

**UNIVERSITY OF SWAZILAND**  
**SUPPLEMENTARY EXAMINATION 2014, MAY**

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**TITLE OF PAPER** : Introductory Organic Chemistry

**COURSE NUMBER** : C203

**TIME** : Three Hours

**INSTRUCTIONS** : **Section A is compulsory.** Answer any **three** questions from Section B. Each question carries **25** marks

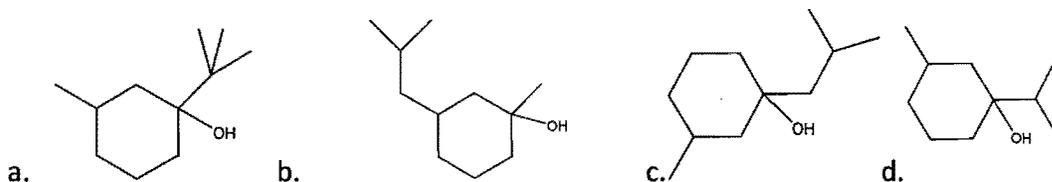
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This Examination Paper Contains Six Printed Pages Including This Page

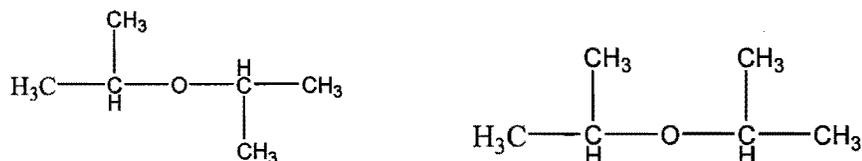
***You are not supposed to open the paper until permission to do so has been granted by the Chief Invigilator.***

**Section A: (compulsory – answer all questions)**

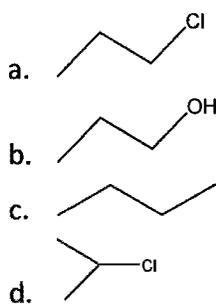
1. Which of these is 3-isobutyl-1-methylcyclohexanol?



2. What is the relationship between the structures shown?



- Different compounds that are isomers
  - Different compounds that are not isomers
  - Resonance structures
  - The same compound
3. Which of the following has the highest boiling point?



4. Ozonolysis of an unknown compound gave  $\text{CH}_2=\text{O}$ ,  $\text{CH}_3\text{CHO}$  and  $\text{CH}_3\text{COCHO}$ .

What are possible structures for the unknown compound?

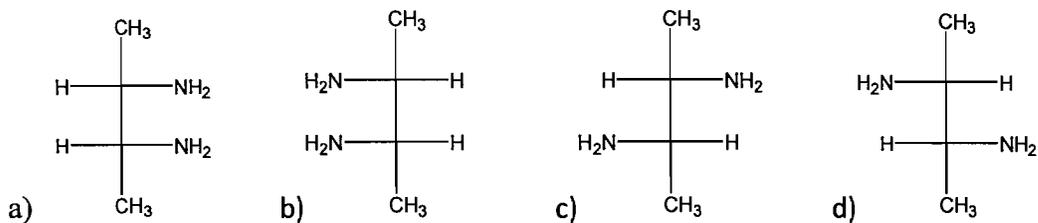


- I and II
- I and IV

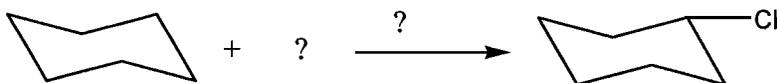
c. II and III

d. II and IV

5. Which of the following is (2R,3R)-2,3-diaminobutane



6. Which of the following sets of reagents and conditions will complete the following reaction?



a)  $\text{Cl}_2$ , Ni or Pt catalyst

b) Aqueous HCl, heat

c)  $\text{CH}_3\text{Cl}$ , light

d)  $\text{Cl}_2$ , light

7. Molecule A is the enantiomer of molecule B. Molecule B is a stereoisomer of molecule C but NOT its mirror image. What is the relationship between A and C?

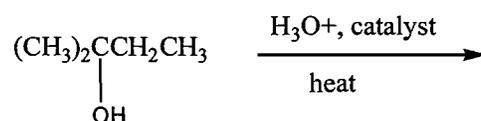
a. Same compound

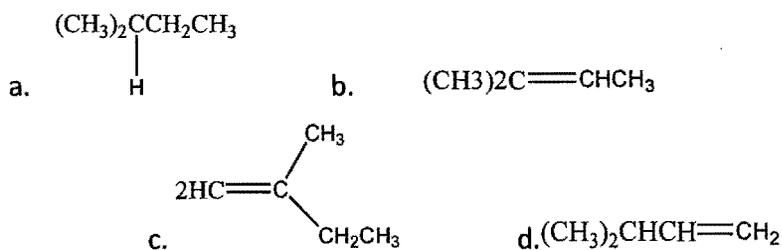
b. Enantiomers

c. Diastereomers

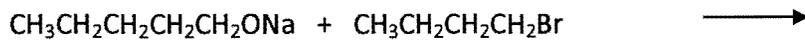
d. Constitutional isomers

8. What is the major product in the following reaction?



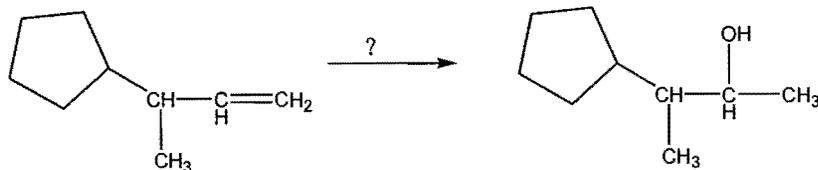


9. What is(are) the major organic product(s) of the reaction shown?



- $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{CH}_2\text{CH}_3$
- $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OCH}(\text{CH}_3)\text{CH}_2\text{CH}_3$
- $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OH} + \text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$
- $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}=\text{CH}_2 + \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$

10. Which of the following sets of reagents can be used to bring about the transformation shown?



- $\text{H}_2\text{O}, \text{H}_3\text{O}^+$
- $\text{Hg}(\text{O}_2\text{CCH}_3)_2, \text{H}_2\text{O}$ ; then  $\text{NaBH}_4, \text{NaOH}$
- $\text{CrO}_3, \text{H}_2\text{SO}_4$
- $\text{BH}_3\text{-THF}$ ; then  $\text{H}_2\text{O}_2, \text{NaOH}$

11. ....substitution reactions are characteristic of all aromatic rings.

- Nucleophilic
- Electrophilic
- Elimination
- None of the above

12. In the mechanism of..... reactions, the leaving group leaves unassisted before the nucleophile attacks.

- $\text{S}_{\text{N}}2$
- $\text{S}_{\text{N}}1$

- c. E2
  - d. None of the above
13. ....can occur more than once on a benzene ring.
- a. Alkylation
  - b. Acylation
  - c. both (a) and (b)
  - d. none of the above

**Section B: (answer any 3 questions)**

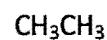
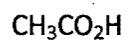
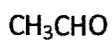
**Question 1**

- a. Give the general formulas for the following classes of organic compounds? (5)
- Alkenes
  - Alkanes
  - Aldehydes
  - Carboxylic acids
  - Esters
- b. Give the structural formulas for the following compounds: (20)
- 3-isobutyl-2-methylcycloheptanol
  - (2R,3R)-2,3-dinitrobutane
  - 3-bromo-1,1,2-trichloropropane
  - 1,3-butadiyne
  - p*-dimethylbenzene
  - 2-aminonitrobenzene
  - Cyclohexyl *n*-propyl ether
  - 3-hydroxypentanal
  - 3-methyl-2-butanone
  - Pentanoic acid

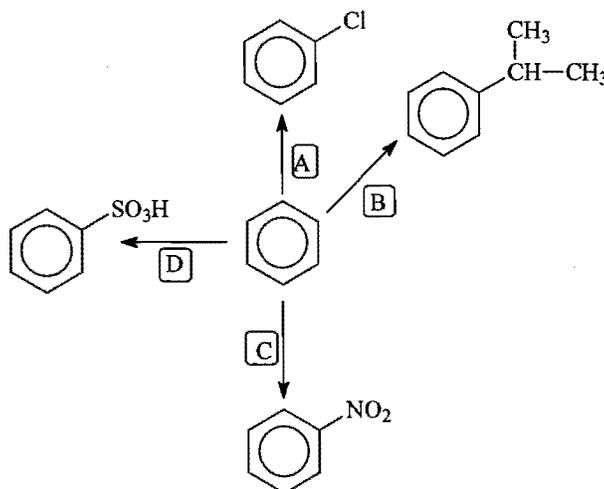
**Question 2**

- a. 2-Benzyl propene reacts with hydrogen bromide and undergoes electrophilic addition reaction
- State Markovnikov's rule. (2)
  - Provide the reaction scheme and the mechanistic pathway of the above reaction. (8)
  - What reagent should be used so that the reaction follows anti-Markovnikov's rule? (3)

(b) Rank the following in order of increasing oxidation level (1 lowest, 4 highest) (4)



(c) Complete the following reactions by supplying the missing reagents only. (8)



### Question 3

In the presence of traces of a mineral acid, H<sup>+</sup>, 2,3-dimethyl-3-pentanol (A) is converted to a mixture of three hydrocarbon products B, C and D in the ratio of 70:20:10.

- Draw the bond-line structure of A. (2)
- Give structures for B (70%), C (20%) and D (10%). (6)
- What mechanistic pathway is being followed in the above reaction? (2)
- Explain why there is a mixture of products. (4)
- Give reasons why B is in major yield followed by C and then D. (2)
- Discuss the Lucas test for distinguishing between 1°, 2° & 3° alcohols (5)
- Write the product of the reaction of ethanol with ethanoic acid (4)

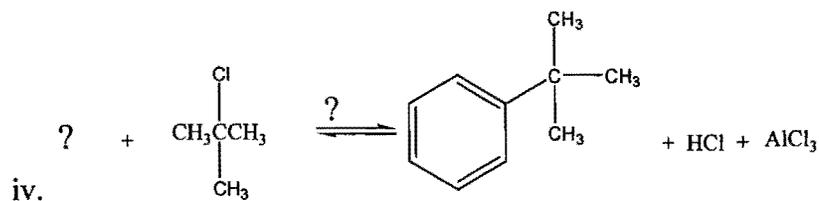
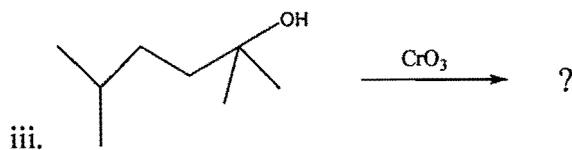
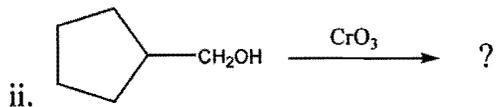
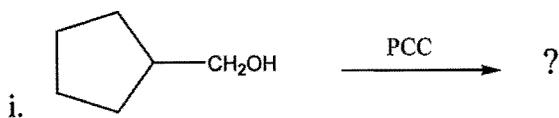
### Question 4

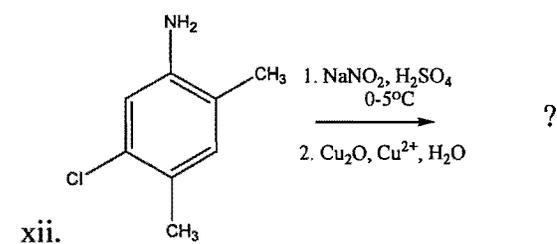
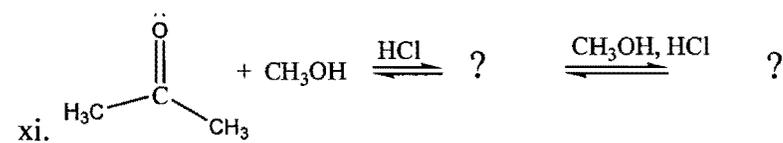
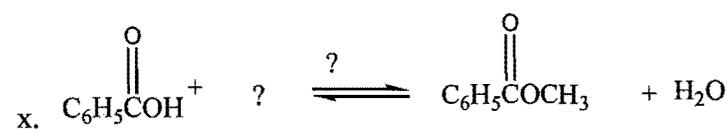
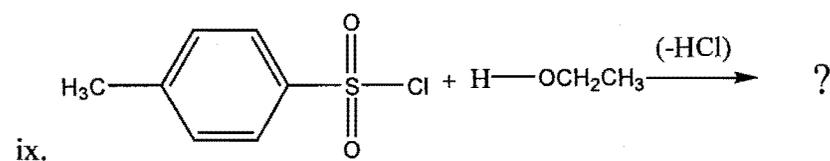
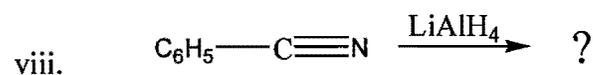
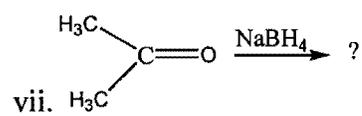
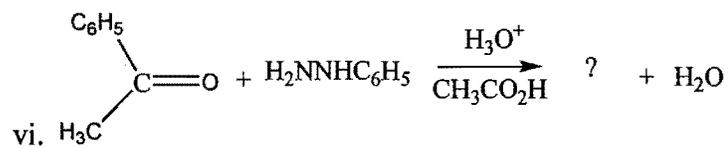
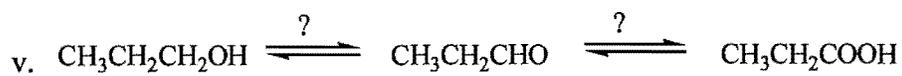
- What is a chiral centre? (2)
- Can the C<sup>+</sup> of a carbocation be a chiral centre? (2)

- c. Draw the following compounds and identify the chiral centre in each of them:(6)
- 2-chlorobutane
  - 1,2-dichloropropane
  - 3-bromo-1-pentene
- d. What is plane-polarized light? (2)
- e. Assign priorities for each of the following pairs of ligands: (10)
- $\text{CH}_3^-$  and  $\text{CH}_3\text{CH}_2^-$
  - $(\text{CH}_3)_2\text{CH}-$  and  $(\text{CH}_3)_3\text{C}-$
  - $(\text{CH}_3)_2\text{CH}-$  and  $\text{H}_2\text{C}=\underset{\text{H}}{\text{C}}-$
  - $\text{HC}\equiv\text{C}-$  and  $(\text{CH}_3)_3\text{C}-$
  - $\text{HC}\equiv\text{C}-$  and  $\text{O}=\underset{\text{H}}{\text{C}}-$
- f. What is the relationship, if any, between the sign of rotation of a chiral compound (+) and (-) and its designation as R or S? (3)

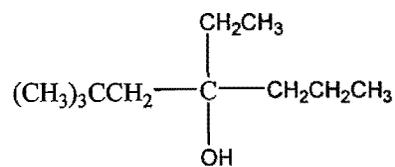
### Question 5

- a. Provide the missing reagents, products and/or reaction condition in the following: (16)





- b. Outline 3 routes of Grignard synthesis of the following compound. (only write the structural formula of the carbonyl compound and Grignard reagent for each synthesis). (9)



UNIVERSITY OF SWAZILAND

CHEMISTRY DEPARTMENT

C203 SECTION A ANSWER SHEET

STUDENT ID NUMBER: \_\_\_\_\_

The correct answer must be indicated by putting a circle on the letter for that answer on the answer sheet provided. If you change your answer, please cancel the wrong answer with a cross and then put a circle around the correct one. If more than one option has a circle around it a zero will be given for that question.

1	A	B	C	D	E
2	A	B	C	D	E
3	A	B	C	D	E
4	A	B	C	D	E
5	A	B	C	D	E
6	A	B	C	D	E
7	A	B	C	D	E
8	A	B	C	D	E
9	A	B	C	D	E
10	A	B	C	D	E
11	A	B	C	D	E
12	A	B	C	D	E
13	A	B	C	D	E