VIT
Vellore Institute of Technology

Final Assessment Test (FAT) – June 2022

Programme	**B.Tech**	Semester	**Winter Semester 2021-22**
Course Title	**ENGINEERING CHEMISTRY**	Course Code	**BCHY101L**
Faculty Name	**Prof. Buthanapalli Ramakrishna**	Slot	**A1+TA1**
Time	**3 Hours**	Class Nbr	**CH2021222300089**
		Max. Marks	**100**
Answer any Ten questions			

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

1. (i) Calculate q, w, ΔE and ΔH for the reversible isothermal expansion of 4 moles of an ideal gas at 150° C from a volume of 15 dm^3 to 45 dm^3. (5 Marks) **[10]**

   (ii) The half-life of a first order decomposition reaction is 20 minutes. If 8.0 grams of the reactant decomposes to X grams in 100 minutes. Determine the value of X. (5 Marks)

2. Explain the d-orbital splitting in case of $[Co(NH_3)_6]Cl_2$ complex and find out its hybridization, oxidation state of central metal atom, primary and secondary valency, CFSE and magnetic moment. **[10]**

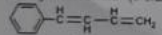
3. (i) Illustrate how CFSE can be of great use to explain the practical trend of lattice energies displayed by 3d series metal ions. (5 Marks) **[10]**

   (ii) Within each given set of compounds, which one has more CFSE? Justify your choice. (5 Marks)

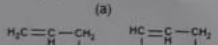
   Set 1 : $[Cr(NH_3)_6]^{3+}$; $[CrF_6]^{3}$; $[Cr(CO)_6]$

   Set 2 : $[Fe(NH_3)_6]Cl_3$; $[Ru(NH_3)_6]Cl_3$; $[Os(NH_3)_6]Cl_3$

4. (i) Predict the product formation in the reaction of HBr with the following compounds with suitable justification. (5 Marks) **[10]**

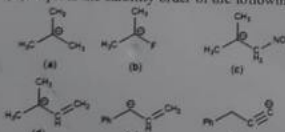


(a)



(b) (c)

(ii) Explain the stability order of the following carbanions with justification. (5 Marks)



(a) (b) (c) (d) (e) (f)

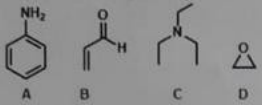
5. (i) Explain the function of a super capacitor and compare its advantages and setbacks with a secondary battery. (5 Marks) **[10]**

   (ii) Describe the principle with appropriate chemical reactions involved in a non-spontaneous deposition of gold on the surface of Iron cathode. (5 Marks)

6. Explain the construction, function and advantages of a spontaneous high energy conversion device that can be operated at 900 °C wherein, insignificant amounts of CO_2 are emitted. [10]
7. Compare and contrast the synthesis and features of thermoplastic and thermosetting polymers with suitable examples. [10]
8. (i) Explain the Mechanism of Conduction in Polyacetylene. (5 Marks) [10]

   (ii) How conductivity of Intrinsically Conducting Polymers can be changed by treating them with Na metal. (5 Marks)
9. (i) In a NaCl crystal, there is a family of planes 0.50 nm apart. If the first-order maximum is observed at an incidence angle of 15.1°, what is the wavelength of the X-ray scattering from this crystal? (5 Marks) [10]

   (ii) Discuss various possible electronic transitions when the given compounds interact with UV-Visible radiation. (5 Marks)



A B C D

10. (i) Explain how a polymer based membrane can be used to demineralize the water based on concentration gradient. List any potential advantages of this method?. (5 Marks) [10]

    (ii) On burning 0.95 of a solid fuel in a bomb calorimeter , the temperature of 4,800g of water increased from 26.8 °C to 29.8 °C. Water equivalents of calorimeter and latent heat of steam are 385.0 g of and 587.0 cal/g respectively. If the fuel contains 0.75% hydrogen, calculate its gross and net calorific value. (5 Marks)
11. (i) Describe the function of any Metal oxide type NO_x gas sensor in detail. (5 Marks) [10]

    (ii) Is it coating Iron pipe with Zinc or connecting a zinc rod to a Iron pipe, which is advantageous to protect the Fe surface from undergoing corrosion? Justify your choice. (5 Marks)