

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086
(For candidates admitted from the academic year 2025 - 2026)

B.Sc. DEGREE EXAMINATION, APRIL 2026
BRANCH IV - CHEMISTRY
SECOND SEMESTER

COURSE : CORE
PAPER : PHYSICAL CHEMISTRY I
SUBJECT CODE : 25CH/MC/PC24
TIME : 3 HOURS

MAX. MARKS :100

Q.No.	SECTION – A	CO	KL
	Answer the Questions: (5 x 2 = 10 Marks)		
1.	What is meant by interfacial tension?	1	K1
2.	State Le Chatelier's principle.	1	K1
3.	What are non-stoichiometric defects?	1	K1
4.	State the Charles' law.	1	K1
5.	State the Law of rational indices.	1	K1
Q.No.	SECTION – B	CO	KL
	Answer the Questions: (5 x 2 = 10 Marks)		
6.	Illustrate the significance of radius ratio rule.	2	K2
7.	Calculate the pH of 0.1 M NH ₄ OH. (Given - K _b = 1.8 × 10 ⁻⁵).	2	K2
8.	Outline the types of liquid crystals.	2	K2
9.	Combining the gas laws obtain the ideal gas equation.	2	K2
10.	Draw (100) plane for a simple cubic system.	2	K2
Q.No.	SECTION -C	CO	KL
	Answer any FOUR questions: (4 x 8 = 32 Marks)		
11.	a) Obtain the packing efficiency, % of void space and void space fraction for an fcc lattice. (5) b) Discuss the action of surfactants in reducing the surface tension. (3)	3	K3
12.	Explain the liquefaction of gases. Discuss critical phenomena and derive the expressions for critical constants from the van der Waals equation.	3	K3
13.	Explain the effect of temperature and pressure on the compressibility factor (Z).	3	K3
14.	Discuss the hydrolysis of salts of weak acids and weak bases, and derive the expression for pH.	3	K3
15.	a) Identify the Weiss and Miller indices in the following intercepts of a crystal lattice: (4) (i) -2a, 3b, ∞c (ii) 2a, b, c (iii) a, ∞b, c b) A capillary tube of internal diameter 0.21 mm is dipped into a liquid whose density is 0.79 g/cm ³ . The liquid rises in this capillary to a height of 6.30 cm. Calculate the surface tension of the liquid. (g = 980 cm/sec ²) (4)	3	K3

Q.No.	SECTION -D Answer any FOUR questions: (4 x 6 = 24 Marks)	CO	KL
16.	Explain the preparation and action of an acid buffer and a basic buffer.	4	K4
17.	Describe the principle and working of a polarimeter for determining optical activity.	4	K4
18.	Derive the expression for RMS velocity of gas molecules.	4	K4
19.	Analyze the crystal lattice of NiAs	4	K4
20.	List the postulates of kinetic theory of gases.	4	K4
Q.No.	SECTION -E Answer any TWO questions: (2 x 12 = 24 Marks)	CO	KL
21.	a) Derive van't Hoff reaction isochore. (4) b) Discuss the differences between crystalline and amorphous solids with suitable examples. (4) c) Consider the equilibrium reaction: $\text{N}_2\text{O}_4 (\text{g}) \leftrightarrow 2\text{NO}_2 (\text{g}) \quad \Delta H = +57 \text{ kJ/mol} \quad \text{and}$ (i) State whether the forward reaction is endothermic /exothermic. (1) (ii) Predict the equilibrium shift when temperature is increased, pressure is decreased and when concentration of NO ₂ is increased. (3)	5	K5
22.	a) Explain the X-ray diffraction patterns of primitive, body-centred, and face-centred cubic lattices, and derive the expressions for interplanar spacing in cubic systems. (8) b) Explain the distribution of Maxwell's molecular velocities. (4)	5	K5
23.	a) Two compounds—one nonpolar and one polar—exhibit significantly different melting and boiling points. Discuss the types of intermolecular forces present in each compound and compare their relative strengths. Explain how these differences in intermolecular interactions lead to the observed variations in physical properties. (7) b) Explain the concept of Reynolds number and its significance in fluid flow. (5)	5	K5
