P. Pages: 2

Time : Three Hours

Max. Marks: 80

	Note	 es: 1. All five questions are compulsory and carry equal marks. 2. Write equations and draw diagrams wherever necessary. 	
1.	a)	Using the first order time-Independent perturbation theory solve the schrodinger wave equation for the ground state energy of helium atom.	8
	b)	Cyclobutadiene C_4H_4 is a four carbon atom ring. Set up the Huckel secular equation for the π molecular orbitals of this planar molecule. Find the energies of the orbitals. Predict total π electronic energy of this compound. Is there extra π electron stabilization in this molecule?	8
		OR	
	c)	Show that ground state term symbol of H_2 is Σ_g^+ and write down molecular wave	4
		function for H_2^- molecule anion.	
	d)	Explain the following terms.i) Spin Orbit Coupling.ii) Zeeman Splitting.	4
	e)	What are term symbols? Calculate term symbol for ground state electronic configuration of nitrogen atom (Z=7).	4
	f)	Explain Russell-Saunders terms and coupling schemes. Determine the atomic term symbols for electrons for which $L=2$ and $S=1$.	4
2.	a)	What do you understand by Stirling's approximation? Write an comparative account of Maxwell-Boltzmann. Bose-Einstein and Fermi-Dirac statistics.	8
	b)	Explain the term activity. How the values of activity and activity coefficient determined by the E.M.F. method and solubility method.	8
		OR	
	c)	Define ionic strength. Calculate the ionic strength of the following i) BaCl ₂ ii) Na ₃ PO ₄	4
	d)	How are excess functions determined experimentally?	4
	e)	Derive an expression for entropy of mixing and enthalpy change of mixing for real solution (non ideal solution).	4
	f)	State the assumptions of Debye-Huckel theory.	4
3.	a)	Discuss the thermodynamics of Frenkel and Schottky defects.	8
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OR

	c)	Explain the properties of p-n junctions with suitable examples.	4
	d)	Write the various applications of superconductivity.	4
	e)	Write a note on non-stoichiometry defects?	4
	f)	Discuss the kinetics of solid state reaction.	4
4.	a)	What is neutron activation analysis. Explain in detail.	8
	b)	Give an account of optical model of nucleus.	8
		OR	
	c)	Discuss isotopic dilution analysis.	4
	d)	What is liquid drop model? Explain and give its merits.	4
	e)	Discuss ionization chamber counter.	4
	f)	Explain in short fermi Gas model.	4
5.	a)	Define the term degeneracy of an energy level.	2
	b)	Explain the term hybridization.	2
	c)	What is Le Chatelier principle of chemical equilibrium.	2
	d)	Define excess chemical potential (μ^E) and excess Gibb's free energy (G^E) .	2
	e)	Which point defect lowers the density of ionic crystals? Why?	2
	f)	What is Meissner effect?	2
	g)	What do you understand by thermonuclear reactions?	2
	h)	Define radioactive decay.	2
