VIT

Final Assessment Test (FAT) – June 2022

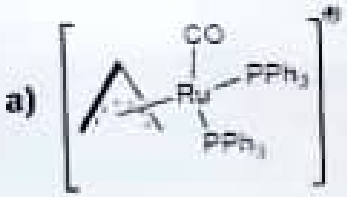
Programme	B.Tech	Semester	Winter Semester 2021-22
Course Title	ENGINEERING CHEMISTRY	Course Code	BCHY101L
Faculty Name	Prof. Dr.Sujoy Sarkar	Slot	B2+TB2
		Class Nbr	CH2021222300066
Time	3 Hours	Max. Marks	100

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

1. [10]
   (i) Show that work done in reversible path is more than irreversible path. (4 marks)
   (ii) Draw **rate of reaction vs time** and **concentration vs time** plots for 0 th, 1 st, 2 nd order reaction kinetics. (3 marks)
   (iii) Heat supplied to a Carnot engine is 1897.8 kJ. How much useful work can be done by the engine which works between 0 °C and 100 °C. (3 marks)

2. [10]
   (i) 'CO is a poisonous gas and excess inhaling could kill the living system'- justify this statement in the light of hemoglobin binding sites. (3 marks)
   (ii) Which of the following molecule s do does not obey 18 electron rule- show the electron count using **ionic** and **covalent** method? [Atomic No. of Ru: 44 and Fe: 26] (4 marks)

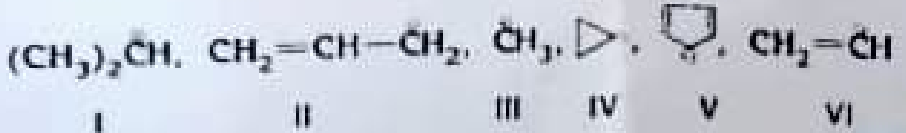
   a)



   b)

   (iii) $[CoF_6]^{3-}$ can't form inner orbital complex – Justify this complex. (3 marks)

3. [10]
   (i) Arrange the following carbanions based on their stability (4 marks)



   (ii) Discuss the synthesis procedure of a natural dye and a synthetic dye. (4 marks)
   (iii) Describe a method to prepare a drug that can be used to reduce the fever. (2 marks)

4. (a) A voltaic cell has an E_{cell} value of 1.563 V. What is the concentration of Ag^+ in the Ag^+? (4 marks) [10]

$$Zn(s) \mid Zn^{2+}(2.00M) \parallel Ag^+(x\ M) \mid Ag(s)$$

$E^\circ_{Zn/Zn^{2+}} = 0.736$ V and $E^\circ_{Ag^+/Ag} = 0.800$ V

(b) A device that was used by NASA in the space shuttle for the electrical power system. Draw the structure and required chemical equations. What is the maximum potential can be obtained from the device? (6 marks)

5. (a) The working principle of supercapacitor and battery is entirely different, however, both are used as energy storage device- Explain (5 marks) [10]

(b) The oxidation of methanol, as described by the equation below, has a ΔG° value of -937.9 kJ/mol, What is the standard cell potential for a methanol fuel cell?

$2CH_3OH + 3O_2 \rightarrow 2CO_2 + 4H_2O$ (3 marks)

(c) Give an example of galvanic cell and electrolytic cell. (2 marks)

6. (a) How will you prepare a polymer which is resistant to water, light, O_2, inorganic acid and alkali, oil, petrol etc., but soluble in highly chlorinated solvents? (3 marks) [10]

(b) Polyacetylene is conducting polymer whereas polyethylene is not- Explain (3 marks)

(c) What is Bakelite ? How do you prepare in the laboratory? (4 marks)

7. (a) In NaCl, Na^+ coordination number is 6 whereas, in CsCl, the coordination of Cs^+ is 8. Explain this fact with structure. (4 marks) [10]

(b) Calculate the packing efficiency in a unit cell of Cubic Close Packing (CCP) structure. (4 marks)

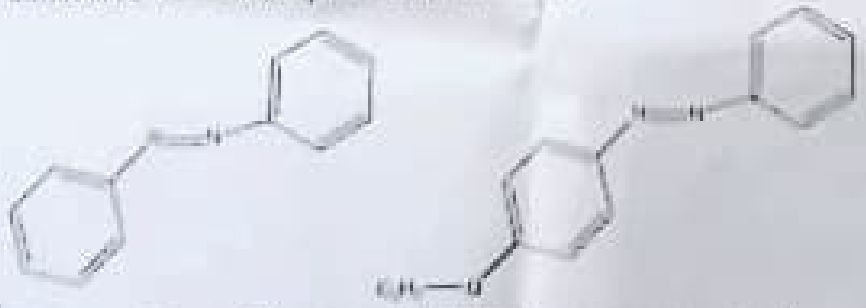
(c) Colour of the nanoparticles depend on their sizes- Justify this statement. (2 marks)

8. (a) You have only UV-Vis spectrometer with you and you recorded four different absorbance maxima at different wavelengths. Comment on the compounds and what type of transitions were taken place? [10]

S. No.	Materials	Wavelength
1.	A	120 nm
2.	B	130-245 nm
3.	C	320-440 nm
4.	D	550-750 nm

(6 marks)

(b) The λ_{max} for the compound A is 320 nm, whereas the compound B show the maximum absorbance at 385 nm, Explain the fact. (4 marks)



9. (a) Estimate the crystallite size and FWHM of the given nanomaterials using p-XRD data where k = 0.9 and λ = 1.5406 Å. (8 marks) [10]

Sample	Peak position	Crystallite Size	FWHM
1	36.35	19	
2	36.21		0.236
3	36.22	20	
4	36.21		0.098

(c) What are the constructive interference and destructive interference? Explain (2 marks)

10. (a) In electron microscopy, electron is used as source instead of light- explain the reason behind [10]
ii. (3 marks)

(b) When electron beam strikes to the sample in the Scanning Electron Microscopy (SEM), what are the different type of emission observed and to detect that what are the detector present inside the instrument. (4 marks)

(c) What are the advantages of TEM instrument? (3 marks)

11. (a) One needs to protect the boiler from hard water, the water needs to be soften and zeolite is [10]
one of the best material to do that. Justify this statement with required chemical equation and drawing. (8 marks)

(b) The water passes through Ion Exchange Resin is not good for drinking- explain the reason. (2 marks)

12. (a) Suppose you are in a place from where CO_x is leaking. How could you qualitatively confirm [10]
that the leaked gas is a carbonmonoxide gas not the other one? (3 marks)

(b) Resins are mostly used as adhesives. Is it possible to utilize the resins to purify the water? If yes, discuss the process in detail with chemical structure. (7 marks)