

QP Code: D141291		Total Pages: 2	Name:
			Register No.
SECOND SEMESTER (CUFYUGP) DEGREE EXAMINATION, APRIL 2026			
CHEMISTRY			
CHE2CJ101 Physical Chemistry I: States of Matter			
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	Calculate the temperature at which the root mean square velocity, average velocity and most probable velocity of O ₂ gas are all equal to 1500 m s ⁻¹ .		
2	Using the expression for the Maxwell distribution of velocities draw the distribution at three different temperatures and comment on the shapes of distribution curves.		
3	Explain the terms collision diameter and mean free path, also show that the mean free path of a gas molecule decreases by increase of pressure.		
4	Give the van der Waal's equation of state for n moles of a gas and explain the terms involved, and the units of the van der Waal's constants in the SI system.		
5	Discuss different types of intermolecular interactions.		
6	Explain i) viscosity of a liquid ii) Poiseuille's equation.		
7	Why does water have the highest melting and boiling points among the hydrides of group 16?		
8	How do crystalline solids differ from amorphous solids?		
9	a) Derive the Braggs law of X-ray diffraction. b) Define the term surface tension.		
10	Write a note on i) Tyndall effect ii) nephelometry iii) foam and aerosol.		
Section B			
All Questions can be answered. Each Question carries 6 marks (Ceiling: 36 Marks)			
11	Derive the kinetic gas equation.		
12	Derive the virial equation of state and the Boyle temperature.		
13	a) Write notes on hydrophilic, hydrophobic, superhydrophilic and superhydrophobic characteristics. b) Explain the above behaviour using the water drop contact angles on surface.		
14	a) Write a note on close packing in crystals. b) An element occurs in the BCC structure with a cell edge of 275 pm, density $d = 7\text{g/cc}$, $7 \times 10^3\text{ kg/m}^3$, $N_0 = 6.022 \times 10^{23}/\text{mol}$. How many atoms of the element does 200 g of the element contains?		
15	a) Give basic idea of neutron diffraction. b) Explain structural transitions in anatase and rutile forms of TiO ₂ .		
16	a) What are lattice planes and Miller indices? b) A lattice plane intercepts the three crystallographic axes at multiples of unit intercepts $3/2$, 2 and 1. What are the Miller indices?		

17	How will you determine the molecular mass using i) osmotic pressure method ii) relative lowering of vapour pressure?
18	Explain the following i) reverse osmosis and its technological relevance ii) Henry's law and its applications.
Section C	
Answer any ONE. Each Question carries 10 marks (1x10=10 Marks)	
19	a) Explain theoretical isotherms from van der Waal's equation and the critical state relationship between van der Waal's constants and critical constants. b) The van der Waal's constants for gaseous HCl are $a = 0.367 \text{ Nm}^4/\text{mol}^2$ and $b = 4.08 \times 10^{-5} \text{ m}^3/\text{mol}$. Find the critical constants. c) Define the term refractive index.
20	Analyze the X-ray powder diffraction pattern of i) NaCl ii) KCl.