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PES University, Bengaluru

(Established under Karnataka Act 16 of 2013)

UE17/18/19/20CY101

END SEMESTER ASSESSMENT (ESA) B TECH.
MAY 2022 UE17/18/19/20CY101 - ENGINEERING CHEMISTRY

Maximum Marks: 100 **Duration: 3 HOURS**

ANSWER ALL QUESTIONS

1.	a	For a rigid diatomic molecule: (i) Draw the energy level diagram for a rigid rotor diatomic molecule upto J=3. (ii) Write the corresponding spectrum obtained from the transition. (iii) Calculate the energy required (in cm^{-1}) for the molecule to move from J=2 to J=3 level if B=10.56 cm^{-1}. (iv) Calculate the reduced mass and moment of inertia for HCl molecule if the bond length is 127 pm. (Given : 1 amu = 1.66 x 10^{-27} kg, C= 3 x 10^8 m/s, atomic masses of H and Cl are 1.008 and 35.45 amu respectively)	8
	b	For a HF molecule which behaves like a harmonic oscillator, the vibrational spectrum shows a fundamental frequency at 4162.97 cm^{-1}. (i) What is the applicable selection rule? (ii) Calculate reduced mass and force constant. (iii) Calculate the zero point energy. (Given: C=3 x 10^8 m/sec, Л=3.14, N=6.02 x 10^{23}, 1 amu =1.66x10^{-27} kg, molar mass of H=1.004g, F=18.998g).	6
	c	State Born-Oppenheimer approximation.	2
	d	Give the classification of nanomaterials with example.	4
2	a	For a Pb-Ag system : (i) Give the temperature and composition values at eutectic point ii) Calculate the degrees of freedom at eutectic point.	3
	b	How many phases and components present for the following system? $CaCO_3(s) \Longleftrightarrow CaO(s) + CO_2$ (closed system)	2
	c	A silver electrode containing 0.15M silver nitrate and copper electrode containing 0.19M copper sulphate were coupled using salt bridge. Write the cell representation, half cell reactions. Calculate E°_{Cell}, E_{Cell} at 25 °C and Wmax. (Given: $E^\circ_{Ag^+/Ag}$ = 0.8V; $E^\circ_{Cu^{2+}/Cu}$= 0.34V)	8
	d	Discuss the construction and working of a calomel electrode. Write any two advantages of calomel electrode.	7
3	a	Describe the construction and working of Lithium-ion battery.	4
	b	i) Define electricity storage density of a battery. ii) Calculate the capacity(Ah), energy density(Wh/kg) and electricity storage density(Ah/kg) of Zn-air battery, if 2.6 g of Zn is stored in the battery weighing 72.0 g. (Given: Voltage available from the battery = 1.39 V and gram molar mass of Zn = 65.38)	6
	c	Give the construction & working of H_2-O_2 alkaline fuel cell. Calculate the efficiency of the fuel cell, if its cell potential is 1.235V. (Given the enthalpy of formation of water is -285.83 kj/mole).	6
	d	Mark the regions in which the following energy storage devices appear in the ragone plot. (i)Fuel cell (ii)Li-ion battery (iii)Supercapacitor	4

4	a	Explain the differential metal and differential aeration corrosion with an example.	6
	b	Discuss how the following factors affect corrosion: (i) Nature of the metal (ii) pH	4
	c	Explain the process of Galvanization, mention one advantage and disadvantages of galvanization.	6
	d	What is cathodic protection? Explain sacrificial anodic method.	4
5	a	Draw the structure of monomer used to synthesize Kevlar. Write two reasons why Kevlar is stronger than steel an equal weight basis. Mention two applications of Kevlar.	6
	b	Give the synthesis of butyl rubber.	4
	c	Calculate the number average, weight average and viscosity average of a polymer having 15 molecules of molecular weight is 1800, 20 molecules of molecular weight is 2200 and 25 molecules of molecular weight is 2800. (Given a=0.64)	6
	d	Explain these principles of green chemistry with example: (i) Prevent waste (ii) Safer synthesis	4

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