National Exams

04-BS-12, Organic Chemistry

May 2015

3 hours duration

Notes

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.

2. This is a CLOSED BOOK EXAM.
   Any non-communicating calculator is permitted.

3. Candidates may use any non-programmable calculator, ex. a Casio or Sharp model

4. ANSWER ALL FIVE PROBLEMS

5. Each problem is of equal value

6. Note that the questions (a), (b) of each problem can be treated independently

Problem No. 1 (20 points)

a) Draw the structural formulas for:

(i) Three secondary amines with the molecular formula $C_4H_{11}N$

(6 points)

(ii) Two aldehydes with the molecular formula C_4H_8O

(4 points)

(iii) Two carboxylic acid with the molecular formula $C_4H_8O_2$

(4 points)

(iv) Three ketones with the molecular formula $C_5H_{10}O$

(6 points)

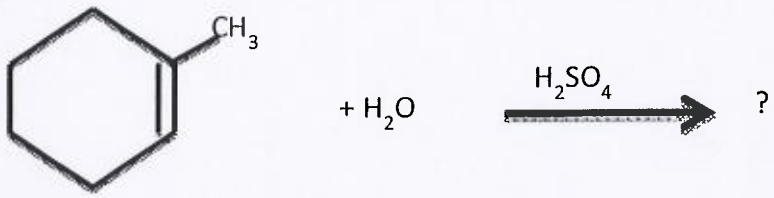
Problem No. 2 (20 points total)

a) Complete the following chemical reactions

(i)

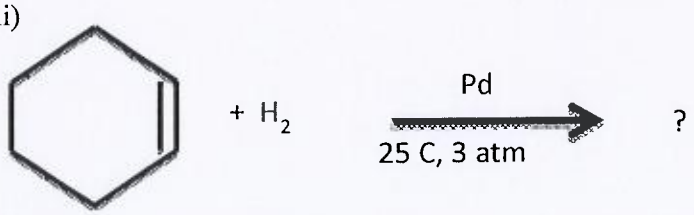
(5 points)

(ii)



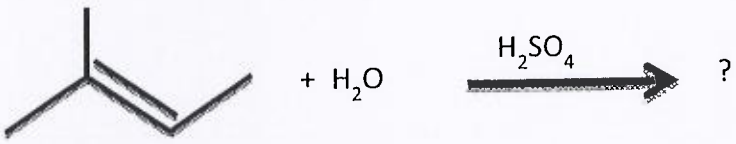
(5 points)

(iii)



(5 points)

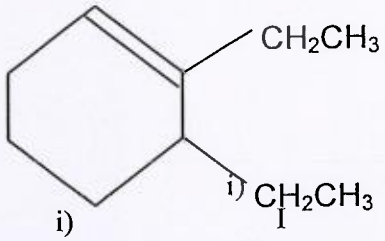
(iv)



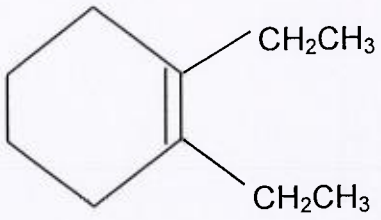
(5 points)

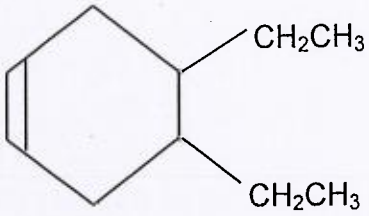
Problem No. 3 (20 points total)

a) Which one of the following three compounds:



i)

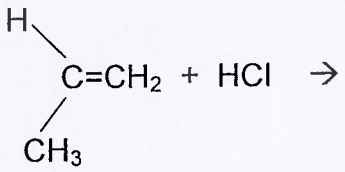




(i) Is the most stable?
(5 points)

(ii) Is the least stable?
(5 points)

b) Write the balanced equation of the mono-chlorination reaction of the methyl-2 propene as shown below, and explain concisely the mechanism of the reaction.

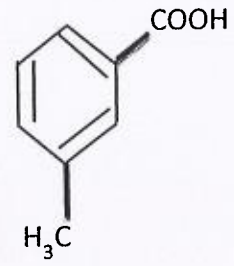


(10 points)

Problem No. 4 (20 points total)

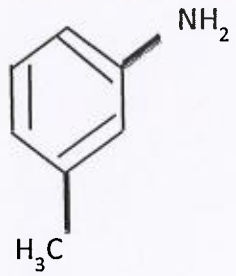
(a) From benzene, how would you prepare the following products? Show all the steps:

(i)



(5 points)

(ii)



(5 points)

b) Draw the following compounds and rank them in order of decreasing stability:

(i) Trans-3 hexene

(ii) Cis-3 hexene

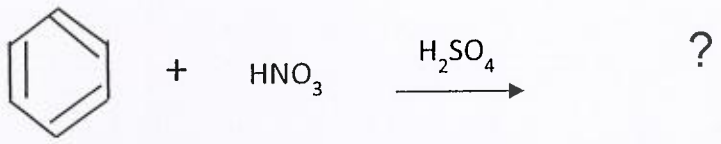
(iii) Cis-2,5-dimethyl-3 hexene

(10 points)

Problem No. 5 (20 points total)

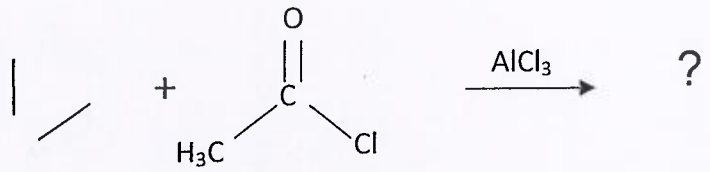
(a) Complete the chemical equations below and write the mechanism of each of the reactions:

(i)



(8 points)

(ii)



(8 points)

(b) Write the balanced equation of the combustion reaction of butane in pure oxygen.

(4 points)