



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

Faculty of Engineering & Technology

DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING

DIPLOMA IN CHEMICAL ENGINEERING

STAGE II SEMESTER II EXAMINATIONS

APRIL/MAY 2010 SERIES

PHYSICAL CHEMISTRY/ORGANIC CHEMISTRY

TIME: 2 HOURS

Instructions to Candidates

You should have the following for this examination:

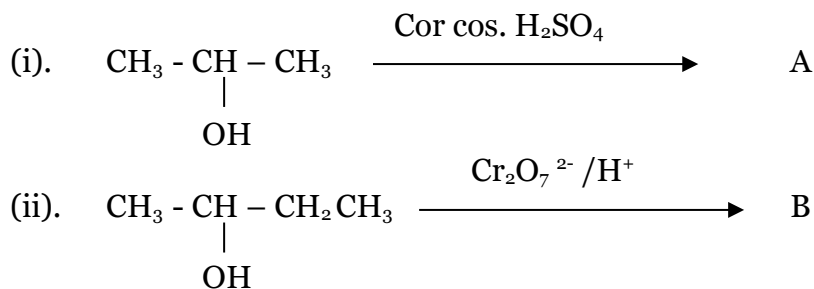
- Drawing instruments
- Scientific Calculator/SMP Tables

The paper consists of **A**, **B** and **C**
Answer **ONE** question from each section

SECTION A: COMPULSORY

Question ONE

- (a). Sketch the graph showing the distribution of velocities at two different temperatures in a system containing N molecules with n molecules having a Kinetic Energy greater than a particular value E given by $\frac{n}{N} = e^{-E/RT}$. **(6 Marks)**
- (b). Define the following terms:
- (i). Order of reaction
 - (ii). Catalyst
 - (iii). System
 - (iv). Morality
- (4 Marks)**
- (c). Write the structure formulae of all alcohols of molecular formula C₅H₁₂O, and name and classify them. **(8 Marks)**
- (d). Write the structures of products A and B of the following reactions.



(2 Marks)

SECTION B - Answer ONE Question

Question TWO

- (a). Show that for a first order reaction the constant characteristics of a particular reaction at a particular temperature is given by:
- $$k = \frac{1}{t} \ln \left(\frac{a}{a-x} \right) \quad \text{(7 Marks)}$$
- (b). Explain **FOUR** factors which affect reaction rates. **(8 Marks)**
- (c). Draw a graph showing the variation in concentration of the reactants and products with time. **(5 Marks)**

Question THREE

(a). Define the following terms.

- (i). Standard enthalpy of formation
- (ii). Calorimetry
- (iii). Isolated systems
- (iv). Endothermic process

(4 Marks)

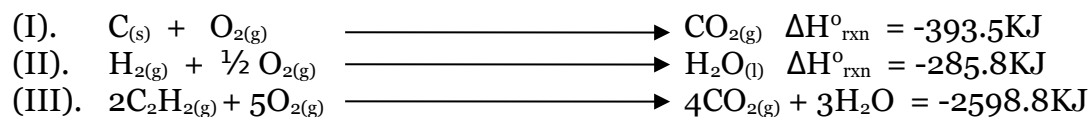
(b). A quantity of 1.922g of Methanol (CH₃OH) was burned in a constant volume bomb calorimeter. Consequently the temperature of the water rose by 4.20°C. If the quantity of water surrounding the calorimeter was exactly 2000g and the heat capacity of the calorimeter was 2.02kg/°C, calculate the molar heat of combustion of methanol.

(7 Marks)

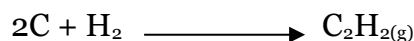
(c). (i). State Hess's law.

(2 Marks)

(ii). Applying Hess's law, determine the ΔH° of a compound from the following equations and enthalpy changes.



Calculate the standard enthalpy of formation of acetylene (C₂H₂) from its elements:



(7 Marks)

Section C - Answer ONE Question

Question FOUR

(a). Differentiate between aldehydes and ketones in terms of structure.

(2 Marks)

- (b). (i). Write the structural formulae of all carbonyl compounds of molecular formula C₄H₈O and name them.
- (ii). Explain two simple tests used to distinguish between the different compounds in b(i).

(7 Marks)

(c). Explain the importance of 2, 4 - dinitrophenylhydrazine (Brady's reagent) in the chemistry of carbonyl compounds.

(4 Marks)

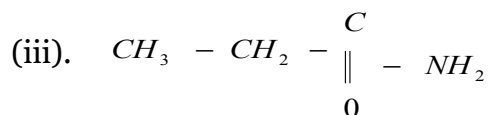
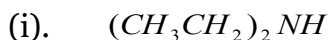
- (d). (i). Write the structural formula of the product of reaction between propanoic acid and ethanol in presence of an acid.
- (ii). Write the general reaction between a carboxylic acid and caustic soda, state the importance of this reaction in industry.

- (iii). Write the structural formulae of all acids and esters of molecular formula $C_4H_8O_2$.

(7 Marks)

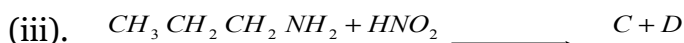
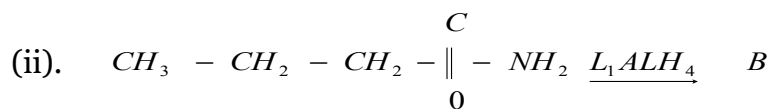
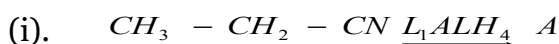
Question FIVE

- (a). Name the following compounds:



(2 Marks)

- (b). Write the structural formulae the products A, B, C and D.



(4 Marks)

- (c). Explain how the following properties of molecular chains in a polymer affect the property of the polymers.

- (i). Intermolecular forces
(ii). Branching
(iii). Cross-linking

(5 Marks)

- (d). Illustrate the polymerisation of the following:

- (i). Propene to form poly(propene)
(ii). chloroethene to form poly(chloroethene)
(iii). 1, 6 – diaminohexane and hexanedioic acid to form nylon 66.

(8 Marks)

