



AUTUMN END SEMESTER EXAMINATION-2017

1st Semester B.Tech

CHEMISTRY CH-1003

(Regular-2017 Admitted Batch)

Time: 3 Hours

Full Marks: 50

Answer any SIX questions including question No.1 which is compulsory.

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable and all parts of a question should be answered at one place only.

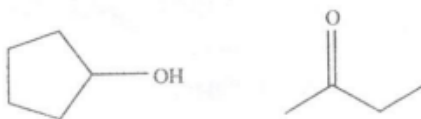
1. (a) What is chromophore and auxochrome? Discuss with proper [1 × 10] example.
- (b) Show that,
$$\Delta G = \Delta H + T \left[\frac{\partial(\Delta G)}{\partial T} \right]_P$$
, where G, H, T, and P are usual thermodynamic parameters.
- (c) A bottle of milk stored at 30 °C, sours in 36 h and in 72 h when refrigerated at 5 °C. Assuming the rate constant to be inversely proportional to souring time, calculate the activation energy required for souring.
- (d) $[\text{Co}(\text{NO}_2)_6]^{2+}$ is easily oxidized to $[\text{Co}(\text{NO}_2)_6]^{3+}$. Explain.
- (e) Explain Type-I and II electrodes with suitable examples.
- (f) Differentiate between n-type and p-type semiconductors on the basis of band diagrams.
- (g) Explain impressed current cathodic protection.
- (h) What are the possible electronic transitions in 'acetone' as radiation in Uv-Vis region strikes on the molecule? Assign the λ_{max} values 195 and 279; ϵ values 9000 and 14 to them.

(1)

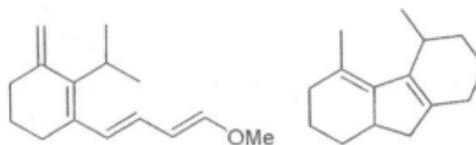
- (i) Explain the terms promoter and poison in reference to catalysis with suitable examples.
- (j) Write the cell reaction occurring in a Li-ion battery.
2. (a) Discuss Le-Chatelier's principle for a reaction which is in equilibrium. With the help of the principle, predict the suitable condition for formation of ammonia. [4]
- (b) For the reaction, [4]
- $$2 \text{O}_3 \longrightarrow 3 \text{O}_2, \text{ the mechanistic steps being,}$$
- $$\text{Step 1: } \text{O}_3 \xrightleftharpoons[k_2]{k_1} \text{O}_2 + \text{O}$$
- $$\text{Step 2: } \text{O}_3 + \text{O} \xrightarrow{k_3} 2 \text{O}_2$$
- Show that, $-\frac{d[\text{O}_3]}{dt} = 2 K_1 [\text{O}_3]$; assuming that, $k_3 [\text{O}] \gg k_2 [\text{O}_2]$
3. (a) Compare stability and magnetic property of the following species: O_2 , O_2^+ , O_2^- [4]
- (b) Magnetic moment of $[\text{Mn}(\text{Br})_4]^{2-}$ is nearly 3.87 BM. Based on this observation, predict the structure of the compound with the hybridization of central metal ion. [4]
4. (a) What is time lag theory? Provide the condition in which a uni-molecular reaction follows 2nd order kinetics. [4]
- (b) In homogeneous catalysis-rate of the reaction depends on concentration of catalyst where as it is neither produced nor consumed in the process. Explain. [4]

(2)

5. (a) Suggest how to distinguish between the following compounds with the help of IR spectroscopy. [4]



- (b) Show that $t_{99.9} = 10 t_{1/2}$, for a first order reaction, where the terms are usual. [4]
6. (a) The equilibrium constant for a reaction at 327°C and 427°C are 10^{-12} and 10^{-7} respectively. Calculate the enthalpy change of the reaction. [4]
- (b) At what temperature a reaction would be spontaneous; if the $\Delta H = 30 \text{ KJ/mol}$ and $\Delta S = 0.08 \text{ KJ/mol}$ at 1 atm. pressure for the reaction. [4]
7. (a) For AX_2 type molecules, discuss different bending vibrations with appropriate diagram. Justify that, conjugation lowers the stretching frequency of a bond. Justify the statement with proper example. [4]
- (b) Calculate λ_{max} value for the following compounds. The increment for auxochrome ' -OMe ' is +6. [4]



8. (a) Explain the mechanism of wet corrosion. Why such a corrosion is known as non-uniform corrosion? [4]

(3)

- (b) Construct the cell for the following cell reaction and also [4]
calculate the equilibrium constant. Given, $E^{\circ}_{\text{Cu}^{2+}/\text{Cu}} = 0.15 \text{ V}$
and $E^{\circ}_{\text{Cu}/\text{Cu}^{+}} = -0.52 \text{ V}$



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(4)