of a reaction.   *(01 mark)*
   (ii) half-life of a reaction. *(01 mark)*
   (iii) Molecularity of a reaction. *(01 mark)*

b) Describe briefly an experiment how the order with respect to hydrogen peroxide can be determined   *(05 marks)*

(c). A compound B decomposes according to the following equation

$$2B \longrightarrow Products$$

The table below shows the concentration of B at variation time

Time (minutes)	2.0	4.0	7.0	10.0	14.0	20.0
[B] (moldm^{-3})	0.82	0.67	0.49	0.37	0.24	0.14

Draw a graph of a log10[B] against time.   *(03 marks)*
(c). Using your graph, determine the
   (i). Original concentration of B.   (01 mark)
   (ii). Order of the reaction and give a reason for your answer (02marks)
   (iii). Rate constant for the reaction. (01mark)
   (iv). Half-life for the reaction.   *(01 mark)*
(d). (i). Using the same axes, draw a labelled diagram for energy-reaction coordinatefor a catalysed and uncatalysed reaction (03 marks)
(ii). State the difference in your diagrams *(01 mark)*
   (iii). State how a catalyst increases the rate of a reaction. *(01 mark)*

7. (a) Briefly describe how aluminum can be obtained from Bauxite
(your answer should include equations where necessary) (08mks)

b) Describe the reactions of aluminium with ;

i)   air   (03mks)

ii)   bromine   (1 ½ mks)

(your answers should include conditions and equations for the reactions)

c)   State what would be observed and write equations for the reactions that
        would take place when to an aqueous solution of aluminium chloride is added.

i)   Magnesium powder and mixture allowed to stand.   (2 ½ mks)

ii)   Sodium carbonate solution   (02mks)

iii)   Sodium hydroxide solution dropwise until in excess. (3 mks)

8   (a) (i)Explain what is meant by the term **equilibrium constant** (01 mark)
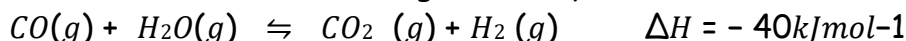   (ii) State any three characteristics of an equilibrium reaction (03 marks)

(b). Discuss the effect of each of the following on the position of equilibrium and
value of equilibrium constant
       (i). Concentration (2marks)
       (ii). Temperature   (05marks)

(c). Carbon monoxide and steam react according to the equation,
$$CO(g) + H_2O(g) \rightleftharpoons CO_2(g) + H_2(g) \qquad \Delta H = -40kJmol{-1}$$
Equal moles of carbon monoxide and steam were made to react in a 1 litre vessel.
When equilibrium was attained, the vessel was found to contain 16.7% carbon
dioxide. Calculate the
(i). Molar concentration of carbon monoxide at equilibrium (03 marks)
(ii). Equilibrium constant, Kc, for the reaction (02 marks)

(d). If the percentage yield of ammonia from nitrogen and hydrogen at 700K and
200atm is 15%. Calculate the equilibrium constant, Kp. (04 marks)

END.