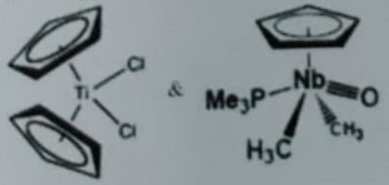
VIT
Vellore Institute of Technology

Final Assessment Test (FAT) – June 2022

Programme	B.Tech	Semester	Winter Semester 2021-22
Course Title	ENGINEERING CHEMISTRY	Course Code	BCHY101L
Faculty Name	Prof. Jayanta Parui	Slot	B1+TB1
		Class Nbr	CH2021222300159
Time	3 Hours	Max. Marks	100

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

1. a.) Graphically show that the expansion of an ideal gas estimates more work if the change is isothermal and reversible than if the change is irreversible. Also write down the mathematical expression for the above mentioned two different processes. [10]
   b.) Describe the reaction progress for a reaction and draw transition state on the energy axis. Explain in terms of collision theory the necessity of the transition state for a reaction.
2. a.) What are the parameters that change the Δ_o (CFSE) of a coordinated complex? Write down at least one example that shows change in Δ_o with respect to one of such parameters. [10]
   b.) Write down the chemical aspects for the presence of metal ion in heme of hemoglobin. Also describe the role of imidazole side chain of the globin chain with related drawing.
3. Write the factors that influence the stability of the reaction intermediates like 'carbon free radicals'. Also write down the respective examples with proper structural formulas. How do the intermediates differ from carbanion and carbocation? [10]
4. a.) Describe the chemistry of Dye Sensitized Solar Cell (DSSC). Also draw the construction of it with proper labelling. [10]
   b.) Describe Czochralski crystal pulling technique drawing the sequential steps. What is the benefit of the technique?
5. a.) Draw any of the crystal structure of a compound that belongs to ABO_3 type distinguishing the position of cations and anions in it. [10]
   b.) Nanoparticle of a semiconductor material may or may not be a quantum dot. Support the statement with drawing of necessary energy states.
6. a.) Write down the different components of a UV-Vis spectrophotometer. Describe how auxochrome having lone pair in it can change the electronic transition in a molecule. [10]
   b.) Draw the approximated XRD patterns that distinguish polycrystalline, single crystalline and amorphous materials. Write down the mathematical expression for d spacing as per the Bragg's law.
7. a.) Define octane and cetane numbers. What is the requirement of antiknocking agent? [10]
   b.) What is reverse osmosis? Explain with drawing how it helps to produce potable water.
8. a.) Among the two organometallics given bellow which one is unsaturated compound? Justify your answer showing related calculations for them. Electronic configuration of Ti [Ar] $3d^2\ 4s^2$ and of Nb [Kr] $4d^4\ 5s^1$ [10]



b.) 5 mol of an ideal gas expands against a constant external pressure of 1 atm from a volume of 15 dm^3 to a volume of 25 dm^3. Calculate the work done by the gas in Joules. Also calculate the work done by the system if the gas undergoes same volume expansion isothermally and reversibly at 25 °C.

9. a.) Describe Polymer Electrolyte Membrane Fuel Cell (PEMFC) with necessary chemical reactions. Also draw an illustration for the cell with appropriate labeling. [10]
   b.) Write down the appropriate structural formulas and differentiate quasi aromatic and aromatic compounds. Also draw the structures of the heterocyclic aromatic and anti-aromatic compounds.
10. a.) Describe water purification through zeolite process along with related drawings and chemical equations. Is this process suitable for the production of deionised water? Justify your answer. [10]
    b.) Write down at least five differences in between thermosetting and thermoplastic polymers with the examples.
11. a.) Describe any one of ways of the nanoparticles' preparations along with necessary drawings. [10]
    b.) Estimate the particle size in nm of the given nanomaterial using p-XRD data:
    Peak position 2θ = 22.44 degree, FWHM of sample = 0.89 degree, k = 0.9 and λ = 1.5406 Å
    (degree to radian=Degree×π/180).
12. a.) What is dye? Describe the differences between natural and artificial dyes. What is the difference between dye and pigment? [10]
    b.) Write down the differences between fullerene, carbon nanotube and graphene. Why is it important to disperse them in liquid phase?