



TECHNICAL UNIVERSITY OF MOMBASA

School of Applied and Health Sciences
DEPARTMENT OF PURE AND APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR:

BACHELOR OF TECHNOLOGY IN APPLIED CHEMISTRY

ACH 4105: ORGANIC CHEMISTRY I

SPECIAL/ SUPPLEMENTARY EXAMINATION

SERIES: July 2025 SERIES

TIME: 2 HOURS

DATE: December 2024

Instructions to Candidates

You should have the following for this examination

Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attempt question ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

Question One (30 Marks)

(a) Convert the following condensed formulas to bond line structures and name the functional group of each compound. **[4 marks]**



(b) Draw all the constitutional isomers of an aldehyde with molecular formula $\text{C}_5\text{H}_{10}\text{O}$ and provide the IUPAC name for each isomer. **[6 marks]**

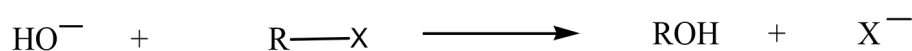
(c) By making use of relevant examples, explain how functional group/s in an organic molecule influence named physical properties of an organic molecule. **[5 marks]**

(d) i. By making use of relevant examples explain the concept of functional group isomers as relate to the structure of organic molecules. **[3 marks]**

ii. State three possible functional groups that may be exhibited by compounds with molecular formula C_4H_8O and indicate how you arrive at your proposals. **[4 marks]**

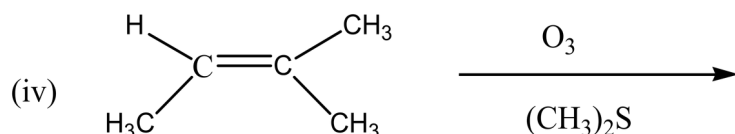
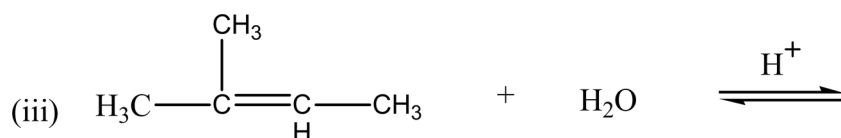
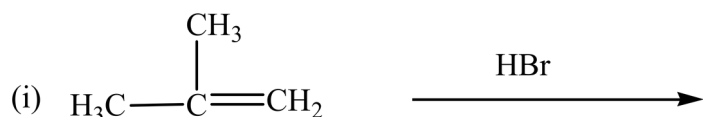
(e) i. What is the difference between unimolecular and bimolecular reactions as applied in the reaction of alkyl halides? **[2 marks]**

ii. With the aid of hypothetical reaction below, differentiate between a S_N1 and S_N2 reaction mechanism of alkyl halides by making use of curly arrows. **[6 marks]**



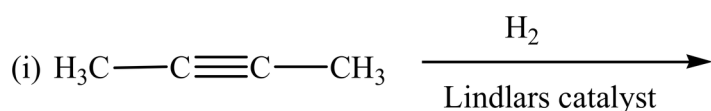
Question Two (20 Marks)

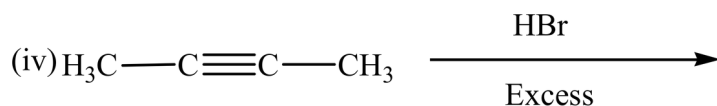
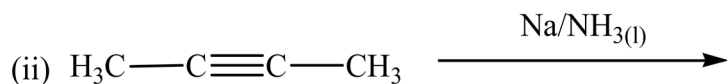
(a) Provide the structures of the main product formed from each of the following reactions of alkenes **[8 marks]**



b) Provide probable reaction mechanisms leading to the formation of the products in (a) (i) and (ii) above by making use of curly arrows. **[4 marks]**

c) Provide the structure of the major product(s) formed from each of the following reactions of alkynes indicating stereochemistry of the products where applicable. **[6 marks]**





Question Three (20 Marks)

a) Explain how compounds with the following functional groups can be distinguished

[4 marks]

i) Carboxylic acid and ester

ii) Primary alcohol and tertiary alcohol

b) Outline the reaction mechanism by making use of curly arrows for the reaction between propane ($\text{CH}_3\text{CH}_2\text{CH}_3$) and chlorine (Cl_2) in the presence of ultraviolet light or heat leading to the formation of 2-chloropropane. Indicate all the initiation, propagation and termination steps.

[10 marks]

c) Provide the structures of the dehydrohalogenation products of the following alkylhalides and indicate the minor product in each case.

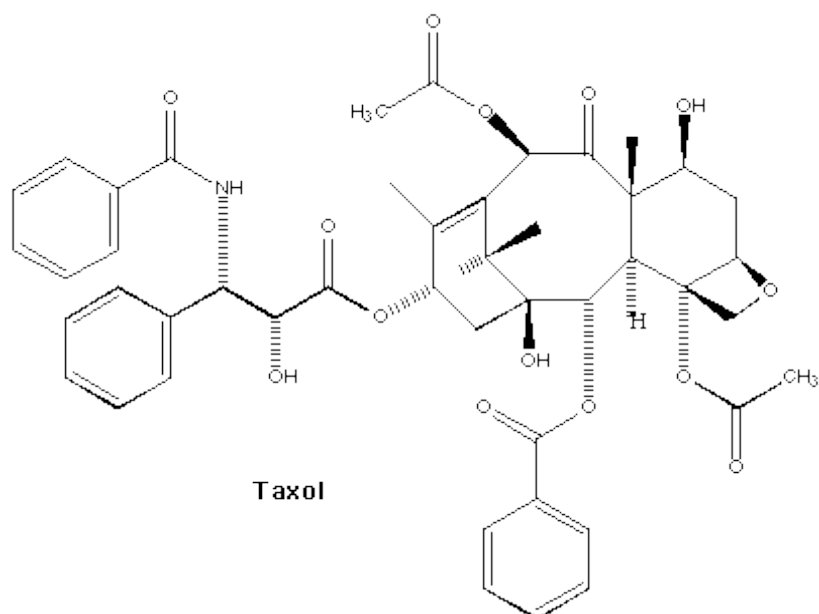
[6 marks]

i) 3-bromo-3-methylhexane

ii) 1-bromo-1-methylcyclopentane

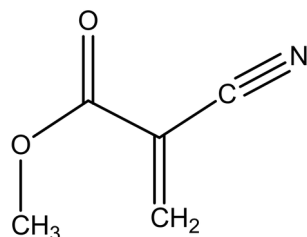
Question Four (20 Marks)

a) Taxol is an exciting anticancer agent which has been used for the treatment of breast, ovarian, lung, bladder, prostate, melanoma, esophageal, as well as other types of solid tumor cancers.



Trace the structure of the molecule and identify all functional groups in the structure of Taxol by circling and providing the names. **[7marks]**

b) Consider the molecule shown below.



(i) What is the degree of unsaturation in the molecule? **[2 marks]**

(ii) Label the hybridization state of all the carbon atoms in this molecule. **[3 marks]**

c) Draw the skeletal structures (line bond formula) of the following organic compounds. **[8 marks]**

(i) 7-ethyl-9-methylbicyclo[4.3.0]nonane

(ii) 4-tertbutyl-2-methyloctane

(iii) 5-isopropyl-2-methylcyclohexanol

(iv) (E)-But-2-ene

(v) Butanoic propanoic anhydride

(vi) 2-aminopentane

Question Five (20 Marks)

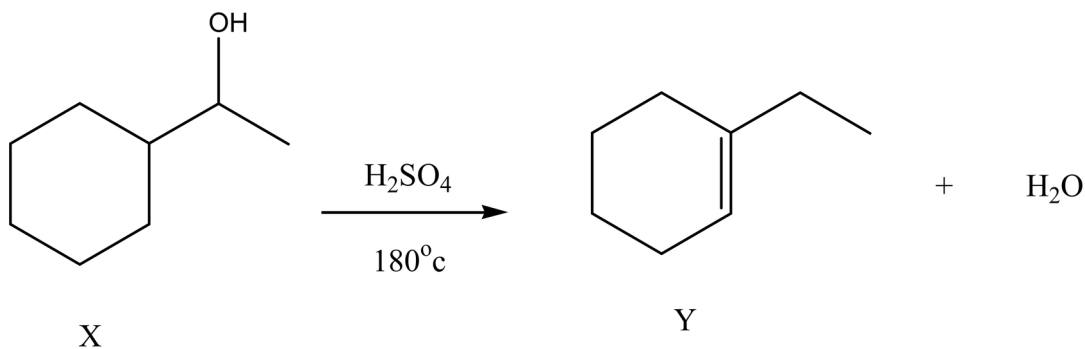
(a) Compare the effects on the reaction rates of S_N1 and S_N2 reactions of alkyl halides (RX , $X = F, Cl, Br, I$) with respect to:

- (i) Structure of the alkyl halide,
- (ii) Nature of the halogen atom (X),
- (iii) Nature of the nucleophile, and
- (iv) Nature of solvent.

[12 marks]

(b) Show the reaction mechanism by making use of curly arrows for the dehydration reaction of alcohol (X) to form alkene (Y).

[6 marks]



(c) Provide the structure of the alkene that would be formed alongside alkene (Y) in (a) above? [2 marks]