ASSIGNMENT BOOKLET

Bachelor's Degree Programme (B.Sc.)
PHYSICAL CHEMISTRY

It is Compulsory to submit the Assignment before filling in the Term-End Examination Form.

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

Please Note

- **You can take electives (56 to 64 credits) from a minimum of TWO and a maximum of FOUR science disciplines, viz. Physics, Chemistry, Life Sciences and Mathematics.**

- **You can opt for elective courses worth a MINIMUM OF 8 CREDITS and a MAXIMUM OF 48 CREDITS from any of these four disciplines.**

- **At least 25% of the total credits that you register for in the elective courses from Life Sciences, Chemistry and Physics disciplines must be from the laboratory courses. For example, if you opt for a total of 64 credits of electives in these 3 disciplines, at least 16 credits should be from lab courses.**

- **You cannot appear in the Term-End Examination of any course without registering for the course. Otherwise, your result will not be declared and the onus will be on you.**

ignou
THE PEOPLE'S
UNIVERSITY

School of Sciences
Indira Gandhi National Open University
New Delhi
(2023)

Dear Student,

We hope, you are familiar with the system of evaluation to be followed for the Bachelor's Degree Programme. At this stage you may probably like to re-read the section on assignments in the Programme Guide that we sent you after your enrolment. A weightage of 30 percent, as you are aware, has been earmarked for continuous evaluation, which would consist of one tutor-marked assignment. The assignment is based on Blocks 1, 2, 3 and 4.

Instructions for Formatting Your Assignments

Before attempting the assignments, 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:

ENROLMENT NO.:….…………………….……

NAME:…………..…………………

ADDRESS:…...............………………

………………………….……

………………………….……

COURSE CODE   : …...........................…………

COURSE TITLE : …...........................………

ASSIGNMENT NO.: …...........................………

STUDY CENTRE   : …...........................…………   DATE:..………………………….
(NAME AND CODE)

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.   While writing answers, clearly indicate the Question No. and part of the question being solved.

6.   Please note that:

   i)   The Assignment is valid from 1st January, 2023 to 31st December, 2023.

   ii)   The response to this assignment is to be submitted to the Study Centre Coordinator within eight weeks of the receipt of this booklet in order to get the feedback and comments on the evaluated assignment.

   iii)   In any case, you have to submit the assignment response before filling the exam for the term end examination.

7.   We strongly suggest that you should retain a copy of your assignment responses.

   Wishing you all good luck.

Tutor Marked Assignment
CHE-04: PHYSICAL CHEMISTRY

Course Code: CHE-04
Assignment Code: CHE-04/TMA/2023
Maximum Marks: 100

Note: Answer all the questions given below. The marks are indicated in the brackets.

1. (a) Write the SI units and its symbols for the following quantities: (3)

    (i)   Molar mass

    (ii) Force

    (iii) Pressure

    (b) How can we differentiate between oil in water and water in oil emulsions? (2)

2. Draw the distribution of molecular speeds of gases. Write expressions for different types of speeds. Also calculate the average speed of oxygen molecules at 298 K. (5)

3. Discuss Linde's method of liquefaction of gases using a suitable diagram. (5)

4. Define vapour pressure. Explain how is it measured? Which are will have lower vapour pressure-water or ethanol? Explain. (5)

5. Briefly explain the terms 'lattice' and 'basis' giving suitable diagrams. (5)

6. (a) "Work can be done in a variety of ways". Explain. (3)

    (b) Derive the following relation: (2)

$$C_p - C_v = nR$$

7. (a) Derive Kirchoff's equation. (2)

    (b) Explain what happens when the value of ΔC_p (3)

    (i) is zero

    (ii) is constant

    (iii) changes with time.

8. Show that for a cyclic process of isothermal irreversible expression and reversible compression, show that the total entrophy change entropy is greater than zero. (5)

9. (a) What is the free energy change when 2 moles of an ideal gas expands reversibly and isothermally at 3.20×10^2 K from an initial volume of 10.00×10^{-2} m^3 to 2.00 m^3? (2)

    (b) Derive the following relation: (3)

$$\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial p}{\partial T}\right)_v$$

10. Draw and explain the vapour pressure curves of a solution showing negative deviation from Raoult's law. (5)

11. Derive the following expression: (5)

$$W_T = W\left(\frac{KV}{V + KV}\right)^n$$

for the mass of an organic compound that remains unextracted after n extractions.

12. (a) Discuss Rast method for determining the relative molecular mass of a non-volatile solute. (3)

(b) An aqueous solution contains 2×10^{-3} kg of a solute is 5.00×10^{-2} kg of water. The molecular mass of the solute is 0.0540 kg mol^{-1}. (2)

Calculate the change in freezing point if ice melts at 273.15 k and its molar enthalpy of fusion is 6021 J mol^{-1}.

13. Discuss the phase diagram of sulphur giving a suitable diagram. (5)

14. (a) Calculate the K_p for the following reaction. $\left(2\frac{1}{2}\right)$

$$H_2O + CO\ (g) \quad = \quad H_2 + CO_2$$

At equilibrium

$$p_{H_2} = p_{CO_2} = 0.755\ Pa$$

$$p_{H_2O} = p_{CO} = 0.240\ Pa$$

(b) Also calculate $\Delta G°$ for this reaction $\left(2\frac{1}{2}\right)$

15. (a) For 0.20 M solution of sodium acetate. Calculate the following at 298 K (5)

(i) K_n

(ii) degree of hydrolysis (α)

(iii) pH

($K_w = 1.0 \times 10^{-14}$ and K_a acetic acid $= 1.8 \times 10^5$)

16. (a) Define molar conductance and give its units. (1)

(b) How can the solubility of a sparingly salt be determined using conductance method. (4)

17. Discuss different types of electrodes giving one example of each. (5)

18. Briefly explain various experimental methods of studying reaction rates. (5)

19. For the photochemical reaction between H_2 and Br, show that (5)

$$\frac{d[HBr]}{dt} \alpha\ I_a^{1/2}$$

20. (a) Differentiate between number average and mass average molar masses. (3)

(b) Calculate the mass average molar mass of molar mass a sample having following distribution. (2)

N_i	5	5	10	15	20
$\dfrac{M_i}{kg\,mol^{-1}}$	1.000	2.000	10.000	20.000	15.000