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. Dr.G Ramachandran**	Slot	**A1+TA1**
		Class Nbr	**CH2021222300076**
Time	**3 Hours**	Max. Marks	**100**

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

1. (i) Calculate the efficiency of a certain power station operates with superheated steam at 300°C (Th = 573 K) and discharges the waste heat into the environment at 20°C (T = 303 K). Consider that there is a 4% efficiency loss due to mechanical friction. (5 marks) **[10]**

(ii) An ideal gas with an initial pressure of $1.4\times10^5 Pa$ and an initial volume of $0.50m^3$ expands isothermally to a volume of $2.2m^3$. What is the total amount of thermal energy transferred to the gas during this process? (5 marks)

2. (i) A first order reaction takes 8 hours for 90% completion. Calculate the time required for 80% completion. (4 marks) **[10]**

(ii) Rate constants for the first-order decomposition of acetonedicarboxylic acid

$CO(CH_2COOH)_2(aq) \rightarrow CO(CH_3)_2(aq) + 2CO_2(g)$

acetonedicarboxylic acidacetone

are $k = 4.75 \times 10^{-4}\ s^{-1}$ at 293 K and $k = 1.63 \times 10^{-3}$ at 303° K. What is the activation energy, E_a, for this reaction? (6 marks)

3. (1) What are oxidation states of metal ion in following complexes? (5 marks) **[10]**

I. $PdCl_2$ II. $Pd(PPh_3)_4$ III. $Pd(OAc)_2$ IV. ArPdBr where Ar is aryl

(2) How many M — M bonds are present in $[Cp\ Mo(CO_3)]_2$? Draw its structure. (3 marks)

(3) Which of the following is the incorrect statement about Zeise's salt? Justify (2 marks)

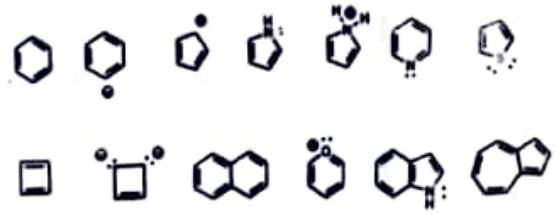
a) Zeise's salt is diamagnetic

b) Oxidation state of Pt in Zeis's salt is +2

c) All the Pt-Cl bond length in Zeise's salt are equal

d) C-C bond length of ethylene moiety in Zeise's salt longer than that of free ethylene molecule

4. **[10]**



Classify the below molecules based on aromaticity with detailed explanation: (10 marks)

5. (i) If the standard electrode potential for a cell is 2 V at 300° K, What is the equilibrium constant (K) for the reaction at 300° K (approximately) (5 marks) **[10]**

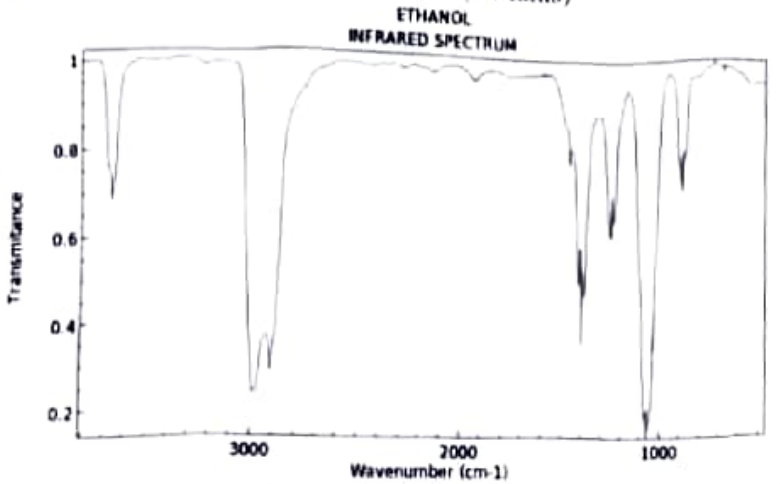
$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$ ($R = 8\ J\ K^{-1}\ mol^{-1}$, $F = 96500\ C\ mol^{-1}$)

(ii) Explain with picture, the characteristics that distinguish a good supercapacitor? (5 marks)

6. (i) Difference between the thermoplastic and thermsetting polymers (5 Marks) **[10]**

(ii) What are the component of the composite materials and differentiate their types with examples (5 Marks)

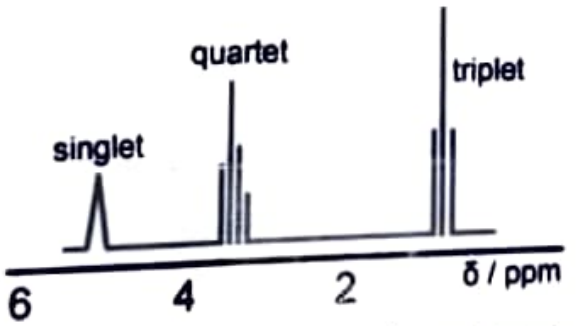
7. (i) From the given spectra, identify the important peaks corresponding to the modes or functional groups present in the ethanol molecule. (5 Marks) [10]



(ii) How can we make simple polyacetylene into conductive system? (5 Marks)

8. (i) Write disadvantage of Ball milling method (3 Marks) [10]

(ii)Below NMR spectra is for Ethanol molecule. Briefly explain about the peaks corresponding to the molecule and its splitting pattern (7 Marks)



9. (i) Which microscopic technique is most extensively used for the characterization of Nanoparticles. Explain the technique in detail with principles and formula. (6 Marks) [10]

(ii) What are the basic principles of NMR spectroscopy? (4 Marks)

10. (i) Do you think molecular modelling is necessary part of chemistry subject? Justify (4 marks) [10]

(ii) Suppose, when you are carrying out a molecular geometry optimization but the calculation fails to converge. What will be your assumption? What other steps you will consider doing further? (6 Marks)

11. (i) How water is purified by zeolite process? With the aid of a chemical equation, briefly explain how temporary and permanent hardness of water can be removed. (5 marks) [10]

(ii) Different types of gas sensors exist. Considering any one gas sensor and elaborate from an engineering point of view. (5 marks)

12. (i) Briefly explain about Ion-exchange process involved in the teatment of hardwater (5 marks) [10]

(ii) Write down the three different steps of preparing the Bakelite? (5 Marks)