

Roll No. 29001020003.

Total Pages : 04

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December 2024

B.Tech. (First Semester)

Chemistry (BSC-102)

Time : 3 Hours]

[Maximum Marks : 75

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

**Part A**

1. ~~(a)~~ What is n-type semiconductor ? 1.5
- (b) Discuss the process of Galvanization. 1.5
- ~~(c)~~ Why eclipsed conformation is less stable than staggered conformation ? 1.5
- ~~(d)~~ Write the mathematical expression for the change in internal energy ( $dU$ ) ? 1.5
- ~~(e)~~ State the four criteria for aromaticity. 1.5
- ~~(f)~~ What are Dipole-Induced Dipole and Induced Dipole-Induced Dipole forces ? 1.5

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(g) Write any two Maxwell's relationships. 1.5

~~(h)~~ Write the expression for the van der Waals equation with correction in pressure and volume. 1.5

~~(i)~~ How the permanent hardness of the water be removed? 1.5

(j) Predict the number of NMR signals in  $\text{CH}_3\text{COCH}_3$  and  $\text{CH}_3\text{COCH}_2\text{CH}_3$ . 1.5

#### Part B

2. ~~(a)~~ Discuss the emission spectroscopy, its principle, instrumentation and applications. Explain the process of fluorescence and phosphorescence using Jablonski Diagram. 10

~~(b)~~ What do you mean by Nuclear Magnetic resonance spectroscopy and state its two applications? 5

3. (a) What do you mean by critical state of a gas? What changes in the properties of a gas occur at this stage? Also write the expression for  $T_c$ ,  $P_c$  and  $V_c$ . 5

(b) Discuss the mathematical expression for change in enthalpy of a reaction. Also derive the relation between the  $C_p$  and  $C_v$  for one mole of an ideal gas. 10

~~(c)~~ Describe the Schrodinger wave equation. Derive the expression for the total energy and normalized wave function for the particle of mass ( $m$ ) in 1-D box with length  $L$  moving with potential  $V(x) = 0$ ,  $0 < x < L$ , otherwise  $V(x)$  is infinite. Also draw the molecular orbital diagram for the  $\text{O}_2$  and predict its bond order and magnetic behavior. 15

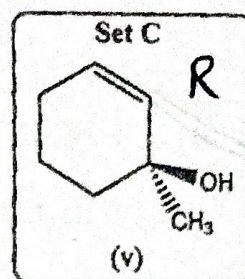
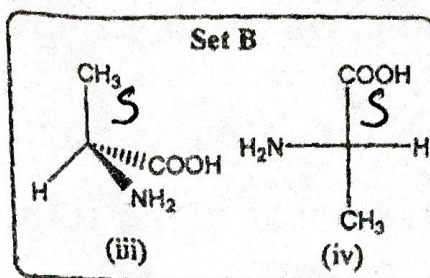
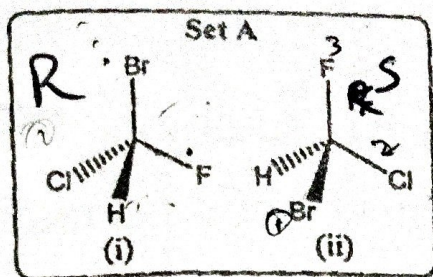
5. (a) Discuss the Nernst Equation, mainly its derivation and expression and also explain one of its applications. 5

(b) Explain the hard and soft acids and bases (HSAB) theory and write its applications. Also Discuss electro negativity based on Pauling and Mulliken's electronegativity equation and Fajan's rules on polarizability. 10

6. (a) What is the isomerism in transition metal complexes; discuss the structural, stereo and geometrical isomerism in detail? 10



- (b) Assign R and S of the following and what is the relationship between the [Set A: (i) and (ii)], [Set B: (iii) and (iv)] 5



7. Write short notes on the following : 15

- (i) Oxymercuration-Demercuration Reaction.
- ~~(ii)~~ Diels-Alder Reaction
- (iii) Wolff-Kishner Reduction
- ~~(iv)~~ Synthesis of Aspirin
- ~~(v)~~ Difference between  $SN_1$  and  $SN_2$ .