VIT

Reg. No. : 22BEC1348

Final Assessment Test (FAT) - JUNE/JULY 2023

Programme	B.Tech.	Semester	Winter Semester 2022-23
Course Title	ENGINEERING CHEMISTRY	Course Code	BCHY101L
Faculty Name	Prof. Dr.Ganesan	Slot	D2+TD2
		Class Nbr	CH2022232300249
Time	3 Hours	Max. Marks	100

Section A (10 X 10 Marks)
Answer any 10 questions

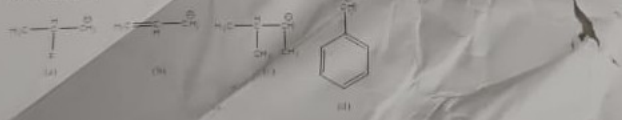
01. (a) Calculate the change in entropy accompanying the heating of 3 moles of helium gas (assumed ideal) from a temperature of 296 K to a temperature of 1009 K at constant pressure. Assume $C_v = 3/2\ R$ (5 marks) [10]

(b) Explain the various processes involved in the Carnot cycle with a neat diagram. (5 marks)

02. (a) $[CoF_6]^{3-}$ is paramagnetic but $[Co(CN)_6]^3$ is diamagnetic. Explain in terms of VBT and mention hybridization and geometry. (5 marks) [10]

(b) Identify the spin of the given complexes using CFT. (a) $[Fe(H_2O)_6]^{3+}$ and (b) $Fe(CN)_6]^{3-}$ (5 marks)

03. Draw the resonance/hyperconjugation structures wherever applicable for each compound and explain their stability. Also arrange the following carbanions in their increasing order of stability. (10 marks) [10]



04. (a) For the given cell representation, construct the cell, explain its working and give the half-cell and net cell reactions. Also calculate the EMF using the Nernst equation. [10]

$$Cd|Cd^{2+}\ (0.02\ M)\ \|\ Cu^{2+}\ (0.4\ M)|Cu$$

The standard reduction potentials of $E^{o}_{Cd^{2+}/Cd} = -0.40$ V and $E^{o}_{Cu^{2+}/Cu} = 0.34$ V (5 marks)

(b) Demonstrate the process of harvesting electrical energy from sunlight by using a dye molecule. (5 marks)

05. (a) What are conducting polymers? Explain the classifications and doping processes in detail by including necessary chemical reactions. (5 marks) [10]

(b) Explain the synthesis of SiO_2 nanoparticles by the sol-gel method. (5 marks)

06. (a) Calculate the crystallite size (D) of the given nanomaterials using the following XRD data: Peak position $2\theta = 24.60^{o}$, FWHM of sample = 2.45°, k = 0.87, and $\lambda = 1.5406$ Å (degree to radian = Degree × π/180). (5 marks) [10]

(b) Explain the various transitions occurring in UV-Visible spectroscopy with an example for each. (5 marks)

07. (a) With the help of a schematic explain the functioning of bomb calorimeter and deduce the relation for the calculation of calorific values. (5 marks) [10]

(b) When 3g of a pre-analyzed sample containing 91% C, 6% H; 1% S and 2% ash is burnt in a bomb calorimeter containing 600g of water and the following results are obtained

Rise in temperature = 2.4°C; The water equivalent = 900g; Cooling correction = 0.05°C

Fuse wire correction = 12 cal; Acid correction = 45 cal.

Calculate the HCV and LCV of the fuel? (5 marks)

08. (a) 50% of a first-order reaction is complete in 35 minutes. Calculate the time required to complete 80% of the reaction. (5 marks) [10]

(b) Account for the following CFSE values based on CFT splitting and provide the splitting pattern for both, and explain. (5 marks)

$[V(H_2O)_6]^{2+}$, $\Delta_o = 11,650\ cm^{-1}$; for $[V(H_2O)_6]^{3+}$, $\Delta_o = 17,240\ cm^{-1}$

09. (a) Apply the rules of aromaticity and identify the most stable compound by giving out the resonance structures. (5 marks) [10]

a b

(b) Explain the construction and working of Li-ion battery with necessary diagram and chemical reactions . (5 marks)

10. (a) Explain the synthesis, properties and applications of ABS or BAKELITE. (5 marks) [10]

(b) Explain the principles, workings and applications of XRD with a neat block diagram. (5 marks)

11. Explain any two cathodic protection methods in detail with suitable diagrams. (10 marks) [10]

12. Explain the purification of water by the ion-exchange method in detail with a neat diagram and the necessary chemical reactions. (10 Marks) [10]

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