



MAASAI MARA UNIVERSITY

**UNIVERSITY EXAMINATIONS 2012/2013
SECOND YEAR SECOND SEMESTER EXAMINATION**

SCHOOL OF SCIENCE

**DIPLOMA IN EDUCATION PRIMARY
OPTION**

COURSE CODE: PCHE 0212

COURSE TITLE: BASIC ORGANIC CHEMISTRY

DATE: April 2013

3 HOURS

INSTRUCTIONS

Answer question **ONE** and any other **TWO** questions

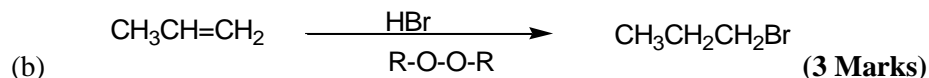
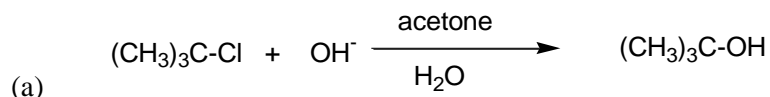
QUESTION ONE (30 Marks)

1. (a) Define the following terms
- (i) Torsional energy
 - (ii) Enantiomers
 - (iii) Diastereomers **(3 Marks)**
- (b) (i) State three properties of enantiomers **(1 ½ Marks)**
- (ii) The concentration of Cholesterol in Chloroform is 6.15g/100ml. A part of the solution in a 5cm tube caused an observed rotation of -1.2° . Calculate the specific rotation. **(2 Marks)**
- (iii) Draw the structure of Cholesterol and identify the stereocenters. Calculate the expected stereoisomers. **(2 Marks)**
- (c) (i) Using an illustration explain how atomic orbitals of hydrogen form molecular orbitals. **(3 Marks)**
- (ii) Explain why S_N2 reactions are not prone to rearrangement **(1 Mark)**
- (iii) Show the mechanism for the reaction below and indicate the S_N1
- $$\begin{array}{ccc}
 & 80\% \text{ C}_2\text{H}_5\text{OH} & \\
 (\text{CH}_3)_3\text{C-Cl} & \xrightarrow{\hspace{2cm}} & \text{CH}_2=\text{C} \begin{array}{l} \text{CH}_3 \\ \text{CH}_3 \end{array} + \text{SN}^1 \text{ Products} \\
 & 20\% \text{ H}_2\text{O at } 20^\circ\text{C} & \text{E}^1
 \end{array}$$
- (3 ½ Marks)**
- (d) (i) Write the formula for calculating formal charge **(½ Mark)**
- (ii) Calculate the formal charge for NH_4^+ **(2 Marks)**
- (iii) Draw the resonance structures for CO_3^{2-} **(1 ½ Marks)**
- (e) (i) Explain the following observation: CCl_4 has a dipole moment of zero **(1 Mark)**
- (ii) Draw the structures of the anti-eclipse and gauche conformation and all the minimum and maximum conformation at C_3 and C_4 of hexane. **(2 Marks)**
- (iii) Using the R/S system write the formula 2-Butanol **(2 Marks)**
- (f) (i) Give the product and the name of the following reaction;
- $$\begin{array}{c}
 \text{H} \\
 | \\
 3\text{CH}_3\text{C}=\text{O} \xrightleftharpoons{\text{H}^+}
 \end{array}$$
- (1 Mark)**
- (ii) Using illustrations explain why alcohol boils at a higher temperature **(2 Marks)**

QUESTION TWO (20 Marks)

2. (a) (i) Define a nucleophile. **(1 Mark)**

(ii) Show the mechanism for the reactions below.



(b) (i) Explain the difference in the physical and chemical properties observed between Ethyl alcohol and dimethyl ether as shown in the table below. **(2 Marks)**

| | | |
|-----------------------|---------------------------------|---------------------------------|
| Molecular Formula | C ₂ H ₆ O | C ₂ H ₆ O |
| B.P °C | 78.5 | -24.5 |
| M.P °C | -117 | -138 |
| Reaction with a metal | Hydrogen is displaced | No reaction |

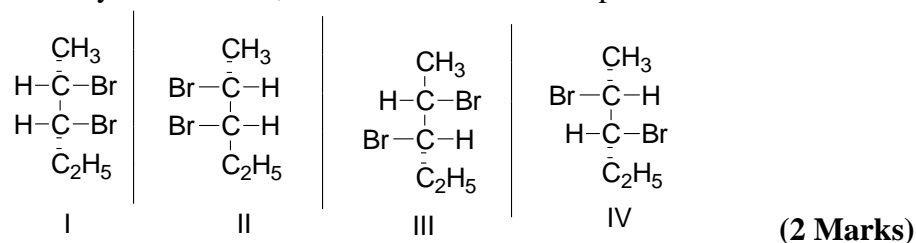
(ii) State two fundamental factors in the structural theory **(2 Marks)**

(iii) Explain why even numbered alkenes have higher B.P than the odd numbered alkanes. **(1 Mark)**

(c) (i) Define SN¹ and SN² reactions **(2 Marks)**

(ii) State three physical properties of carboxylic acids **(3 Marks)**

(iii) Identify enantiomers, diastereomers in the compounds below



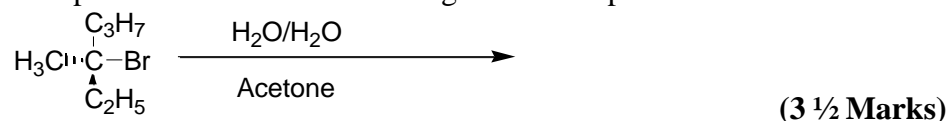
(iv) State the four steps for writing the nomenclature using the R/S system **(4 Marks)**

QUESTION THREE (20 Marks)

3. (a) (i) State the Zaitsev's rule. **(2 Mark)**
- (ii) Compare and contrast substitution versus elimination reactions on 1°; 2° and 3° substrates. **(3 Marks)**

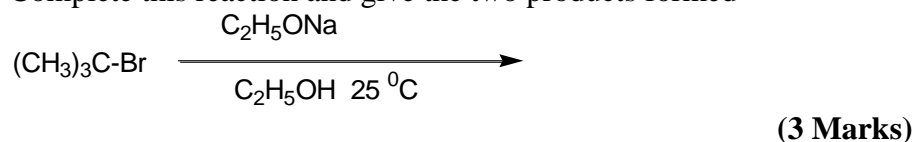
- (b) (i) Explain why branching of alkanes reduces the boiling points **(2 Marks)**
- (ii) Give the reason for the differences in the Bp and M.p of *trans* and *cis* alkenes. **(2 Marks)**

- (iii) Complete the reaction below and give the two products formed.

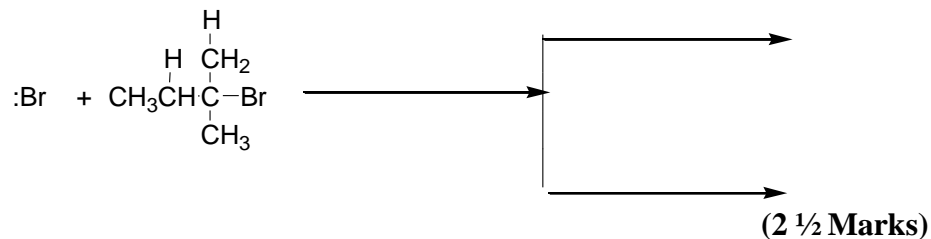


- (c) (i) The stability of a carbocation depends on the groups attached to the central positively charged Carbon and the order of their reaction is 3° > 2° > 1° > Methyl. Give the reason for this trend **(2 Marks)**

- (ii) Complete this reaction and give the two products formed



- (iii) Complete the reaction below and give the products formed



QUESTION FOUR (20 Marks)

4. (a) State the modern times Markovnikov's rule **(1 Mark)**
- (b) (i) The following data was reported for a compound newly isolated from a plant source: $[\alpha]_D^{20} = +33.5^\circ$. Explain what each represents **(2 Marks)**
- (ii) A solution of 2g (+)-glyceraldehyde in 10ml water was placed in a 100mm cell using the Sodium D-line; an observed rotation of $+1.74$ was reported. Determine the specific rotation **(3 ½ Marks)**
- (c) (i) State the three parts that constitute the IR region **(1 ½ Marks)**
- (ii) Draw the IR spectrum for acetic acid. **(3 ½ Marks)**
- (iii) State the three rules for writing Lewis structure **(3 Marks)**
- (vi) The dipole moment of a gas phase HBr molecule is 0.827D. Determine the charge distribution in the diatomic if the bond distance is 141.5pm **(2 ½ Marks)**
- (d) (i) Briefly describe the absorption of light in the IR region of the spectrum **(2 Marks)**
- (ii) State two factors used to recognize the presence of a chiral molecule **(1 Mark)**
- (iii) Define a resonance structure **(1 Mark)**

End