

National Exams

**04-BS-12, Organic Chemistry**

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

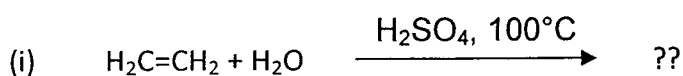
**Problem No.1 (20 points)**

- 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.

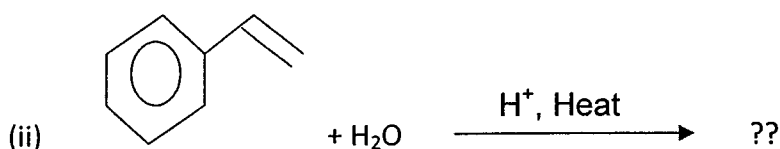
(i) an alcohol (ii) a phenol (iii) an ether (iv) an amide (v) a carboxylic acid

(10 points)

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



(5 points)



(5 points)

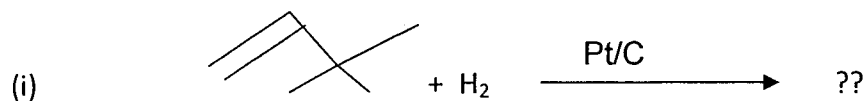
**Problem No.2 (20 points total)**

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

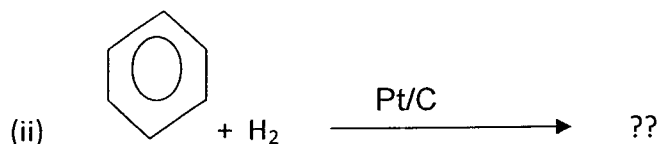
- (i) 2,3,5-trimethyl-4-propylheptane
- (ii) 4-isobutyl-2,5-dimethylheptane
- (iii) 3-chloro-5-iodo-4-methyl octane
- (iv) 1-Bromo-2 chloro hexane
- (v) 2,2,4-trimethylpentane also called iso-octane

(10 points)

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



(5 points)



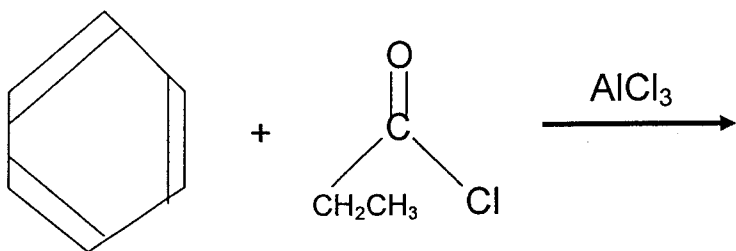
(5 points)

**Problem No.3 (20 points total)**

- (a) Write the chemical formula and draw the structure for both the CIS and TRANS isomers of 3-heptene

(5 points)

- (b) Write the mechanism for the chemical reaction involving benzene:



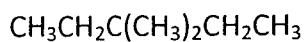
(10 points)

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

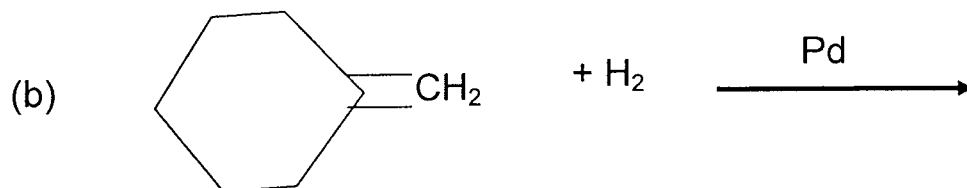
(5 points)

**Problem No.4 (20 points total)**

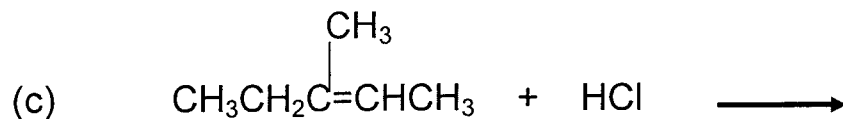
- (a) Classify the carbon atoms in the following structure as either primary, secondary or tertiary:



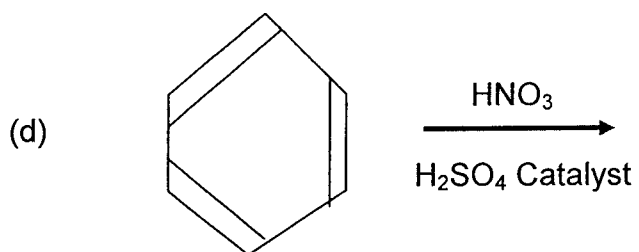
(5 points)



(5 points)



(5 points)

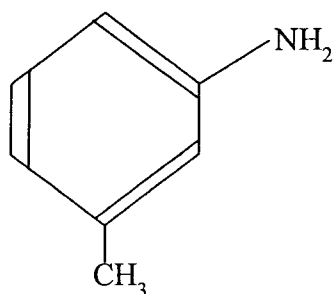


(5 points)

**Problem No.5 (20 points total)**

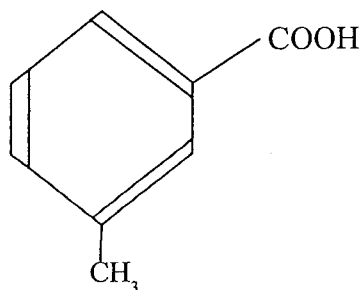
(a) From benzene, how would you prepare the following products? Show all the steps:

(i)



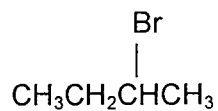
(5 points)

(ii)



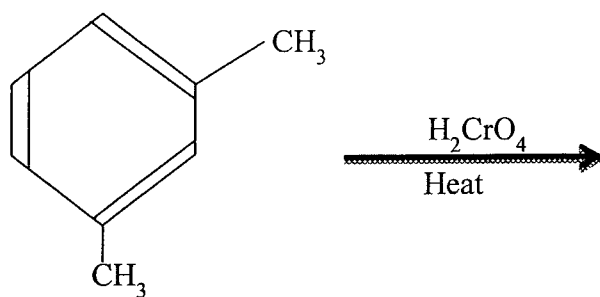
(5 points)

(b) Provide a concise definition of an enantiomer and draw the enantiomers of the following molecule:



(5 points)

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



(5 points)