ASSIGNMENT BOOKLET

Bachelor's Degree Programme
(BSCG)

CHEMICAL ENERGETICS, EQUILIBRIA AND FUNCTIONAL ORGANIC
CHEMISTRY I

Valid from 1st January, 2022 to 31st December, 2022

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THE PEOPLE'S
UNIVERSITY

School of Sciences
Indira Gandhi National Open University
Maidan Garhi
New Delhi-110068
(2022)

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.

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Instructions for Formatting Your Assignments

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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, 2022 to 31ˢᵗ December, 2022**. If you have failed in this assignment or fail to submit it by December, 2022, then you need to get the assignment for the year 2023, 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

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

PART A: CHEMICAL ENERGETICS AND EQUILIBRIA

1. a) Define chemical thermodynamics and outline its significance. (2)

    b) Explain different types of thermodynamic systems with suitable examples. (3)

    c) Derive an expression for isothermal reversible expansion of a gas from a volume V_1 to V_2. (5)

2. a) Describe the method for experimental determination of energy changes accompanying chemical reactions under constant volume conditions. (3)

    b) Explain the significance of $\Delta_r U$ and $\Delta_r H$ and derive the relationship between them. (3)

    c) Predict the enthalpy of hydrogenation of 1-propene using the bond enthalpy data from Table 3.2 of (Unit 3; p, 76). (4)

3. a) Define spontaneity of a reaction and give the criteria of spontaneity of reactions in terms of i) entropy and ii) Gibbs energy. (3)

    b) Derive an expression for the entropy change for isothermal Mixing of Ideal Gases. (3)

    c) Define equilibrium constant and for the following reaction (4)

    $$2NH_3(g) \rightleftharpoons 2N_2(g) + 3H_2(g)$$

    i. Write the expression for K_c.
    ii. Relate K_c to K_p, and
    iii. Relate K_c to K_x

4. a) Define degree of ionisation of a weak electrolyte and list the factors affecting it. (3)

    b) What are amphoteric substances? Explain with the help of suitable examples. (2)

    c) State Le- Chatelier's principle and for the following reaction at equilibrium (5)

    $$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g) \quad \Delta H = -198 \text{ kJ}$$

    Predict the effect of
    i. Adding $SO_2(g)$ at equilibrium
    ii. Decreasing the temperature
    iii. Reducing the volume of the container to half
    iv. Adding an inert gas under conditions of constant pressure.

5. a) Define solubility and give the relationship between solubility and solubility product constant for sparingly soluble salts of AB types. (2)

    b) Calculate the degree of ionisation and the pH of a 0.01 M aqueous solution of formic acid at 298K. [Given, K_a (HCOOH) = 1.7×10^{-4} at 298K]. (4)

c) Calculate the pH of 0.01 M aqueous solution of sodium formate at 298 K. [Given: K_a (HCOOH) $=1.7 \times 10^{-4}$ at 298K] (4)

PART B: FUNCTIONAL GROUP ORGANIC CHEMISTRY-I

6 Write chemical equation(s) for following conversions : (5)

    i) Phenol to benzene

    ii) Ethylbenzene to 1-chloro-1-phenylethane

    iii) Aniline to chlorobenzene

    iv) Phenol to 4-hydroxybenzaldehyde

    v) Anisole to phenol

  b) Write the mechanism of the Friedel-Crafts alkylation reactions. (5)

7. a) What do you understand by *ortho* and *para*-directing activator? Explain with the help of a suitable example. (5)

  b) Write the mechanism of the reaction of allyl chloride with water. (5)

8. Explain following: (5+5)

  a) Reaction of silver cyanide with bromopropane gives 1-propylisonitile not *n*-propyl cyanide. (5)

  b) Ether is the major product in the reaction of *tert*-butylbromide with ethanol (5)

9. a) Why thionyl chloride is generally used to convert alcohols to alkyl halides? Taking suitable example write the mechanism of the reaction of an alcohol with thionyl chloride. (5)

  b) How you will distinguish between aldehydes and ketones? (5)

10. a) Write the mechanism for Knoevenagel condensation. (5)

  b) Complete the following reactions: (5)