BINDURA UNIVERSITY OF SCIENCE EDUCATION

CHEMISTRY DEPARTMENT

HBSCED AND BSC CHT

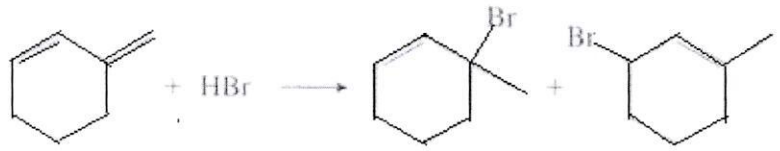
COURSE: CH103 ORGANIC CHEMISTRY 1

2 HOURS

ANSWER QUESTION ONE AND FOUR OTHER QUESTIONS TWO FROM EACH OF THE SECTIONS A AND B. EACH QUESTION CARRIES 20 MARKS

1. (a) Define the following terms:
   (i) Regiospecific
   (ii) Enantioselective
   (iii) Enantiomer (3x2 marks)

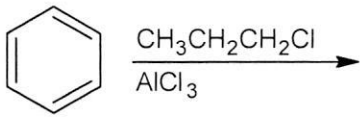
   (b) Show all the steps in the mechanism of the following reaction and explain the regiochemistry of the addition reaction:



(4 marks)

   (c) Give IUPAC names for the 3 isomers of C_5H_{12}. (3x2 marks)

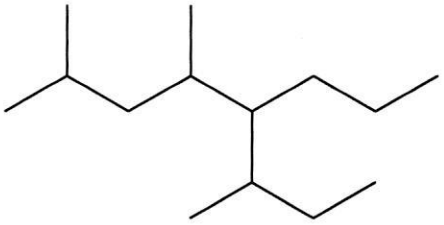
   (d) Predict the products of the following reaction:



(4 marks)

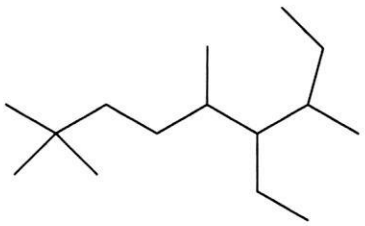
SECTION A: ANSWER TWO QUESTIONS

2. (a) Give the IUPAC names for the following compounds:
   (i)



(2 marks)

(ii)



(2 marks)

(b) Give the mechanism for the catalytic hydrogenation of alkenes. (4 marks)

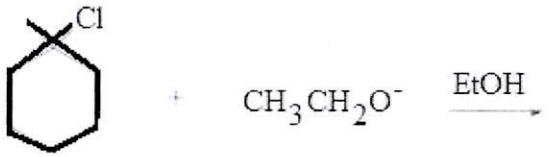
(c) (i) State the factors affect second order nucleophilic substitution reactions (S_N2). (4 marks)

(ii) Discuss how any two of the stated factors in (c) (i) affect the S_N2 reactions. (4+4 marks)

3. (a). State Zaitsev's rule. (2 marks)

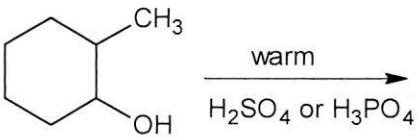
(b) Use Zaitsev's rule to predict the major and minor products of the following reactions:

(i)



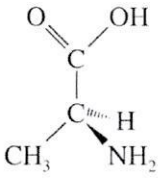
(4 marks)

(ii)



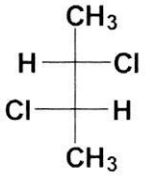
(4 marks)

(c) Assign R,S configuration to each chiral center in the following molecules:
(i)



(3 marks)

(ii)

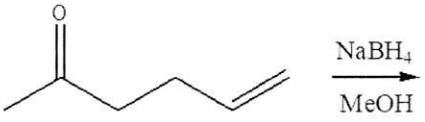


(3x2 marks)

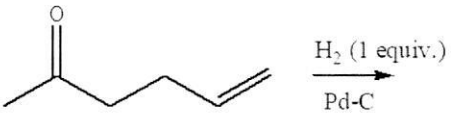
4. (a) Explain why aldehydes are more reactive than ketones towards nucleophilic attack. (4 marks)

(b) Draw the products of the following reactions:

(i)

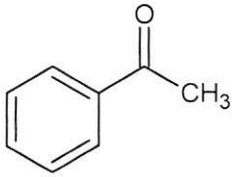


(ii)



(2+2 marks)

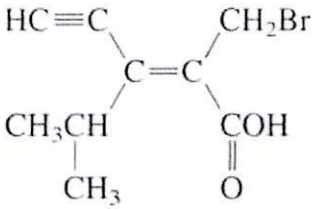
(b) Draw the structures and give the names of the hydride (H^-) reduction of the achiral ketone below:



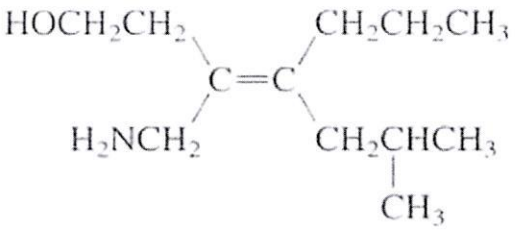
(6 marks)

(c) Derive the E/Z designation for each of the following compounds:

(i)



(ii)



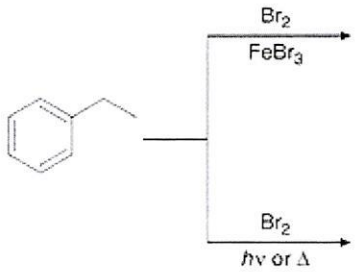
(3+3 marks)

SECTION B: ANSWER TWO QUESTIONS

5. (a) Write resonance structures for chlorobenzene to show the electron donating resonance effect of the chloro group. (6 marks)

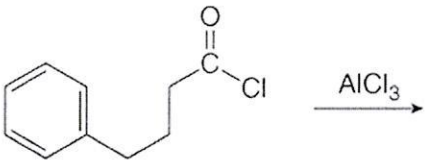
(b) Predict products of the following reactions:

(i)



(6 marks)

(ii)



(2 marks)

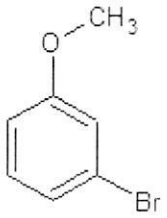
(c) Rank the compounds in each group in order of their reactivity to electrophilic substitution;

(i) Nitrobenzene, phenol, toluene, benzene

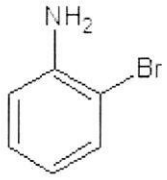
(ii) Phenol, benzene, chlorobenzene, benzoic acid (2x3 marks)

6. (a) Show the structures of the products you would obtain from mononitration of the following compounds. Explain your answer.

(i)



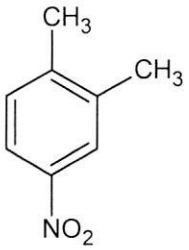
(ii)



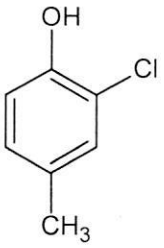
(4+4 marks)

(b) How would you synthesize the following compounds starting from Benzene? Assume that ortho and para isomers can be separated.

(i)



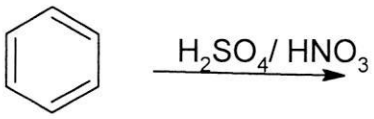
(ii)



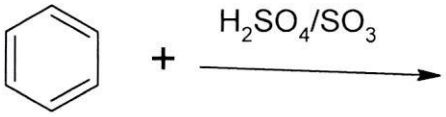
(2x6 marks)

7. (a) Show, with mechanisms, the products of the following reactions:

(i)



(ii)



(2x8 marks)

(b) Which would you expect to be more reactive toward nucleophilic addition p-methoxybenzadehyde or p-nitrobenzadehyde? Explain. (4 marks)

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