BCHCT-131

ASSIGNMENT BOOKLET

Bachelor's Degree Programme
(BSCG)

ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY AND ALIPHATIC HYDROCARBONS

Valid from 1st January, 2025 to 31st December, 2025

School of Sciences
Indira Gandhi National Open University
Maidan Garhi
New Delhi-110068
(2025)

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, 2025 to 31st December, 2025**. If you have failed in this assignment or fail to submit it by December, 2025, then you need to get the assignment for the year 2025, 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

Atomic Structure, Bonding, General Organic Chemistry and Aliphatic Hydrocarbons
Core Course in Chemistry

Course Code: BCHCT-131
Assignment Code: BCHCT-131/TMA/2025
Maximum Marks: 100

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

PART-(A) **(50)**

1. How is the following expression for radius of hydrogen atom arrived at? (5)

$$r = \frac{n^2 \in_0 \eta^2}{\pi mZe^2}$$

2. (a) Briefly explain Heisenberg uncertainty principle. (2)

   (b) Name the phenomena which can be explained using (3)
   (i) wave nature of radiation
   (ii) particle nature of radiation.

3. Arrive at the time independent Schrodinger equation for a particle. (5)

4. Explain the transformation of Schrodinger equation from Cartesian to spherical polar coordinates and give its solution. (5)

5. (a) Write the electronic configuration of the following: (3)
   Cl, Cr, Nb

   (b) State aufbau principle. (2)

6. First ionisation energies of second period elements show that the values increase from lithium to beryllium, decrease for boron, and increase up to nitrogen, again decrease in oxygen and finally increase up to neon. Explain. (5)

7. Calculate the lattice energy (in Units kJ mol^{-1}) for ZnO crystal using electrostatic model and using a Born-Haber cycle. Compare the two answers and comment on any difference. (5)

   Useful data:

   Medelung constant (A) = 1.6411

   Born Constant (n) = 8

   Internuclear distance (a) = 199 pm

   $Zn(s) + ½\ O_2(g) \rightarrow ZnO(s)$ $\Delta H_f = -350.5$ kJ mol^{-1}

   $Zn(s) \rightarrow Zn(g)$ $\Delta H_S = 130.4$ kJ mol^{-1}

   $Zn(g) \rightarrow Zn^+(g)$ $I(Zn) = 906.3$ kJ mol^{-1}

   $Zn^+(s) \rightarrow Zn^{2+}(g)$ $I(Zn^+) = 1733$ kJ mol^{-1}

   $½\ O_2(g) \rightarrow O(g)$ $½\Delta H_d = 248.5$ kJ mol^{-1}

   $O(g) \rightarrow O^-(g)$ $E_A(O) = 141$ kJ mol^{-1}

   $O^-(g) \rightarrow O^{2-}(g)$ $E_A(O^-) = -780$ kJ mol^-

8. a) i) Define formal charge. State the purpose of calculating formal charge of a molecule and write its assumptions. (2)

ii) Calculate the formal charges of NH_3 and NH_4^+.

b) Predict the molecular geometry of XeF_4 and PCl_5 molecules by using VSEPR theory. (3)

9. Draw the resonance structures of HCl. Out of them which one has little importance as a resonance structure and why? (5)

10. Write the molecular orbital configurations of O_2^+ and O_2^-. Calculate their bond orders and comment on their magnetic nature.

PART-(B)

11. a) Write the chain isomers for a molecule having molecular formula C_5H_{12}. (2)

b) Write the geometrical isomers of 1,2-dimethylcyclopropane. Which one of them will have a dipole moment and why? (3)

12. Write the Fischer projections of stereoisomers of 2,3,4-trihydroxybutanal. Classify as them as erythrose or threose type. Also mark their configuration as D or L. (5)

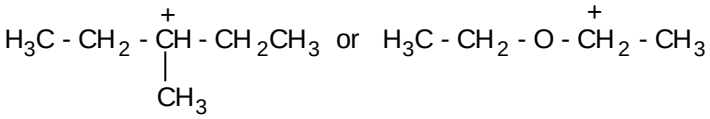
13. Draw and explain various confirmations of butane. Which one of them is least stable and which one is the most stable? (5)

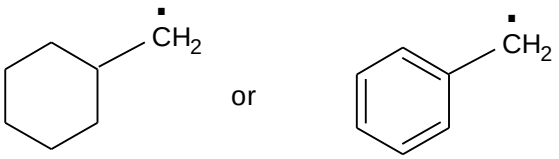
14. a) Write the resonance structures of ethanoate ion. Is the negative charge localised or not? (2)

b) Illustrate hyper conjugation with a suitable example. (3)

15. a) How does the stabilities of free radicals resemble those of carbocations? Explain with the help of suitable examples. (2)

b) Which out of the following pairs is more stable and why? (3)

i) 

ii) 

16. Briefly explain the following reactions and give their importance; (5)
(i) Wurtz reaction
(ii) Sabatier-Senderen's reaction

17. Explain the mechanism of Birch reduction giving a suitable example. (5)

18. Write the mechanism of hydration of 1-butene. (5)

19. Write the products formed when 2-pentyne undergoes ozonolysis. Give the mechanism involved. (5)

20. Draw the molecular orbitals of benzene and illustrate its electronic configuration. (5)