

UNIVERSITY OF SWAZILAND

FINAL EXAMINATION 2013, DECEMBER

TITLE OF PAPER : Introductory Organic Chemistry

COURSE NUMBER : C203

TIME : Three Hours

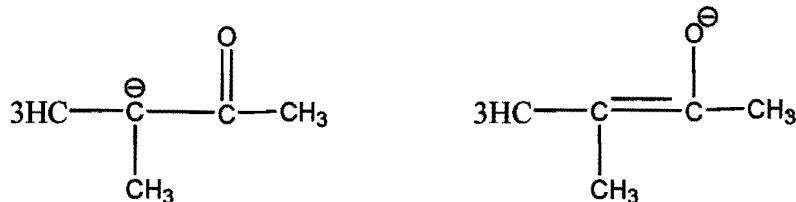
INSTRUCTIONS : **Section A is compulsory. Answer any three**
questions from Section B. Each question carries **25**
marks

This Examination Paper Contains 12 Printed Pages Including This Page

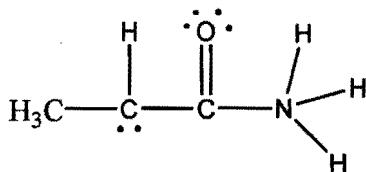
***You are not supposed to open the paper until permission to do so has been granted by
the Chief Invigilator.***

Section A: (compulsory – answer all questions)

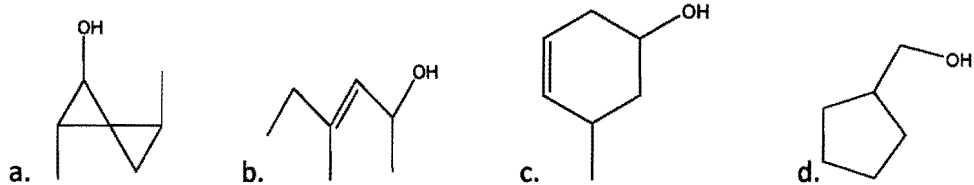
1. What is the relationship between the structures shown?



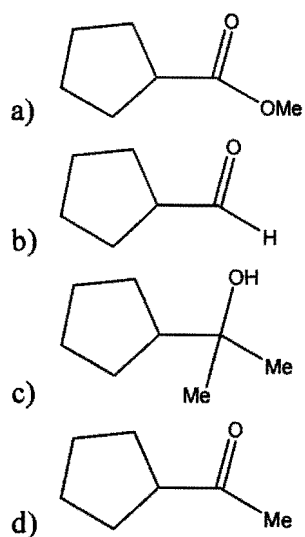
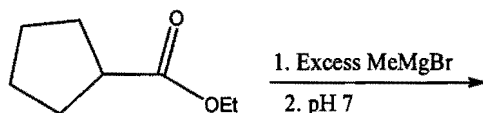
- A. Resonance forms
B. The same compounds
C. Different compounds
D. Isomers
2. Which of the following molecules is the least soluble in water?
- a. CH_3CHO
b. $\text{H}_2\text{C}=\text{CHCH}_2\text{CH}_3$
c. $\text{H}_2\text{C}=\text{CHCH}_2\text{OH}$
d. $\text{CH}_3\text{CH}_2\text{OH}$
3. What is the total charge of the following species?



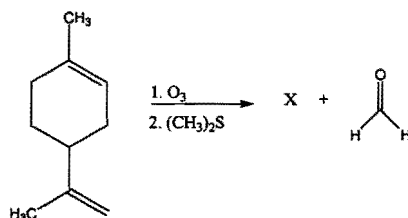
- a. +1
b. +2
c. 0
d. -1
4. Which of the following is an isomer for cycloheptanol?

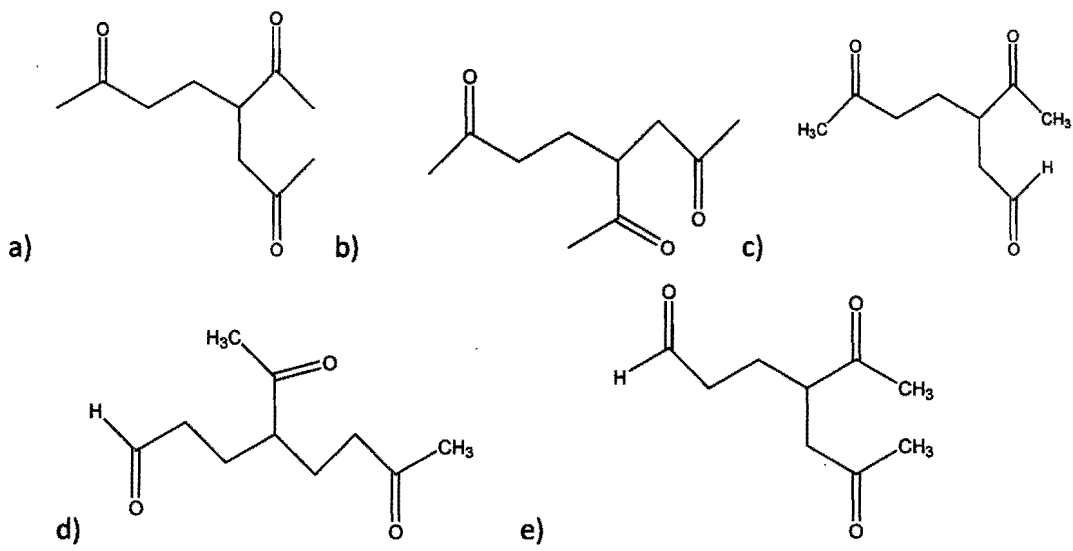


5. What would be the major organic product of the reaction scheme shown below?

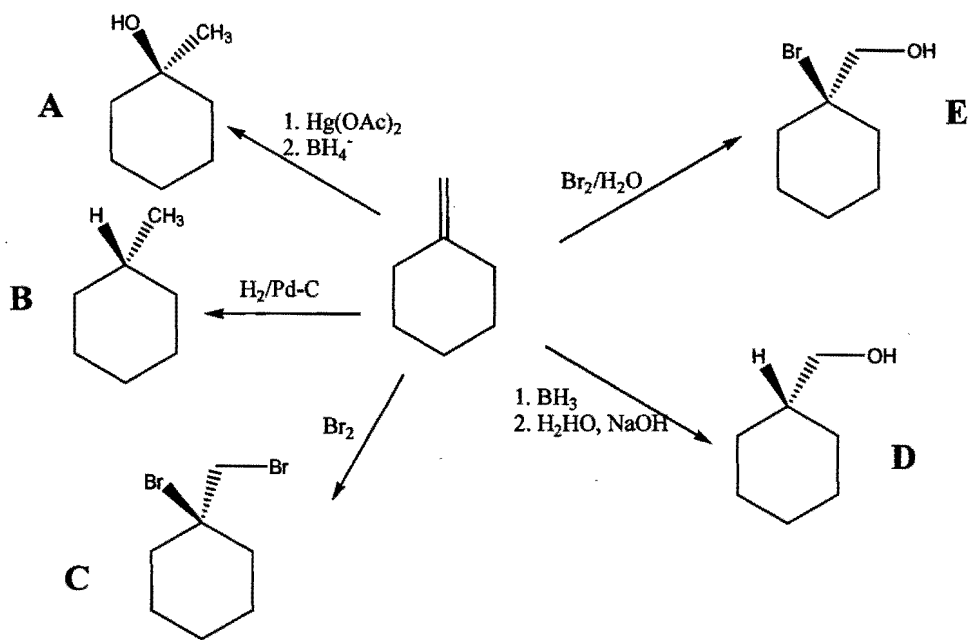


6. The ozonolysis of limonene (an oil from lemon) gives formaldehyde and compound X. choose the correct structure for compound X.

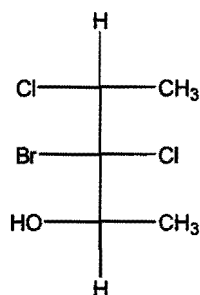




7. Which of the following reactions is incorrect?

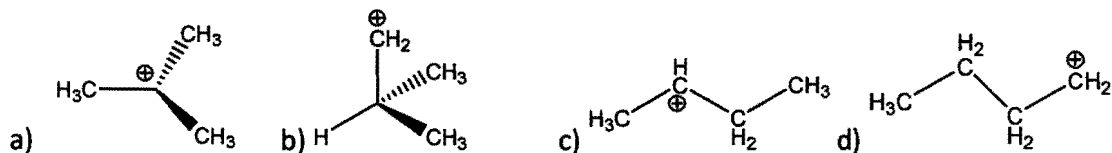


8. Give the IUPAC name of:

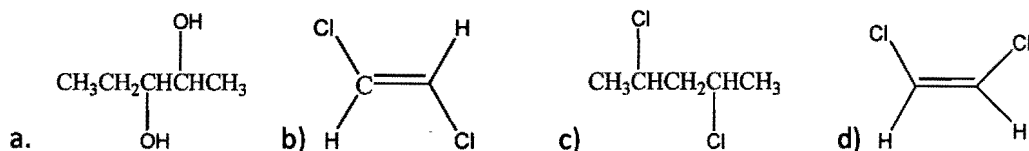


- (2R,3S,4S)-3-bromo-3,4-dichloro-2-pentanol
- (1R,2R,3R)-2-bromo-2,3-dichloro-1,3-dimethyl-propanol
- (1R,2S,3R)-2-bromo-1,2-dichloro-1,3-dimethyl-3-propanol
- (2R,3S,4R)-3-bromo-3,4-dichloro-2-pentanol

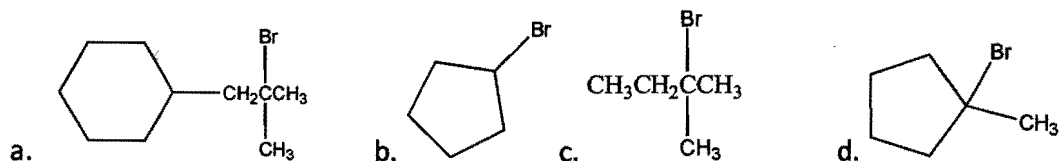
9. Which of the following is the most stable carbocation having the molecular formula C_4H_9^+ ?



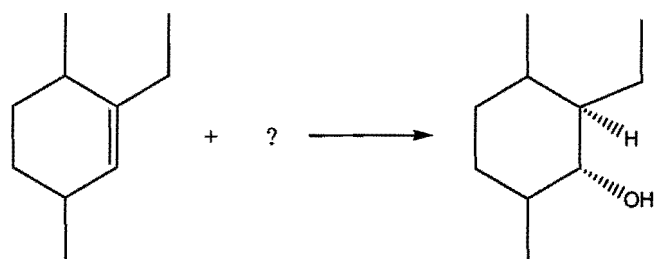
10. Which of the following has a meso stereoisomer?



11. Which of the following alkyl halides gives only one alkene as the product in the E2 reaction?

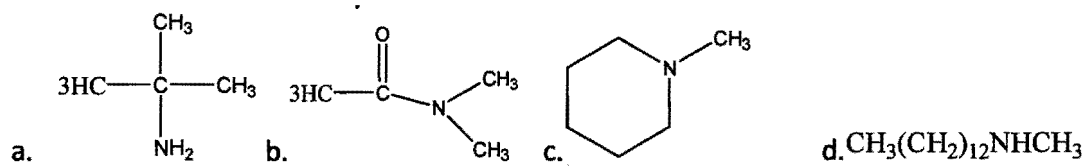


12. Which of the following will give the transformation shown?



- a) $\text{Cl}_2, \text{H}_2\text{O}$
- b) PBr_3 followed by H_3O^+
- c) $\text{Hg}(\text{OAc})_2/\text{H}_2\text{SO}_4, \text{water}$
- d) BH_3, THF followed by $\text{H}_2\text{O}_2, \text{OH}^-$

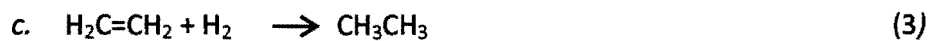
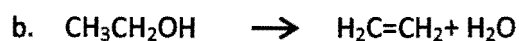
13. Which of the following is a 3° amine?



Section B: (answer any 3 questions)

Question 1

- a. Classify these reactions as additions, eliminations, substitutions or rearrangements

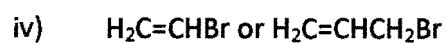
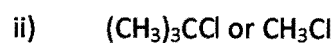


- b. Which of the following would you expect to behave as electrophiles and which as nucleophiles?



- c. Which reagent in each pair will react faster in an $\text{S}_{\text{N}}2$ reaction with hydroxide ion?

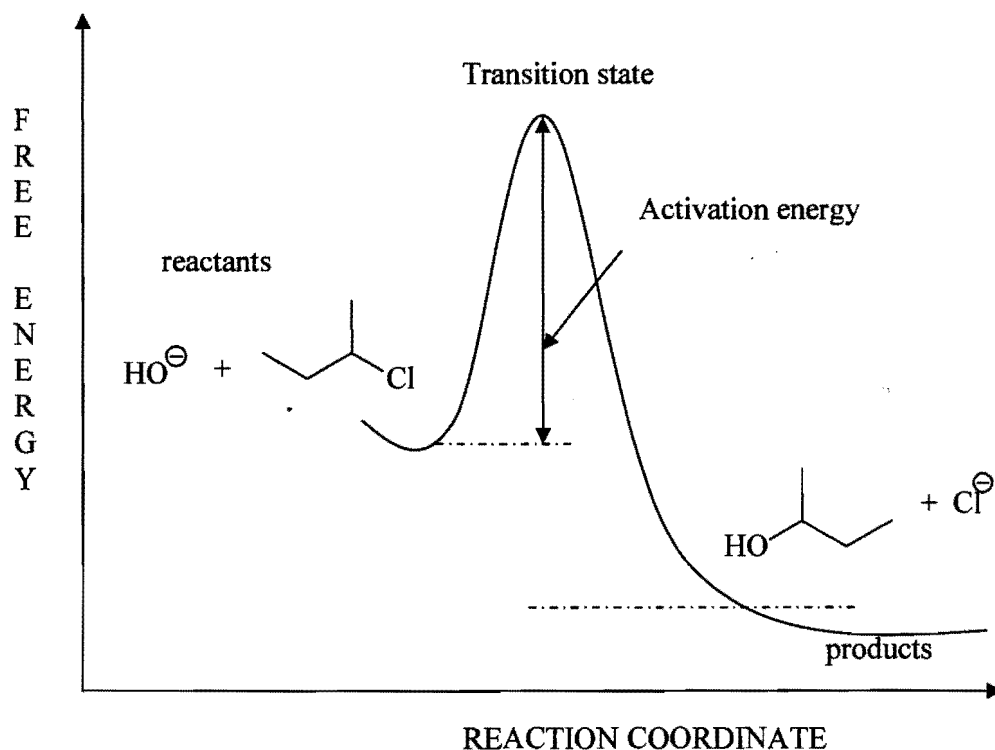
(6)



- c. The hydrolysis of 2-iodo-3-methylbutane yields a tertiary alcohol as the major product. Provide an equation, with mechanism, for this reaction and explain why the tertiary alcohol is the major product. Also, give the name and structure of both the major and minor products. (9)

Question 2

- a) Consider the following diagram and answer the questions below.

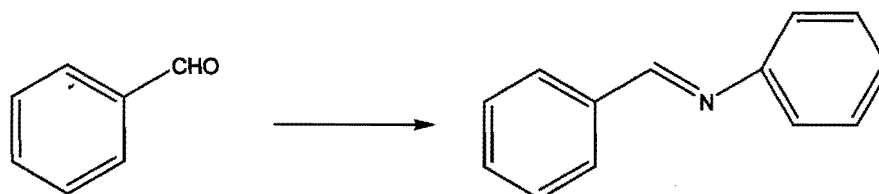


- Write an equation that expresses the rate of the reaction. (1)
- Classify the type of organic reaction occurring. What mechanistic pathway is followed? (1)
- Identify the leaving group and nucleophile. (1)
- Name one source from which the nucleophile can be obtained. (1)
- State the conditions that would favour the type of mechanism identified in Question (ii) above. (5)
- Briefly explain the following terms (2)
 - transition state and

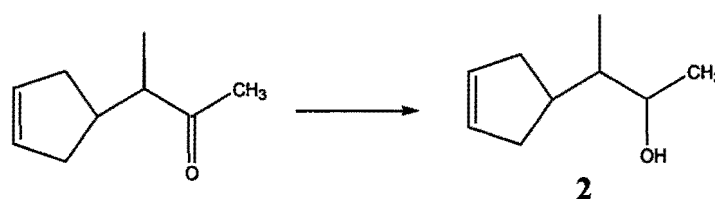
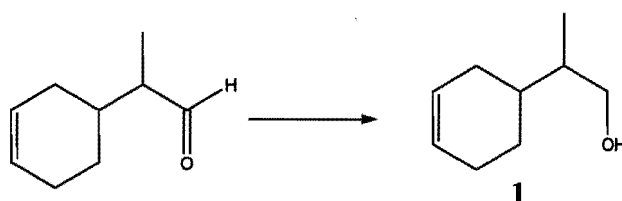
- Activation energy. (2)
- vii) Give a complete mechanism, **showing all arrows**, for this reaction. (6)
- viii) Does this mechanism affect the stereochemistry of the product? If yes, explain how. (4)
- ix) Give the name of the mechanistic pathway that the reaction would take when the hydroxide ion is replaced with a hindered base such as *tert*-butoxide ion (2)

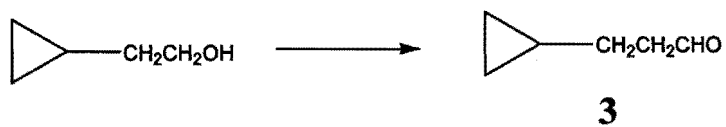
Question 3

- a. Provide the reagents required to accomplish the following transformation, and show, by means of a reaction mechanism, how the product is formed (10)

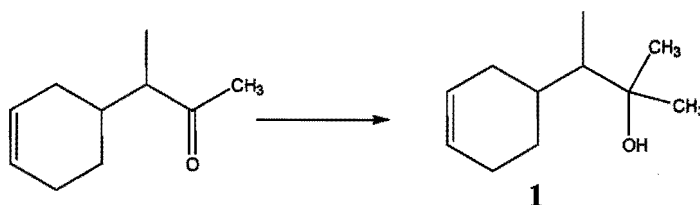


- b. What reagents could you use to accomplish the following transformations, affording compounds 1, 2 and 3. (3)



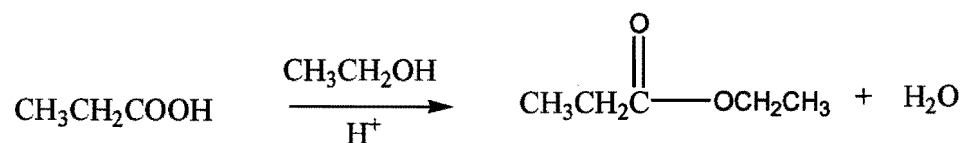


- c. Classify the alcohols (1 & 2) as primary, secondary or tertiary. (2)
- d. Show the mechanism for the following reaction. (10)

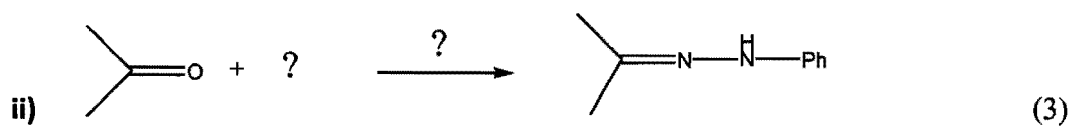
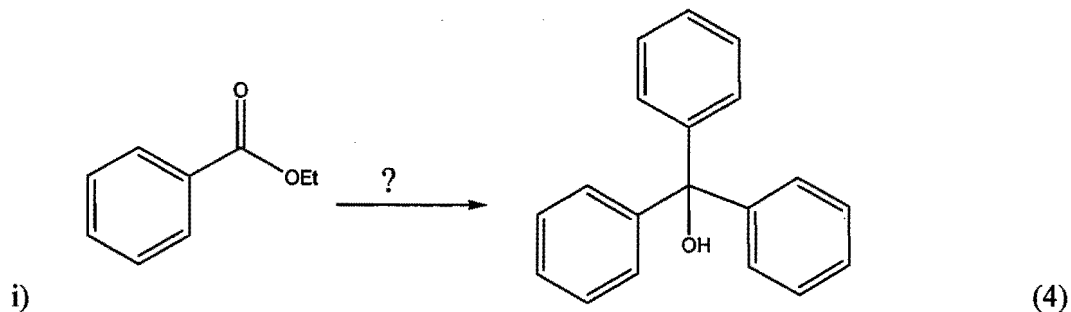


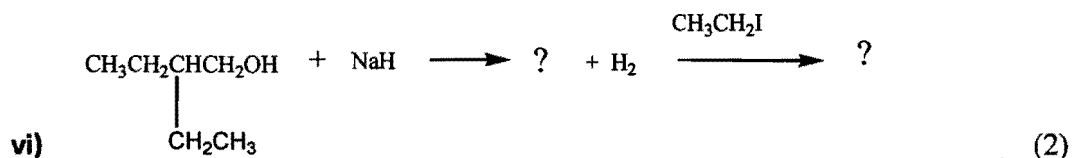
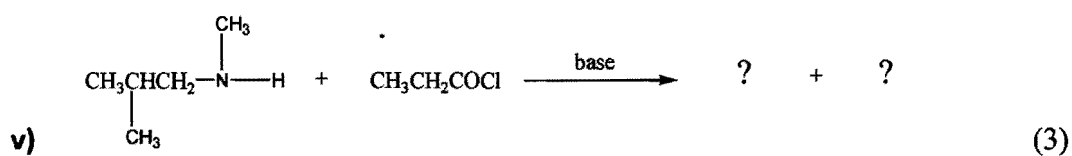
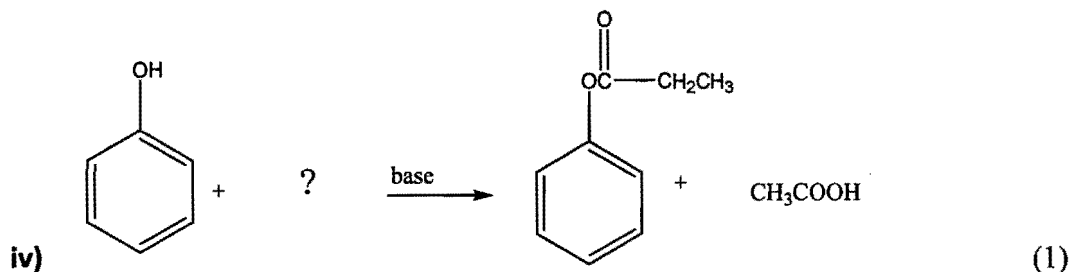
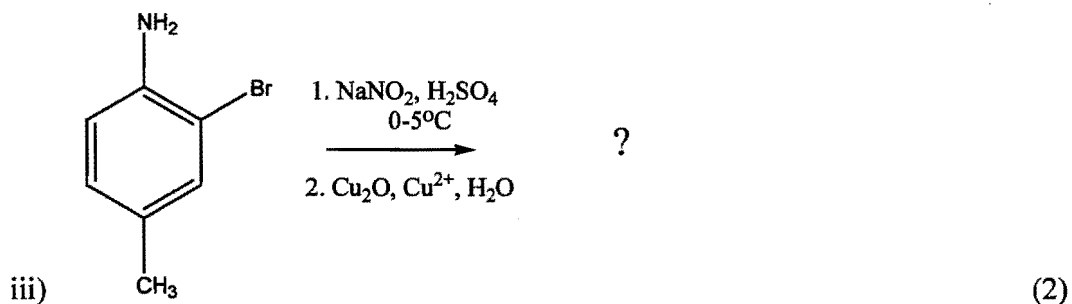
Question 4

- a. Show, with mechanistic detail, how the ester (below) is formed from a carboxylic acid and an alcohol in the presence of an acid catalyst. (10)



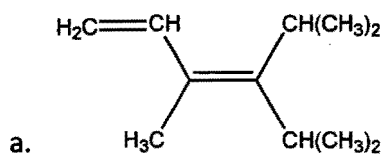
- b. Provide the missing reagents, product and/or reaction conditions where necessary for accomplishing the following transformations. Mechanisms are not necessary

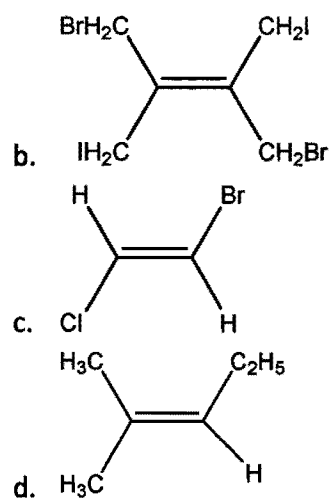




Question 5

- What is stereochemistry (2)
- How do structural (constitutional) isomers differ from stereoisomers? (3)
- What is a chiral molecule? How does it differ from an achiral molecule? (3)
- What is the difference between enantiomers and diastereomers? (3)
- Illustrate the structures of *cis*- and *trans*-2-butene (4)
- Which alkenes do not have geometric isomers? (4)





(a) Explain the following observations:

- (i) Benzene undergoes electrophilic aromatic substitution and not electrophilic addition. (3)
- (ii) Inductive effect in the reactions of aromatic benzene. (3)

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