BCHCT-133

ASSIGNMENT BOOKLET

Bachelor's Degree Programme
(BSCG)

CHEMICAL ENERGETICS, EQUILIBRIA AND FUNCTIONAL ORGANIC CHEMISTRY I

Valid from 1st January, 2023 to 31st December, 2023

School of Sciences
Indira Gandhi National Open University
Maidan Garhi
New Delhi-110068
(2023)

Dear Student,

Please read the section on assignments in the Programme Guide for B. Sc. that we sent you after your enrolment. A weightage of 30 per cent, as you are aware, has been earmarked for continuous evaluation, **which would consist of one tutor-marked assignment** for this course. The assignment is in this booklet, and it consists of two parts, Part A and B. It covers all blocks of the course. The total marks of all the parts are 100, of which 35% are needed to pass it.

Instructions for Formatting Your Assignments

Before attempting the assignment please read the following instructions carefully:

1) On top of the first page of your answer sheet, please write the details exactly in the following format:

ROLL NO.: ……

NAME: ……

ADDRESS: ……

……

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COURSE CODE: …….

COURSE TITLE: …….

ASSIGNMENT NO.: ……..…

STUDY CENTRE: ……..….. **DATE:** …….……...

PLEASE FOLLOW THE ABOVE FORMAT STRICTLY TO FACILITATE EVALUATION AND TO AVOID DELAY.

2) Use only foolscap size writing paper (but not of very thin variety) for writing your answers.

3) Leave 4 cm margin on the left, top and bottom of your answer sheet.

4) Your answers should be precise.

5) Solve Part (A) and Part (B) of this assignment, and **submit the complete assignment answer sheets within the due date.**

6) The assignment answer sheets are to be submitted to your Study Centre within the due date. **Answer sheets received after the due date shall not be accepted.**

   We strongly suggest that you retain a copy of your answer sheets.

7) This assignment is **valid from 1st January, 2023 to 31st December, 2023**. If you have failed in this assignment or fail to submit it by December, 2023, then you need to get the assignment for the year 2024, and submit it as per the instructions given in the Programme Guide.

8) **You cannot fill the examination form for this course** until you have submitted this assignment.

We wish you good luck.

ASSIGNMENT

CHEMICAL ENERGETICS, EQUILIBRIA AND FUNCTIONAL ORGANIC CHEMISTRY I

Core Course in Chemistry

Course Code: BCHCT-133
Assignment Code: BCHCT-133/TMA/2023
Maximum Marks: 100

Note: Attempt all questions. The marks for each question are indicated against it.

PART A: CHEMICAL ENERGETICS AND EQUILIBRIA (50)

1. (a) State Zeroth law of thermodynamics and give the requirement for thermal equilibrium. (2)

   (b) Differentiate between a closed and an isolated thermodynamic system with the help of suitable examples. (3)

   (c) 0.25 mol of an ideal monoatomic gas undergoes isothermal expansion from a volume of 2.0 dm^3 to 10 dm^3 at 27°C. Calculate the maximum work that can be obtained from this process. (5)

2. (a) Calculate the amount of heat required to increase the temperature of 2.00 moles of Argon gas from a temperature of 200 K to 500 K under isobaric conditions.

   [Given: $C_{p,m}$ = 20. 79 J $K^{-1}mol^{-1}$] (2)

   (b) Calculate ΔH^o for the reaction

   $CO_2(g) + H_2(g) \rightarrow CO(g) + H_2O(g)$

   Given: ΔH for $CO_2(g)$, $CO(g)$ and $H_2O(g)$ are -393.5, -111.31 and -241.80 kJ mol^{-1} respectively. (3)

   (c) Differentiate between enthalpy driven and entropy driven reactions with the help of suitable examples. (5)

3. (a) Define enthalpy of atomisation. The enthalpy of atomisation of graphite is found to be 715 kJ $mo1^{-1}$, write the thermochemical equation for the process. (2)

   (b) Derive an expression for isothermal mixing of ideal gases. (3)

   (c) Fossil fuels are being replaced with hydrogen, much of it is being derived from methane, CH_4, in natural gas which uses the forward reaction of the equilibrium: (5)

   $CH_4(g) + H_2O(g) \rightleftharpoons CO(g) + 3H_2(g)$

   What will be the expression for K_c for the above reaction? (5)

4. (a) The successive ionisation constants of polyprotic acids are smaller and smaller. Explain. (3)

(b) Determine the acid-base nature of the aqueous solution obtained by dissolving $NaNO_2$ in water to get 0.01 M solution at 298 K. [Given: K_a (HNO_2) = 4.5×10^{-4}] (3)

(c) Consider the equilibrium $PCl_3(g) + Cl_2(g) \rightleftharpoons PCl_5(g)$, This reaction is endothermic. What will be the change in the concentration of Cl_2 a) more PCl3 is added b) more PCl5 is added c) temperature is increased and d) the volume of the container is reduced. (4)

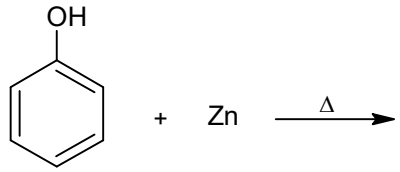
5. (a) The sulphides of group IV cations are not precipitated in Group II. Explain. (2)

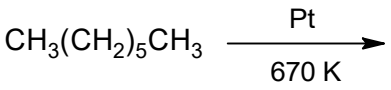
(b) Arrange propanoic acid, ethanoic acid and 2-chloroethanoic acid in the increasing order of their acidities giving reasons. (3)

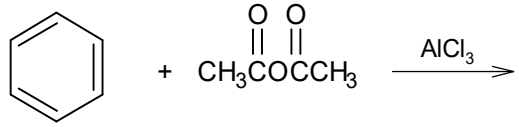
(c) The solubility product of AgCl is 1.8×10^{-10}. Calculate the concentration of chloride ions required to precipitate silver ions from its 0.01 M solution. (5)

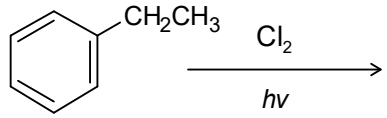
PART B: FUNCTIONAL GROUP ORGANIC CHEMISTRY-I **(50)**

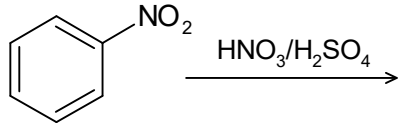
6. (a) Complete the following reactions: (5)

(i) 

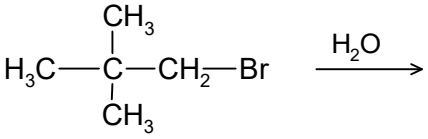
(ii) 

(iii) 

(iv) 

(v) 

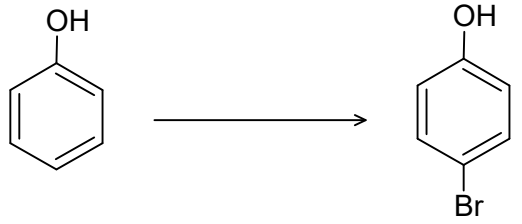
(b) Write the product for the following reaction. Explain product (s) formation using its mechanism. (5)

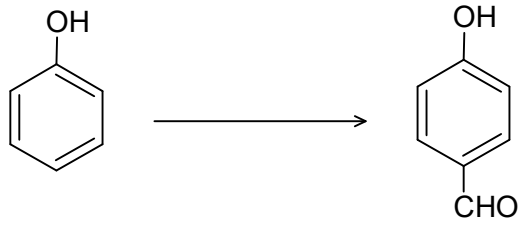


7. (a) Why alkenyl and aryl halides are less reactive towards nucleophilic substitution? (5)

(b) What is the best way to convert alcohol to alkyl halides? Explain with suitable examples. (5)

8. (a) How you will carry out following conversions? Write all the steps involved in these conversions. (5)

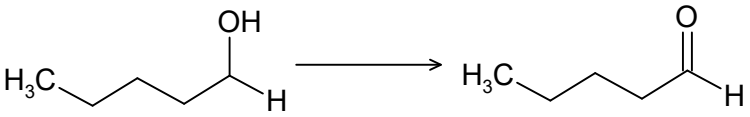
(i) 

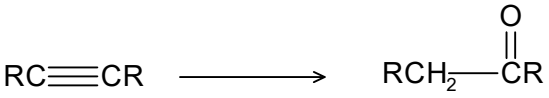
(ii) 

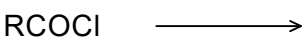
(b) Identify suitable alkyl halides for the preparation of anisole and MTBE. Justify your answer. (5)

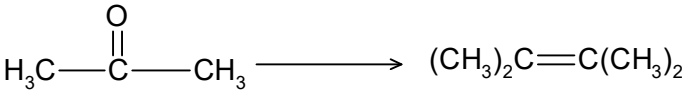
9. (a) Distinguish between crown ethers and cryptands. (5)

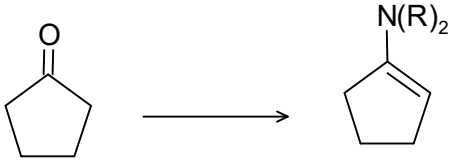
(b) Find out suitable reagents for the following conversions: (5)

(i) 

(ii) 

(iii) 

(iv) 

(v) 

10. Write the mechanism of the following reactions: 10

(a) Acid-catalyzed enolisation

(b) Claisen-Schmidt reaction