
UNIVERSITI SAINS MALAYSIA

Second Semester Examination
Academic Session 2003/2004

February/March 2004

KOT 121 – Organic Chemistry I

Time: 3 hours

Make sure this paper has SEVEN printed pages before answering the questions.

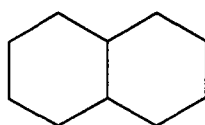
Answer FIVE questions.

Only the first five questions answered by the candidate will be graded.

1. (a) Give a suitable structure of a hydrocarbon having 7 carbon atoms and the information below :
- Two carbon atoms having sp hybridisation and two more having sp^2 hybridisation.
 - One C-C bond formed as a result of $Csp-Csp^2$ electron sharing and another from $Csp-Csp^3$ electron sharing.

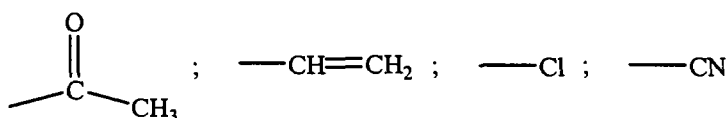
(5 marks)

- (b) Draw the most stable chair conformation for decalin (**I**) and state whether the conformation you have drawn is the *cis*- or *trans*-isomer.

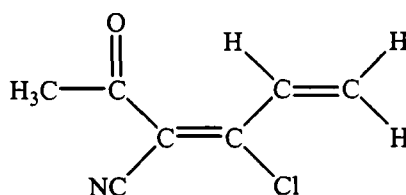
**(I)**

(5 marks)

- (c) (i) Arrange the following substituents in decreasing order of priority according to the *E, Z* system.



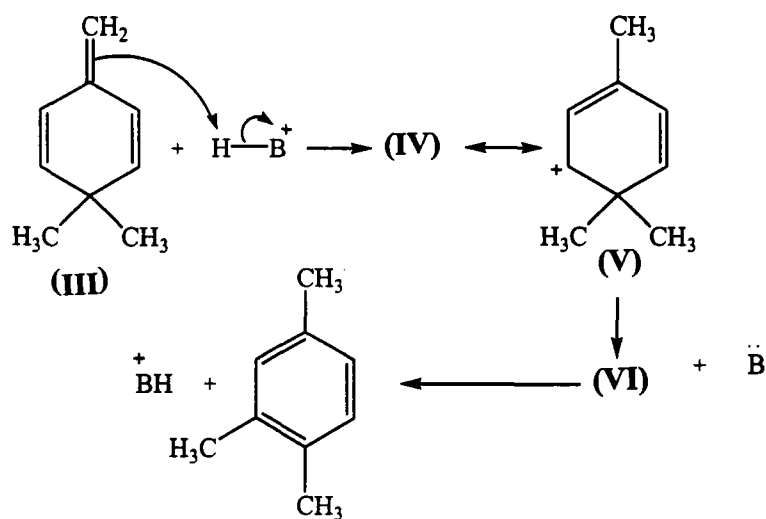
- (ii) State whether the dienone below has the *E* or *Z* configuration. Explain.



(5 marks)

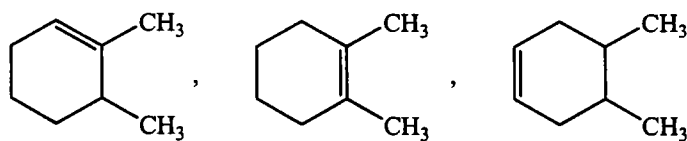
- 3 -

- (d) Complete the mechanism for the transformation below by identifying the structures (IV) and (VI) and showing electron movements in (IV), (V), and (VI).



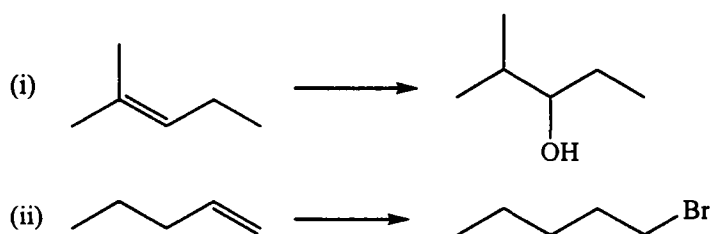
(5 marks)

2. (a) Choose (i) the most stable, and (ii) the most unstable structure among the compounds below.



(2 marks)

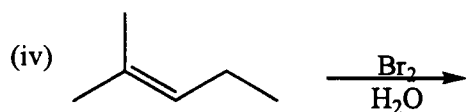
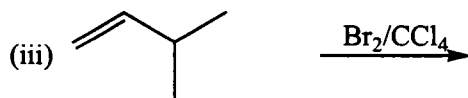
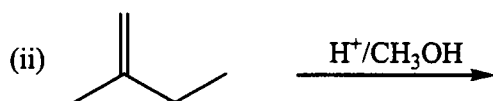
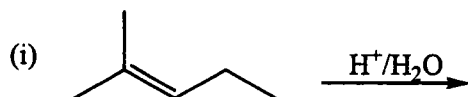
- (b) Identify the reagents used in the reactions below:



(6 marks)

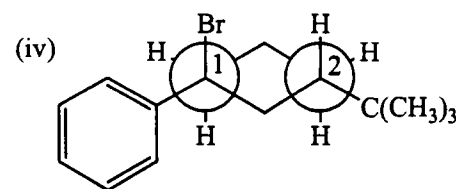
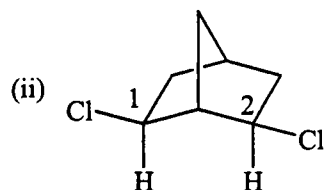
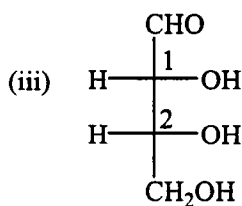
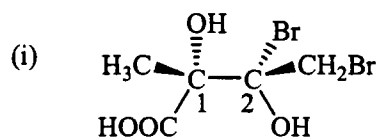
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(c) Give the major product from each of the reactions below:



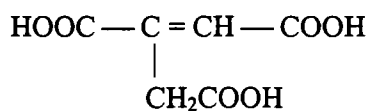
(12 marks)

3. (a) Show the R/S configuration of each of the chiral centres in the molecules below:



(8 marks)

(b) Enzymatic hydration of aconitic acid (VII) gives two products, namely citric acid and isocitric acid. Isocitric acid is optically active while citric acid is optically inactive. Show the structures of both products.



(VII)

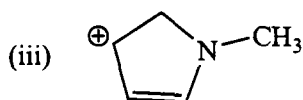
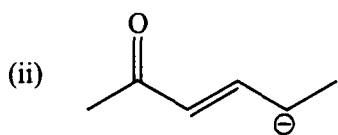
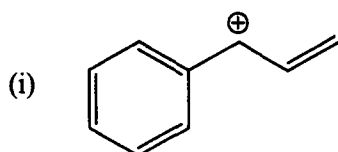
(6 marks)

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- (c) The addition of bromine to an alkene is an *anti*-addition reaction. Draw the products with the correct stereochemistry for the reaction of bromine with (*E*)-3-methyl-2-pentene.

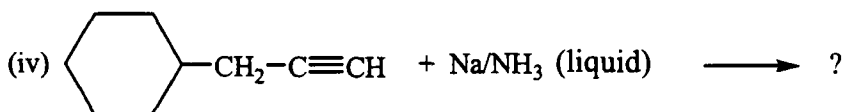
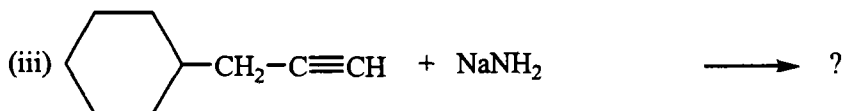
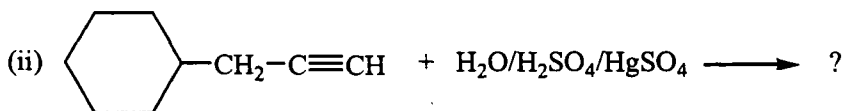
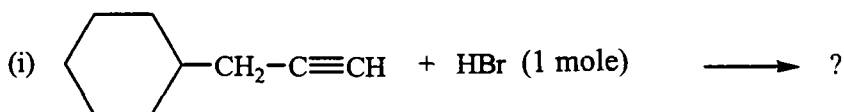
(6 marks)

4. (a) Draw all the resonance contributors for each of the species below:



(10 marks)

- (b) Give the major product of each of the reactions below:

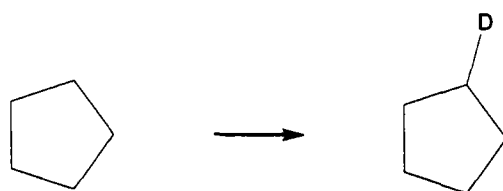


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(10 marks)

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6. (a) Show the initiation, propagation and termination steps in the monochlorination of cyclopentane
(6 marks)
- (b) If cyclopentane reacts with more than one equivalent of Cl_2 at high temperatures, how many dichlorocyclopentanes are expected to form?
(8 marks)
- (c) Suggest a method for the conversion below:

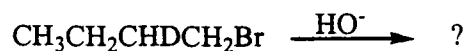


(6 marks)

7. (a) You are asked to prepare styrene by the dehydrohalogenation of either 1-bromo-2-phenylethane or 1-bromo-1-phenylethane with KOH in ethanol. Which halide should you use in order to obtain a higher percentage of styrene as product? Explain.

(6 marks)

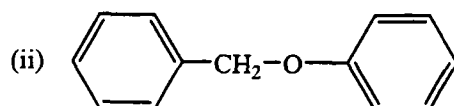
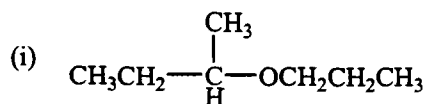
- (b) Two products are obtained from the $E2$ reaction below:



- (i) What are the products?
(ii) Which product is formed more? Explain.

(6 marks)

- (c) How would you prepare the products below using an alkyl halide and an alcohol?



(8 marks)