

QP Code: D141820		Total Pages: 2	Name:
			Register No.
SECOND SEMESTER (CUFYUGP) DEGREE EXAMINATION, APRIL 2026			
CHEMISTRY / POLYMER CHEMISTRY			
CHE2MN101: Quantum Mechanics, Solid States and Gaseous States			
2024 Admission onwards			
Maximum Time: 2 Hours			Maximum Marks: 70
Section A			
All Questions can be answered. Each Question carries 3 marks (Ceiling: 24 Marks)			
1	Define eigen values and eigen functions.		
2	Explain the term Linear operator.		
3	Set up the Schrodinger wave equation for a simple harmonic oscillator, and give the energy eigen values.		
4	What is meant by amorphous solid? Why is glass regarded as an amorphous solid?		
5	Draw the unit cell structure of CsCl.		
6	Using the kinetic gas equation, derive Avogadro's Law.		
7	What is collision number and mean free path? Write equations of both.		
8	Write equations for most probable velocity, root mean square velocity and average velocity.		
9	Explain compressibility factor.		
10	Discuss van der Waals equation of state.		
Section B			
All Questions can be answered. Each Question carries 6 marks (Ceiling: 36 Marks)			
11	Explain the Stern - Gerlach experiment.		
12	a) Give the Schrodinger equation of the hydrogen atom in spherical polar coordinates. b) Explain spherical harmonics.		
13	Explain i) Bravais lattice ii) semiconductors and insulators.		
14	Describe the variation of viscosity with temperature and pressure.		
15	Explain briefly about P – V isotherms of a real gas.		
16	a) Write down any three characteristics of gas. b) Calculate the critical volume, the critical temperature and the critical pressure for carbon dioxide gas. Given the values of van der Waals constants for CO ₂ : $a = 3.61 \text{ atm litre}^2 \text{ mole}^{-2}$ and $b = 4.27 \times 10^{-2} \text{ litre mole}^{-1}$.		
17	The coefficient of viscosity of C ₂ H ₄ gas is 10.08 micro Pascal second ($\mu \text{ Pa s}$) at 20 °C. Calculate the collision diameter of C ₂ H ₄ molecules at N.T.P.		
18	Two moles of NH ₃ are enclosed in a five litre flask at 27°C. Calculate the pressure exerted by the gas assuming that i) the gas behaves like an ideal gas ii) the gas behaves like a real gas. Given $a = 4.17 \text{ atm litre}^2 \text{ mole}^{-2}$ and $b = 0.37 \text{ litre mole}^{-1}$.		

Section C**Answer any ONE. Each Question carries 10 marks (1×10 = 10 Marks)**

19	a) Enlist the postulates of quantum mechanics. b) Give the significance of Schrodinger wave equation.
20	a) Briefly explain the defects in crystals. b) Write a short note on diamagnetism, ferromagnetism and antiferromagnetism.