

020103

March 2023

B.Tech. - 1 SEMESTER

Chemistry (BSC-102)

Time : 3 Hours]

[Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART-A

1. (a) Represent the fundamental modes of vibration of CO_2 . (1.5)
- ✓ (b) List the general properties of ideal gases. (1.5)
- (c) Which of the following nuclei do not show nuclear magnetic resonance : ^1H , ^2H , ^{12}C , ^{13}C , ^{14}N . (1.5)
- (d) Calculate the radial nodes and angular nodes associated with 5d orbital. (1.5)
- ✓ (e) Define critical temperature (T_c) and critical pressure (P_c). (1.5)

020103/1390/111/10

365 [P.T.O.]

- (f) Explain the cause of optical activity in compounds. (1.5)
- (g) Why NH_3 is more basic than PH_3 ? (1.5)
- (h) What are soft acids and soft bases? (1.5)
- (i) Arrange the following in increasing order, of heat of hydrogenation :
Propene, 2-methyl propene, 1-Butene and 2-Butene. (1.5)

- (j) Arrange the following in order of increasing pK_a value :
Ortho nitro benzoic acid, benzoic acid, meta nitro benzoic acid and para nitro benzoic acid. (1.5)

PART-B

2. (a) What is optical activity and Chirality. Discuss stereoisomerism in coordination compounds with suitable example. (10)
- (b) Explain the criteria of spontaneity and reversibility in term of S, U, H and G. (5)
3. (a) What are Enantiomers and Diastereomers? Explain their physical and chemical properties. (5)
- (b) What the main reasons for deviation of real gases from ideal behavior? Derive the expression for the equation of state for real gases. (10)

4. State and illustrate the basic principle and applications of Rotational and Vibrational spectroscopy. (15)

5. (a) Draw and discuss the application of Ellingham diagram. (5)
- (b) Draw MO (Molecular Orbital) diagram of NO and F_2 and predict their bond order and magnetic behavior. (10)

6. (a) Explain the following :
(i) What is Electronegativity? Explain the different quantitative scale for measuring the Electronegativity. (5)

- (ii) Explain the postulates and application of Fajan's rules. (5)
- (b) What are semiconductors? Discuss in brief 'Band Theory' in metals. (5)

7. Explain the following :
(i) Shielding and Deshielding of proton.
(ii) $\text{S}_{\text{N}}1$ and $\text{S}_{\text{N}}2$ reaction.
(iii) Energy versus reaction coordinate graph for H_2 molecule.
(iv) Slater's Rule of Shielding contribution.
(v) Conformations of n-Butane. (5×3=15)