

SUPPLEMENTARY/ BACKLOG EXAMINATION

COURSE NAME: B.Tech
BRANCH NAME:

SEMESTER: 1st and 2nd
SPECIALIZATION:

SUBJECT NAME: CHEMISTRY (New NEP Syllabus)

FULL MARKS: 50

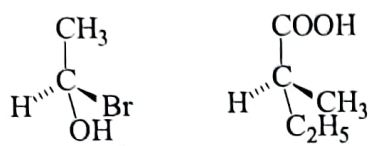
TIME: 2.5 Hours

Answer All Questions.

The figures in the right-hand margin indicate Marks. Symbols carry usual meaning.

- Q1. Answer all Questions. [2×5]
- What is the basis of classification of blocks in the modern periodic table? -CO1
 - Give the expression of Gibbs-Helmholtz equation with respect to work function and write its significance. -CO2
 - Calculate the number of vibrations in carbon dioxide molecule. Explain why one of the vibrations in this molecule is infra-red inactive. -CO3
 - Distinguish between a pair of enantiomers and a pair of diastereo isomers. -CO4
 - What is the structure of a carbanion? -CO5
- Q2.
- Write the correct electronic configurations of elements with atomic number 29 and 47. [4] -CO1
 - How many types of atomic radii are there. Give a brief note and their trend in a group and in a period. [4] -CO1
- OR**
- What is ionization potential of an atom? Explain its trends in a group and in a period. [4] -CO1
 - What is electron affinity of an atom? Why the 2nd electron affinity is endothermic in nature whereas the 1st electron affinity is exothermic? [4] -CO1
- Q3.
- Derive the mathematic formulation of entropy. Prove that for a cyclic process, entropy change is zero. [4] -CO2
 - Calculate the entropy change for the following processes: [4] -CO2
 - $\text{H}_2\text{O} (\text{s}, 1\text{atm}, 273\text{K}) \longrightarrow \text{H}_2\text{O} (\text{l}, 1\text{atm}, 273\text{K})$
 - $\text{H}_2\text{O} (\text{l}, 1\text{atm}, 373\text{K}) \longrightarrow \text{H}_2\text{O} (\text{v}, 1\text{atm}, 373\text{K})$

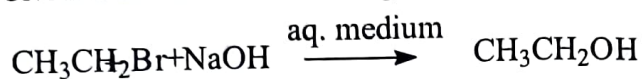
Given, $\Delta H_{\text{fusion}} = 6.026 \text{ kJ/mol}$ and $\Delta H_{\text{vaporization}} = 40.60 \text{ kJ/mol}$ for water.
- OR**
- Derive the expression of standard free energy change for a chemical equilibrium containing ideal gases. What are the significances of the expression? [4] -CO2
 - Derive the Gibbs-Duhem equation and write its significance. [4]
- Q4.
- Derive an expression of spectroscopic energy change for a rigid diatomic molecule undergoing rotation. [6] -CO3
 - Calculate the moment of inertia for carbon monoxide molecule if the 1st line in the rotational spectrum is 3.84235 cm^{-1} . [2] -CO3
- OR**
- Assume, a ball attached to a spring undergoes harmonic oscillation. Prove that the frequency of this harmonic oscillator is independent of amplitude, rather it is related to the force constant and mass of the ball. [6] -CO3
 - The reduced mass of a diatomic molecule undergoing harmonic oscillation is $62.9 \times 10^{-24} \text{ gm}^{-1}$ and its bond force constant is $9.7 \times 10^5 \text{ dyne/cm}$. Calculate the frequency of vibration in spectroscopic unit. [2] -CO3
- Q5.
- Indicate the pairs of structural isomers of the following compounds: [4] -CO4
 $\text{C}_3\text{H}_6\text{O}$, $\text{C}_2\text{H}_6\text{O}$, $\text{C}_4\text{H}_9\text{Cl}$, C_5H_{12}
 - What are enantiomers? Write down the pairs of enantiomers for the compounds [4] -CO4
 $\text{CH}_3\text{CH}(\text{OH})\text{COOH}$.
- OR**
- Discuss the conformations of n-butane [4] -CO4
 - Find out the R,S configurations of the following compounds: [4] -CO4



Q6.

- a) Discuss one method of formation of carbocation, its stability and one of its reactions.
 b) Give mechanism of the following reaction:

[4] -CO5
 [4] -CO5



Discuss its stereochemistry in one or two lines.

OR

- a) Discuss one method of formation of carbene, its stability and one of its reactions
 b) Give mechanism of the following reaction:

[4] -CO5
 [4] -CO5

