

National Exams

04-BS-12, Organic Chemistry

December 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.
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), (c), (d), (e), (f) or (g) of each problem can be treated independently

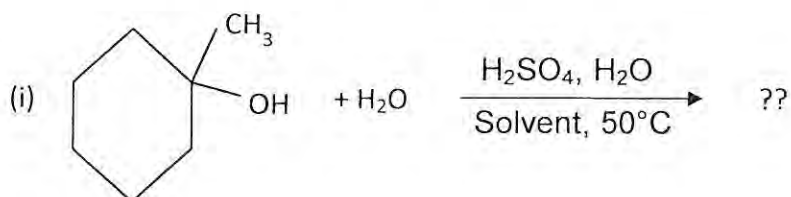
Problem No.1 (20 points)

a) For an organic compound with the molecular formula $C_5H_{10}O_2$, Explain if the following functional groups are present in the compound and if not explain why? If the functional group is present, give an example of the compound and name it.

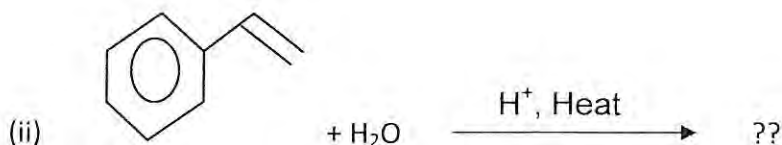
- (i) An ester (ii) a phenol (iii) an ether (iv) an amide (v) an aldehyde

(5 points)

(b) Give the product(s) of the following reactions:



(5 points)



(5 points)

(c) Write a balanced equation for the complete combustion of propyl alcohol (ie, reaction with oxygen)

(5 points)

Problem No.2 (20 points total)

(a) Draw the line structure and condensed formula for the following compounds

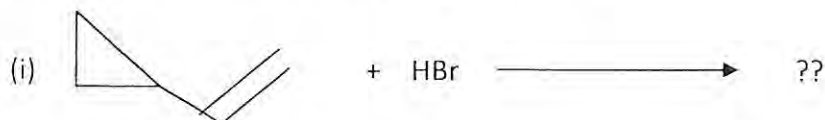
- (i) 2,3,5-trimethyl-4-propylheptane
(ii) 4-isobutyl-2,5-dimethylheptane
(iii) 3-chloro-5-iodo-4-methyl octane

(iv) 1-Bromo-2 chloro hexane

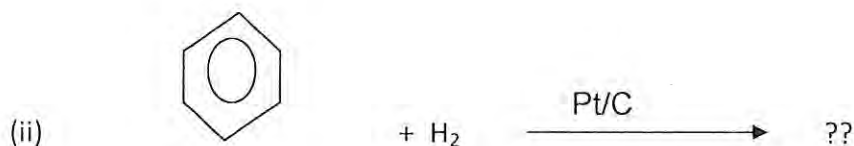
(v) 2,2,4-trimethylpentane also called iso-octane

(10 points)

(b) Give the product or products of the following reactions:



(5 points)



(5 points)

Problem No.3 (20 points total)

(a) Propose the structures that describe:

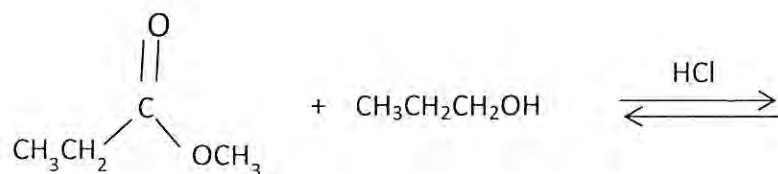
(i) Two (2) isomeric esters with the formula C₅H₁₀O₂

(5 points)

(ii) Two isomeric disulfides with the formula C₄H₁₀S₂

(5 points)

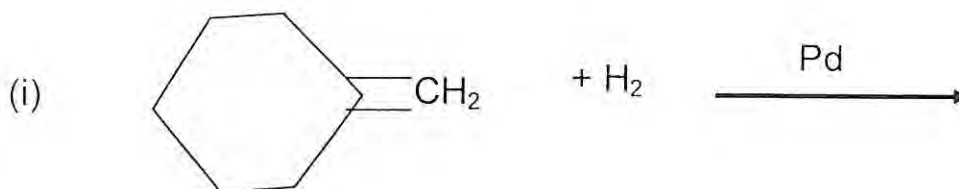
(b) Write the mechanism of the following acid-catalyzed transesterification reaction and give the product(s) of the reaction:



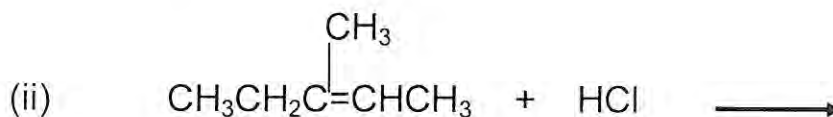
(10 points)

Problem No.4 (20 points total)

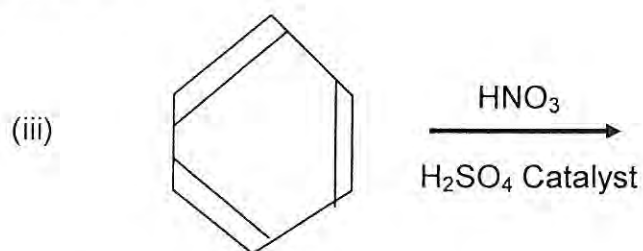
(a) Provide the products of the following chemical reactions



(5 points)

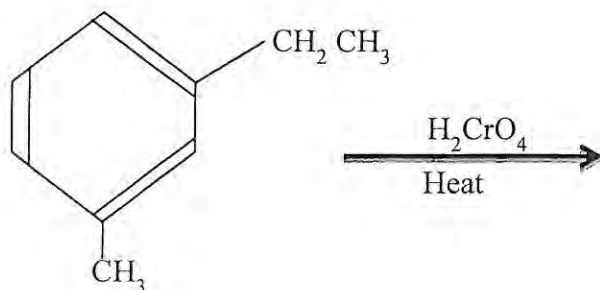


(5 points)



(5 points)

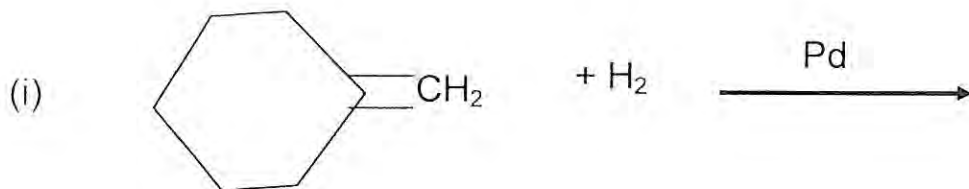
(b) Write the expected products from the following chemical reaction:



(5 points)

Problem No.5 (20 points total)

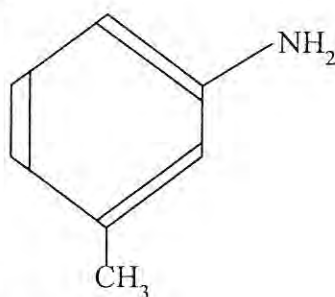
(a) Provide the products of the following chemical reactions



(5 points)

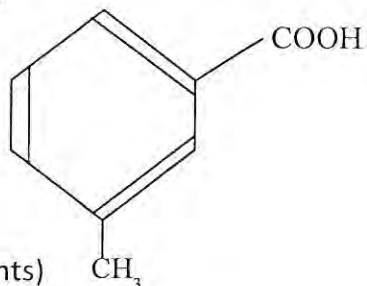
(b) From benzene, how would you prepare the following products? Show all the steps:

(i)



(5 points)

(ii)



(5 points)

(c) Classify the carbon atoms in the following structure as either primary, secondary or tertiary: $\text{CH}_3\text{CH}_2\text{C}(\text{CH}_3)_2\text{CH}_2\text{CH}_2\text{CH}_3$

(5 points)