

Enrolment No.:

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M. Sc. Chemistry, I Semester
Supplementary Examination 2024

Paper Title: Analytical Chemistry

Paper Code: MCHCC-104

Time: 2.5 hours

Maximum Marks: 60

Note: This paper has 3 sections A, B, and C, Attempt all three sections; **Section A:** Answer *all* the questions; **Section B:** Answer *any 2* out of 4; **Section C:** Answer *all* the questions, each question has an *internal choice*

Abbreviations Used

CLO- Course Learning Outcome, PLO- Program learning Outcome, BTL- Bloom Taxonomy Level: BT level 1-Remember; BT level 2-Understand; BT level 3-Apply; BT level 4-Analyse; BT level 5-Evaluate, BT level 6-Creat

Q.No		BTL	CLO	PLO
<u>SECTION - A</u>				
Attempt <u>all</u> questions		1 x 15 = 15 Marks)		
A 1.	Define the following terms. (a) Adsorbate (b) Adsorbent (c) Sorption (d) Desorption	1/2	1/2	1/2
A 2.	Differentiate between adsorption and absorption	1/2	1/2	1
A 3.	Is anhydrous calcium chloride an adsorbent or adsorbent? Justify your answer.	1/4	4	4
A 4.	On what principle separation is based in chromatography?	1/2	1/2	1/2
A 5.	What is Partition Coefficient (K)? What does it signify?	2/4	2-4	2-4
A 6.	What is the role of mobile phase in the separation of analytes by gas chromatography	1/2	1/2	1/2
A 7.	What is the criteria for compounds to be analysed by gas chromatography?	1/2	1/2	1/2
A 8.	What is bonded phase chromatography? Give one example each of a common polar and a non-polar functional group for bonded stationary phase.	1/2	2/3	2/3
A 9.	What is glass transition temperature?	1/2	1/2	1/2
A 10.	How would you define thermal gravimetric analysis (TGA) and what are its different types?	1/2	2/3	2/3

A 11.	What are the two different types of solvent systems used in column chromatography?	1/2	1/2	1/2
A 12.	Size exclusion chromatography is also known by gel permeation and gel filtrations chromatography. Are the two terms same or different? Specify.	2-3	2-3	2-3
A 13.	What is gas amplification factor?	1/2	1/2	1/2
A 14.	How is isocratic elution different from gradient elution	2-4	2-4	2-4
A 15.	What are primary and secondary ion pairs	1/2	1/2	1/2

SECTION - B

Attempt **any two** out of following four questions

(10 x 2 = 20 Marks)

B 1.	(a) Describe briefly the process of adsorption. Differentiate between chemisorption and physisorption	3-4	3-5	3-5
	(b) Discuss the classification of chromatography on the basis of the following parameters. (i) Mobile phase (ii) Mechanism of separation	3-4	3-4	3-4
B 2.	(a) What makes HPLC to be called as high performance? Draw the labelled schematic diagram of HPLC instrumentation and briefly describe its each component.	4-6	4-6	4-6
	(b) Why does a chromatography peak broaden? Discuss the salient features of van deemter theory.	2-4	2-4	2-4
B 3.	(a) Discuss the principle and process of separation in size exclusion chromatography.	4-5	4-5	4-5
	(b) What do you understand by the term "exclusion limit". How can the molecular weight of a protein be determined by size exclusion chromatography	4-5	4-5	4-5
B 4.	Draw the six-region curve for gas-filled detectors and discuss briefly the following regions. (i) Recombination region (ii) Ionization region (iii) Proportional region	3/4	3-5	3-5

SECTION - C

Attempt **all** questions, each question has an **internal choice**

(5 x 5 = 25 Marks)

C 1.	Explain the principle, process and applications of thin layer chromatography?	4/5	4/5	4/5
OR				
	Substance X and Y have retention times of 25 and 30 min. respectively, on a 25 cm long column. An unretained species passes through the column in 1.30 min. The peak widths (at base) for X and Y are 1.11 and 1.21 min. respectively. Calculate the following: (i) Retention factors of X and Y (ii) Number of theoretical plates for the column (N)	5	5/6	5/6

	(iii) Height equivalent to theoretical plate (H)			
	(iv) Selectivity factor (α)			
C 2.	Discuss the significance of plate height and number of theoretical plates in the determination of chromatographic column efficiency.	3/4	3/4	3/4
	OR			
	What is the criteria of selection of an ideal mobile phase reservoir used in HPLC and why He degassing of the liquid mobile phase is required?	2-5	2-5	2-5
C 3.	Give an account of the packed and capillary columns used in gas chromatography specifying their advantages with respect to each other.	5/6	5/6	5/6
	OR			
	Discuss the mechanism of separation by anion and cation exchangers. Explain the role of buffer in ion exchange chromatography.	3/4	3/4	3/4
C 4.	What is bonded phase chromatography? Describe the types of bonded phases. Discuss briefly the significance of end capping and double end capping process.	3/4	3/4	3/4
	OR			
	What is Geiger Muller counter? Draw the labeled schematic diagram of a Geiger Muller counter and explain its working.	5/6	5/6	5/6
C 5.	Describe briefly the classification of TGA curves and name the factors affecting the TGA curves.	3/4	3/4	3/4
	OR			
	Discuss the different types of stationary phase used in size exclusion chromatography.	5/6	5/6	5/6

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