



SPRING END SEMESTER EXAMINATION-2016

2nd Semester B.Tech & B.Tech Dual Degree

CHEMISTRY

CH-1003

(Regular-2015 Admitted Batch)

Time: 3 Hours

Full Marks: 60

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

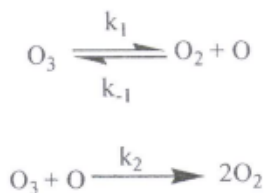
The figures in the margin indicate full marks.

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) $[\text{Fe}(\text{CN})_6]^{4-}$ is colourless. Explain. [2 × 10]
- b) What are bathochromic and hypochromic shifts? Explain how these are affected by conjugation.
- c) From the molecular orbital diagram of O_2 , arrange the following species in increasing order of their bond dissociation energies. O_2^{2+} , O_2 , O_2^- and O_2^{2-} .
- d) What is a promoter? Give an example.
- e) What is dry corrosion? Explain with one example.
- f) Show that for an ideal gas $(\partial U / \partial V)_T = 0$.
- g) A reaction proceeds 6 times faster at 333K as it does at 303K. Find the activation energy for the reaction.
- h) What is finger print region in IR spectroscopy?

(1)

- i) Calculate the change in free energy accompanying the compression of one mole of an ideal gas at 27°C from 25 to 250 atm pressure.
- j) How a fuel cell is different from a battery? Discuss its advantages and limitations.
2. a) The magnetic moment of $[\text{MnCN}_6]^{3-}$ is nearly 2.8 B.M. [4]
Predict the type of hybridization and geometry of the ion.
- b) Calculate CFSE of the complexes $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ and $[\text{Cu}(\text{NH}_3)_6]^{2+}$. [4]
3. a) What is a glass electrode? Explain how it is used to find the pH of an unknown solution. [4]
- b) Calculate the pH of a solution placed in a quinhydrone half cell coupled with a standard calomel half cell. The emf of the cell is 0.15 V at 298K. Given $E^\circ_{\text{Calomel}} = 0.2415\text{V}$ and $E^\circ_{\text{QH}_2\text{Q}} = 0.6996\text{V}$. [4]
4. a) The mechanism for thermal decomposition of Ozone is [4]



Assuming that $k_2[\text{O}_3] \ll k_{-1}[\text{O}_2]$, show that the overall rate of the reaction is $-\text{d}[\text{O}_3]/\text{dt} = k[\text{O}_3]^2 / [\text{O}_2]$, where $k = k_1 k_2 / k_{-1}$

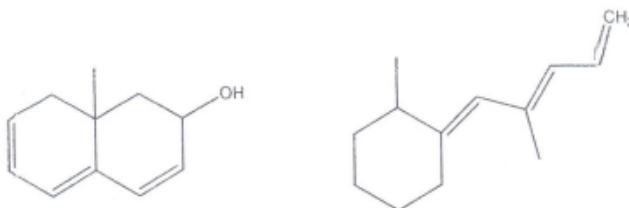
(2)

- b) The half life period becomes 2.5 times if the concentration is made half. What is the order of the reaction?

[4
(E)]

5. a) Find the λ_{\max} value for the following compound

[4



Basic values for homo annular diene = 253 nm, hetero annular diene = 214 nm, increments for ring residues /alkyl substituents = 5nm, exocyclic double bond=5nm and extended conjugation = 30nm.

- b) CO molecule shows IR absorption at 2144 cm^{-1} . Calculate the value of the stretching force constant.

[4

6. a) Explain Le-Chatelier's principle with reference to the Birkeland-Eyde process for manufacture of nitric acid.

[4

- b) ΔG_0 for the reaction

[4



is -33kJ/ mole at 298 K . Find K_p for this reaction.

7. a) Write the cell reaction and Nernst eqn for emf of the following cell.

[4



- b) Write short notes on pitting corrosion.

[4

(3)

8. a) Kinetics of catalytic decomposition of hydrogen peroxide is studied by titrating H_2O_2 with KMnO_4 at different intervals of time. Find the rate constant assuming the reaction to be of first order. [4]

Times	0	600	1200
KMnO_4 (ml)	22.8	13.8	8.2

- b) Explain adsorption theory of catalysis. [4]

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