RAMAKRISHNA MISSION VIDYAMANDIRA (Residential Autonomous College affiliated to University of Calcutta) FIRST YEAR [2019-22] B.A./B.Sc. FIRST SEMESTER (July – December) 2019 Mid-Semester Examination, September 2019 Date : 16/09/2019 **INDUSTRIAL CHEMISTRY (Honours)** Paper: II [CC 2] : 1 pm – 2 pm Full Marks: 25

[5×5]

Answer any five questions from question no. 1 to 7.

Time

Identify the extensive and intensive properties from the among followings: 1. a) free energy, molar enthalpy, heat capacity, temperature, molar volume, density, Cell constant, entropy, Melting point. [2] Show that for any substance, $C_p - C_v = \alpha^2 T V / \beta$. All terms has their usual meaning. b) [3] From the diagram calculate the E_{O_2/H_2O}^0 2. a) $O_2 \rightarrow H_2O_2 \rightarrow H_2O$ Given that $E^{o}H_{2}O_{2}/O_{2} = 0.70$ V and $E^{o}H_{2}O/H_{2}O_{2} = 1.76$ V [2] Calculate the potential and free energy change of the following cell at 298 K b) [3] $Zn|Zn^{2+}$ (c=0.1M) || Cu²⁺(c=0.01M)|Cu Given that $E^0 Zn^{2+}/Zn = -0.762 V$ $E^0 Cu^{2+}/Cu = +0.337 V$ EMF of the cell Sn, SnCl₂ (0.5 M) ||AgCl (S), Ag is 0.430 V at 25° C and 0.448 at 0° C. 3. a) Calculate the free energy change (ΔG), enthalpy change (ΔH) and entropy (ΔS) of the cell at 25° C. [3] One can always write $dU=n C_v dT$. Criticize or Justify. [2] b) Justify or criticize that 'adiabatic work is a state function'. 4. a) [2] Prove that for a reversible adiabatic process $TV^{\gamma-1} = Constant$. b) [3] Calculate the energy of one photon of light of wavelength 2500Å. Will it be able to dissociate a 5. a) bond in diatomic molecule which absorbs this photon and have bond energy equal to 95 kcal per mole. [3] Why chain inhibition step is occurred in HBr chain reaction? [2] b) Can the quantum efficiency be greater than 1? Explain. [3] 6. a) b) After some time why the quantum yield of HI decomposition reaction decreases from 2. [2] Photolysis of acetaldehyde is given below. 7. a)

 $CH_3CHO \longrightarrow CH_3 + CHO$, rate constant = I_{abs}

$$\dot{C}H_3 + CH_3CHO \longrightarrow CH_4 + \dot{C}H_3CO, \text{ rate const.} = k_2$$

$$\dot{C}H_3CO \longrightarrow CO + \dot{C}H_3, \text{ rate const.} = k_3$$

$$\dot{C}H_3 + \dot{C}H_3 \longrightarrow C_2H_6 \text{ rate const.} = k_4$$
Show that $\frac{d[CO]}{dt} = k_2 \left(\frac{l_{abs}}{2k_4}\right)^{1/2} [CH_3CHO]$
b) Calculate the energy of one photon of light of wavelength 2500Å.

_____ × _____

[4+1]