

QP Code: D 123064	Total Pages: 2	Name:
		Register No.
SECOND SEMESTER (CUFYUGP) DEGREE EXAMINATION APRIL 2025		
(CHEMISTRY)		
CHE2MN101: QUANTUM MECHANICS, SOLID STATE AND GASEOUS STATE		
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	Write and explain the Schrodinger equation of the hydrogen atom in spherical polar coordinates.	
2	Set up the Schrodinger wave equation for a simple harmonic oscillator, and give the energy eigen values.	
3	Explain briefly about i) atomic orbitals ii) angular momentum.	
4	How many atoms are present in the unit cell of bcc and fcc lattices?	
5	Explain the term 'Super conductor'.	
6	Explain the terms collision diameter, collision number and mean free path.	
7	Explain i) viscosity of gases ii) Compressibility factor iii) Boyle temperature.	
8	Carefully explain the causes of deviation from ideal behaviour.	
9	Express the van der Waals equation in virial form.	
10	Calculate the Boyle temperature T_B for CO_2 gas, assuming it to be van der Waals gas. The van der Waals constants for CO_2 gas are $a = 3.59 \text{ dm}^6 \text{ atm mol}^{-2}$, $b = 0.0427 \text{ dm}^3 \text{ mol}^{-1}$.	
Section B		
All Questions can be answered. Each Question carries 6 marks (Ceiling: 36 Marks)		
11	State and explain the postulates of quantum mechanics.	
12	Explain the Stern - Gerlach experiment.	
13	How will you distinguish between ferromagnets, antiferromagnets and ferrimagnets with the help of electron spins?	
14	What do you know about defects in crystals? Explain briefly.	
15	Starting from the basic postulates of the kinetic theory of gases, derive the kinetic gas equation.	
16	Describe the variation of viscosity with temperature and pressure.	

17	For hydrogen gas, calculate i) the root mean square velocity ii) the average velocity and iii) the most probable velocity at 0°C.
18	A certain gas has the following values of its critical constants : $P_c = 45.6 \text{ atm}$, $V_{m,c} = 0.0987 \text{ dm}^3 \text{ mol}^{-1}$ and $T_c = 190.6 \text{ K}$. Calculate the van der Waals constants of this gas. Also, estimate the radius of the gas molecules assuming that they are spherical.
Section C	
Answer any ONE. Each Question carries 10 marks (1×10 = 10 Marks)	
19	Derive an expression for the energy of a particle in one dimensional box.
20	a) Explain i) Crystalline and amorphous solids ii) seven crystal systems b) Explain briefly about P – V isotherms of a real gas.