Ist & 2nd SEMESTER EXAMINATION, 2022 – 23…..
Ist yr B.Tech.
Chemistry (Concepts in chemistry for engineering)

Duration: 3:00 hrs   **Max Marks: 100**

Note: - Attempt all questions. All Questions carry equal marks. In case of any ambiguity or missing data, the same may be assumed and state the assumption made in the answer.

Q 1.	Answer any four parts of the following.	5x4=20
	a) On the basis of band theory, differentiate between insulator, conductor and semiconductor.	
	b) What is the principle of IR spectroscopy? Calculate the fundamental modes of vibrations in C_2H_2, C_6H_6 and CH_4 molecules.	
	c). What is crystal field theory. Explain why $[CoF_6]^{3-}$ is paramagnetic whereas $[Co(NH_3)_6]^{3+}$ is diamagnetic though both are octahedral.	
	d) What are Vander Waal forces? The Vander-Waals constant of a gas are a = 0.765 dm^6 atm mol^{-2} and b = 0.0226 dm^3 mol^{-1}. Calculate critical constant	
	e) Give at least five difference between enantiomer and diastereomers.	
	f) Using normalization method, calculate the constant A for the following wavefunction. $$\psi = Ae^{-r}$$	
Q 2.	Answer any four parts of the following.	5x4=20
	a) What do you understand by chemical shift? If the observed chemical shift of a proton is 350 Hz from TMS and the operative frequency of NMR spectrometer is 100 MHz. Calculate the chemical shift in δ ppm.	
	b) Solve the Schrodinger wave equation for particle in one dimension box of length L.	
	c) Discuss the synthesis of commonly used drug by taking suitable example.	
	d) Discuss the molecular geometries of the following BCl_3 and PCl_5.	
	e) Write a short note on Ellingham diagrams	
	f) Calculate the standard free energy change ($\Delta G°$) of the reaction : $$CO(g) + ½ O_2(g) \rightarrow CO_2(g)\ \Delta H° = -282.84\ kJ$$ The standard entropy of CO_2 (g), CO(g) and O_2(g) are 213.8,197.9 and 205.01 $JK^{-1}mol^{-1}$, respectively. Is this reaction feasible at standard state?	
Q 3.	Answer any two parts of the following.	10x2= 20
	a) Discuss factor effecting rate of corrosion and various methods of cathodic protection of corrosion	
	b) Give the importance of electrochemical series. Derive nerst equation. The emf of the cell $Pb/PbSO_4/Na_2SO_4.10H_2O/Hg_2SO_4/Hg$ is 0.95 V at 25°C. The temperature coefficient is 1.0×10^{-4} VK^{-1}. Calculate the values of ΔG, ΔS and ΔH.	
	c) Explain term internal conditioning for the treatment of hard water. Why Calgon conditioning is better than phosphate and carbonate conditioning.	
Q 4.	Answer any two parts of the following.	10x2= 20
	a) Discuss isomerism in transitional metal complexes. Draw all possible stereoisomer for molecule 5-bromo hept-2-ene which has only one stereogenic center.	
	b) Write short notes on the following organic reactions : i) Oxidation reactions ii) Ring opening reactions	

	c) Discuss Nucleophilic substitution reactions with its mechanism of alkyl halide in terms of kinetic, stereochemistry and reactivity of alkyl halides.	
Q 5.	Answer any two parts of the following.	10x2= 20
	a) Why molecules absorb in UY-Visible region? What are the types of electronic transitions that can occur in a molecule? Give possible electronic transitions in methanol and formaldehyde.	
	b) Draw well leveled energy level diagram and explain fluorescence, phosphorescence and intersystem crossing.	
	c) What is the principle of NMR spectroscopy? Why TMS is used as reference in NMR spectroscopy. Predict the NMR spectra of ethanol and isopropanol.	

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