K. K. Wagh Institute of Engineering Education & Research, Nashik
(An Autonomous Institute From A.Y. 2022-23)

SUMMER-2024	
Exam Seat No.:	
Academic Year: 2023-2024	Semester: III
Class: SY-B.Tech Chemical Engineering	Program: B.Tech
Branch Code: CHE	Pattern: 2022
Name of Course: Chemistry I	Course Code: CHE222002
Max. Marks: 60	Duration: 2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 02 pages.
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

Question No. 1 Attempt following Question

1	The Nitrogen molecule containing triple bond in it. Justify it by using Molecular orbital theory.	(6)	CO1

Question No. 2 Attempt following Question

2	What is half life time? Show that half life time of first order reaction is independent of the concentration of reactant.	(6)	CO2

Question No. 3 Attempt following Question

3.a)	Discuss the principle, technique and applications of column chromatography.	(6)	CO3

<div align="center">**OR**</div>

3.b)	Discuss any two types of detectors commonly employed in gas chromatography.	(6)	CO3

3.c)	Discuss the key components and operation of instrumentation used in infrared (IR) spectroscopy.	(6)	CO3

<div align="center">**OR**</div>

3.d)	What are the modes of vibration in infrared (IR) spectroscopy Explain the concepts of stretching vibration.	(6)	CO3

3.e)	When beam of ultraviolet light is absorbed by the organic compound, it gives different types of electronic transitions discuss four of them.	(4)	CO3

<div align="center">**OR**</div>

3.f)	Explain the principle, technique and applications of flame photometry.	(4)	CO3

Question No. 4 Attempt following Question

4.a) Explain Van't Hoff's Boyle's law and Van't Hoff's Charles's law and give the equation obtained after combining both law.   (6) CO4

<div align="center">**OR**</div>

4.b) What are the key factors that influence the solubility of a gas in a particular solvent?   (6) CO4

4.c) Define the term vapour pressure, and how does it relate to the behavior of liquids give any two factors that influence vapour pressure of liquids?   (6) CO4

<div align="center">**OR**</div>

4.d) What is freezing point depression? Derive the equation showing the relation between molecular mass of non-volatile solute and depression in freezing point.   (6) CO4

4.e) In 1 kg of water (approximately 1 liter) you dissolve 10 grams of table salt (NaCl) into it. The molecular weight of NaCl is approximately 58.44 g/mol. find the elevation in boiling point (Kb of water = 0.512 °C/m).   (4) CO4

<div align="center">**OR**</div>

4.f) 100 grams of sugar (sucrose Molecular weight 342 g/mol) dissolve into 500 grams of ethanol (C_2H_5OH). Assuming that sucrose is dissolve completely find elevation in boiling point of the solution? For ethanol, the ebullioscopic constant (Kb) is approximately 1.22°C/kg.   (4) CO4

Question No. 5 Attempt following Question

5.a) Discuss any three factors which affect the rate of SN^1 reactions?   (6) CO5

<div align="center">**OR**</div>

5.b) Demonstrate the stereochemical changes taking place during SN^1 and SN^2 reactions.   (6) CO5

5.c) Toluene undergoes electrophilic substitution at ortho and para, while benzaldehyde at meta only Justify it.   (6) CO5

<div align="center">**OR**</div>

5.d) What is elimination reaction? Justify it with the help of E2 mechanism.   (6) CO5

5.e) Show the conversion of oximes to N-substituted amide by Beckman's rearrangement reaction.   (4) CO5

<div align="center">**OR**</div>

5.f) What is nitration reaction? Discuss the mechanism of nitration reaction of benzene.   (4) CO5

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