National Exams

04-BS-12, Organic Chemistry

May 2014

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.
   An approved Casio or Sharp calculator is allowed.

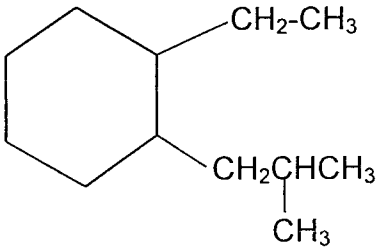
3. ANSWER ALL FIVE PROBLEMS

4. Each problem is of equal value

5. Note that the questions (a), (b), (c), (d), (e), (f) or (g) of each problem can be treated independently

Problem No. 1 (20 points total)

a) In the following organic compound



(i) Mark the primary, secondary and tertiary carbons with a "p", an "s" or a "t" accordingly.

(5 points)

(ii) In total how many of each type of carbon are there in the compound?

(5 points)

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

(i) Trans-3 hexene

(ii) Cis-3 hexene

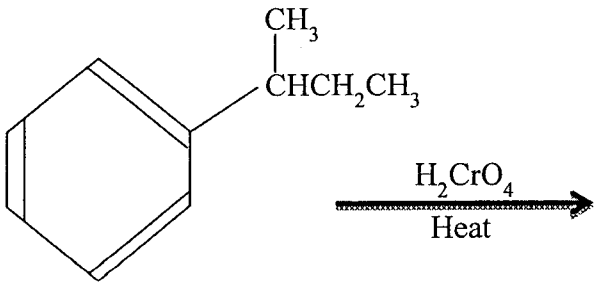
(iii) Cis-2,5-dimethyl-3 hexene

(10 points)

Problem No.2 (20 points total)

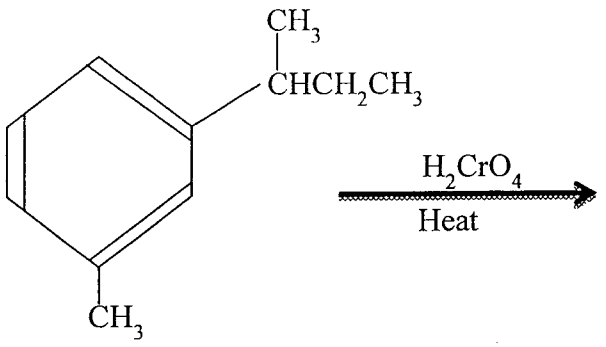
a) Write the expected products from the following chemical reactions:

(i)



(5 points)

(ii)



(5 points)

(iii) 2-methylpropene + Br_2 →

(5 points)

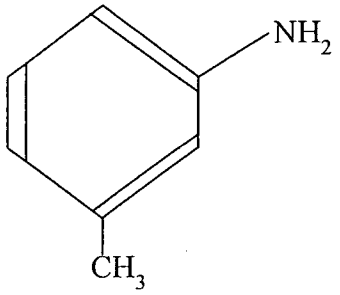
(iv) Cyclohexene + HBr →

(5 points)

Problem No.3 (20 points total)

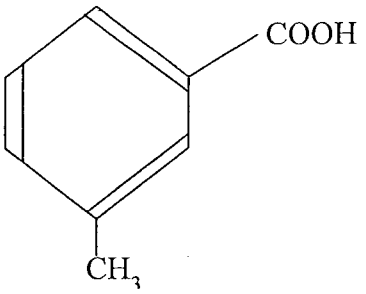
(a) From benzene, how would you prepare the following products? Show all the steps:

(i)



(5 points)

(ii)



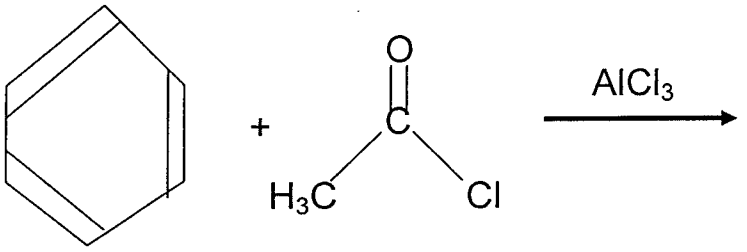
(5 points)

(b) Write a balanced equation for the complete combustion of 1-ethyl-3methyl cyclohexane (i.e., reaction with oxygen)

(10 points)

Problem No.4 (20 points total)

(a) Write the mechanism for the chemical reaction involving benzene:



(10 points)

(b) Rank the following organic compounds in order of increasing stability. Which one of the three compounds is the least stable and which one is the most stable?

(i) 3,4-dimethyl-2 hexene

(ii) 2,3-dimethyl-2 hexene

(iii) 4,5-dimethyl-2 hexene

(10 points)

Problem No. 5 (20 points total)

a) There are five constitutional isomers with the molecular formula C_6H_{14}.

(i) Draw their structural formula

(4 points)

(ii) Show their line structures

(4 points)

(iii) Name them

(4 points)

b) Classify the following alkene reactions as addition, elimination, or substitution reactions:

(i)

$$CH_3CH{=}CH_2 + H_2 \rightarrow CH_3CH_2CH_3$$

(4 points)

(ii)

$$CH_3CH_2CH_2OH \xrightarrow[\text{Catalyst}]{H_2SO_4} CH_3CH{=}CH_2 + H_2O$$

(4 points)