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PES University, Bengaluru

(Established under Karnataka Act 16 of 2013)

UE20CY101

END SEMESTER ASSESSMENT (ESA) B TECH. I SEMESTER APRIL 2021

UE20CY101 - ENGINEERING CHEMISTRY

Time: 3 hours **Answer All Questions** **Max marks: 100**

1	a)	The rotational constant of ICl is 0.1142 cm^{-1}. Calculate the reduced mass , moment of inertia and bond length of ICl molecule. (Given: Atomic masses of I = 126.9 amu and Cl = 34.9688 amu, Avagadro's number = 6.023 x 10^{23}, Speed of light = 3 x 10^{10} cm/s, π = 3.14, Planck's constant = 6.627 x 10^{-34} Js, 1 amu = 1.66 x 10^{-27} kg)	6
	b)	State Franck-Condon principle. With the help of suitable diagram, show the vibrational-electronic transition and corresponding spectrum if transition takes place from $v'' = 0$ to $v' = 2$.	3
	c)	For a diatomic molecule showing anharmonic oscillations : i) Write the selection rule ii) Draw energy level diagram showing fundamental absorption, first and second overtones. iii) Define zero point energy .	5
	d)	i) How are nanomaterials classified based on their dimensions? Give an example for each of them. ii) Explain why melting point of nanoparticles is different from that of the bulk materials.	6
2	a)	Derive Gibb's phase rule using thermodynamic principles.	4
	b)	For a Pb-Ag system : (i)Why is reduced phase rule used? (ii)Draw a neat labeled phase diagram . (iii)Give the temperature and composition values at eutectic point.	5
	c)	For a cell represented by Fe/Fe^{2+} (0.28 M)// Cl^- (0.35 M)/Cl_2 (1 atm)/Pt i) Name the types of electrodes used in the above cell. ii) Write the half cell reactions taking place at anode and cathode iii) Calculate E^o_{cell} and E_{cell} at 298 K. [Given : $E^o_{Fe2+/Fe}$ = -0.44 V, $E^o_{Pt/Cl2/Cl^-}$ = 1.36 V, R = 8.314 J/K/mol, F = 96500 C/mol]	7
	d)	Discuss construction of a glass electrode . What is alkaline error ? Mention any one advantage of a glass electrode.	4
3	a)	Define shelf life of a battery. Why do reserve batteries have a very long shelf life? Discuss the construction and working of Mg-AgCl reserve battery(with reactions).	6
	b)	Why do Lithium batteries have high electricity storage density? Calculate the electricity storage density (amp hour kg^{-1}) of a Lithium battery which stores 2.08 g of Lithium. Total weight of the battery is 72.6 g. (Given : F = 96500 C/mol, gram atomic mass of Li is 7g)	4
	c)	i) Draw a neat labeled diagram of Direct CH_3OH - O_2 Polymer electrolyte membrane fuel cell and write the reactions taking place at anode and cathode. ii) Explain why the above fuel cell is operated between 60 ^oC and 90 ^oC ? iii) Calculate the efficiency of the H_2 - O_2 alkaline fuel cell if the cell voltage is 1.22 V, enthalpy of formation of water is -285.3 kJ/mol and F = 96500 C/mol.	8
	d)	What are supercapacitors? Give any two factors which affect the capacitance of a supercapacitor?	2

4	a)	Discuss the various steps involved in galvanisation. Mention one advantage and one disadvantage of galvanization .	6
	b)	Explain the impressed cathodic current method for corrosion protection. What is H_2 embrittlement?	5
	c)	With a suitable example explain differential aeration corrosion . Write the reactions taking place at anode and cathode.	5
	d)	Discuss the effect of the following on extent of corrosion: i) Anodic and Cathodic polarisation ii) Temperature	4
5	a)	Calculate the number average molecular weight and weight average molecular weight of a polymer which contains 10 molecules with molecular weight 3800, 20 molecules with molecular weight 4900 and 30 molecules with molecular weight 6300 molecular weight.	4
	b)	Write the reaction for synthesis of Kevlar. Why is Kevlar stronger than steel on an equal weight basis(give two reasons)? Give any one application of Kevlar.	6
	c)	Define conducting polymers. Draw the structure of any one conducting polymer and write the two structural features of a conducting polymer. Mention any two ways by which doping is done to get a conducting polymer.	6
	d)	What are biodegradable polymers? Give two examples. Explain the two steps involved in biodegradation of polymers.	4

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