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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S1 (S, FE) S2 (S, FE) Examination December 2024 (2019 Scheme)

Course Code: CYT 100
Course Name: ENGINEERING CHEMISTRY
(2019 -Scheme)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks Marks

1	How is single electrode potential developed?	(3)
2	There are automatic built-in circuit breakers in Li ion battery. Explain.	(3)
3	State Beer Lambert's law and write the expression for absorbance.	(3)
4	Which of the following nuclei are NMR active – ^{12}C, ^{1}H, and ^{13}C. Why?	(3)
5	Give any three differences between thermogravimetric analysis (TGA) and differential thermal analysis (DTA).	(3)
6	How are nanomaterials classified based on dimensions?	(3)
7	Draw the chair and boat conformations of cyclohexane. Why boat form is less stable than chair form?	(3)
8	What is optical activity? Draw the optical isomers of lactic acid [$CH_3CH(OH)COOH$].	(3)
9	Which is the standard for expressing the hardness of water. Why is it selected as the standard?	(3)
10	List out any three advantages of ion exchange process.	(3)

PART B

Answer one full question from each module, each question carries 14 marks.

MODULE 1

11	(a)	Derive Nernst equation for electrode potential. Calculate the EMF of a Daniel cell when the concentration of Zn^{2+} ion is 0.02M and that of Cu^{2+} ion is 0.2M. Given $E^0_{Zn^{2+}/Zn} = -0.76V$ and $E^0_{Cu^{2+}/Cu} = +0.34V$.	(8)
	(b)	Explain electroless nickel plating. List out any two applications of electroless nickel plating.	(6)
12	(a)	Give the principle of glass electrode. Explain the determination of pH using glass electrode?	(8)

(b) Explain hydrogen evolution corrosion in acid and alkaline media with examples. (6)

MODULE 2

13 (a) Explain the different types of electronic transitions in UV spectroscopy. Draw the molecular energy level diagrams of 1,3-butadiene and benzene showing the electronic transitions. (8)

(b) What is chemical shift in NMR spectroscopy? Name the reference compound used in measuring the chemical shift of signals in ^1H NMR spectra of molecules and why is it selected as the reference? (6)

14 (a) Show that the frequency of absorbed infrared radiation (υ) is equal to the fundamental vibrational frequency (υ_0) of a diatomic molecule. CO molecule shows IR absorption at $2137cm^{-1}$. Calculate the force constant of the CO bond, if the atomic masses of C=12amu and of O = 16amu. 1amu = $1.67x10^{-27}$kg (8)

(b) Draw the structure of the following molecules which give only one signal in the ^1H NMR spectra (i) C_2H_6O (ii) C_8H_{18} and (iii) C_4H_6. (6)

MODULE 3

15 (a) Explain the principle, instrumentation and procedure employed in High Performance Liquid Chromatography (HPLC)? (10)

(b) TGA can be employed in the determination of stability of polymers. Substantiate the statement with examples. (4)

16 (a) Explain the principle, instrumentation and any two applications of differential thermal analysis (DTA) and draw the DTA of calcium oxalate monohydrate in a current of air. (10)

(b) Explain the synthesis of aluminium oxide nanoparticles by sol gel method. (4)

MODULE 4

17 (a) What are conducting polymers? Draw the structure of polyacetylene and polyaniline. Explain different types of doping in conducting polymers with examples. (8)

(b) Draw the energy profile of various conformations of butane and comment on the stabilities of these conformations. (6)

18 (a) Draw the structures of geometrical isomers of 1,2-dimethylcyclohexane and their chair conformations. Explain the stability of each conformation. (10)

(b) How is Kevlar synthesised? Explain the reason for its strength. (4)

MODULE 5

19 (a) Explain the principle and procedure used in the estimation of hardness of water in EDTA method. (10)

(b) Calculate the temporary and permanent hardness of water containing 240ppm Ca^{2+}, 72ppm Mg^{2+}, 732ppm HCO_3^-, 126ppm Cl^-, 72ppm SO_4^{2-}, 124ppm Na^+. (4)

20 (a) Explain the various steps involved in Municipal water treatment. (10)

(b) Determine the maximum BOD of water sample containing 70mg of carbohydrate (CH_2O) per litre. (4)

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