I SEMESTER EXAMINATION, 2022 – 23
I yr, B.Tech: Common to All Branch
Engineering Chemistry

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) What do you understand by temporary and permanent hardness? A sample of hard water has hardness 500 ppm. Express the hardness in ^0Fr an ^0Cl.	
	b) Define bond Order. Explain why helium is monoatomic and hydrogen is diatomic?	
	c) What are equivalent and non-equivalent protons? Find out number of NMR Signals in Mesitylene and ethanol.	
	d) Define GCV and NCV. A sample of coal has following composition by mass C = 70%, O = 8%, H= 10%, N=3%, S= 2%, Ash=7%. Calculate HCV of the fuel.	
	e) Define corrosion. Why Iron nail present on the door undergoes corrosion?	
	f) Explain the different mechanisms of lubrication.	
Q 2.	Answer any four parts of the following.	5x4=20
	a) What is Biogas? Write the composition of Biogas and the raw materials that can be used for regeneration of biogas.	
	b) Find out the vibrational degree of freedom in:	
	i) CO_2 ii) SO_2 iii) CH_4 iv) C_2H_2	
	c) Define functionality. What is the minimum functionality required for a compound to act as monomer?	
	d) Write the synthesis of Aspirin with the help of chemical reaction.	
	e) What is vulcanization? Write down its advantages.	
	f) Define entropy. One mole of an ideal gas at 300K expands reversibly from 3×10^{-2} m^3 to 5×10^{-2} m^3. Calculate the entropy change for the gas.	
Q 3.	Answer any two parts of the following.	10x2= 20
	a) With the help of molecular orbital diagram explain the paramagnetic character of O_2 and the diamagnetic character of N_2.	
	b) Describe the construction and working of Galvanic cell. Calculate the EMF of the following cell at 25^0C and also write the cell reactions:	
	Zn | Zn^{2+} (0.2 *M*) || Ag^+ (0.002 *M*) |Ag	
	The standard *emf* of the cell is 1.54 V.	
	c) Explain the Zeolite process of water softening? The hardness of 10,000L of a sample of water was removed by passing it through a zeolite softener. The zeolite softener then required 200L of NaCl solution containing 150 gm/L of a NaCl for regeneration. Find the hardness of water sample.	
Q 4.	Answer any two parts of the following.	10x2= 20
	a) Write down synthesis and application of following polymers-	
	i) Nylon 66 ii) BUNA-S iii) PVC iv) Polyurethane	
	b) Explain the principle of IR spectroscopy. For XY_2 bent molecule show various	

	types of stretching and bending vibrations in IR spectroscopy. Discuss the significance of fingerprint region. c) Explain Molecular Orbital Theory in case of metals and on its basis differentiate between conductors, semiconductors and insulators.	
Q 5.	Answer any two parts of the following. a) Explain SN_1 and SN_2 reaction with mechanism. b) Describe Electrochemical theory of corrosion. How corrosion can be prevented by sacrificial anodic protection and impressed current cathodic protection. c) With the help of a neat diagram, explain the construction and working of Bomb calorimeter. The following data is obtained in bomb calorimeter : Weight of crucible = 3.469gm Weight of crucible + fuel = 4.678gm Water equivalent of calorimeter =570gm Water taken in calorimeter= 2200gm Rise in temperature = 2.3°C Cooling correction = 0.047°C Acid correction = 62.6 Cal. Fuse wire correction = 3.8 Cal. Cotton thread correction = 1.6 Cal Calculate the GCV of fuel sample. If the fuel contains 6.5% H, determine the value of NCV.	10x2= 20

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