

Ex/SC/CHEM/UG/CORE/TH/05/2025(OLD)

BACHELOR OF SCIENCE EXAMINATION, 2025

(3rd Semester)

CHEMISTRY (CORE)

PAPER : Core/Chem/ TH/05

Time : Two Hours

Full Marks : 40

(20 marks for each Unit)

Use a separate answer script for each Units.

UNIT—3051-I

1. Answer *any five* questions. 2×5=10

(a) State with explanation and equation whether acidity/basicity will increase or decrease in the following cases:

(i) cupric sulfate is added to ammonium chloride solution

(ii) KI is added to aqueous suspension of HgO

(b) Arrange with explanation, the following in their increasing order of acidity:

CH₃COOH, ClCH₂COOH, Cl₂CHCOOH and

Cl₃CCOOH

(2)

(c) Explain Lux-Flood acid-base concept. Give examples.

(d) Write characteristics of hard acid and soft acid.

(e) Calculate pH of the solution of a 25 mL of 0.1 M acetic acid when 25 mL of 0.1 M KOH is added to it.
(Given : K_a of acetic acid is 1.75×10^{-5})

(f) Can Fe^{3+} and Mg^{2+} be separated quantitatively as hydroxide from solution that is 0.10 M in each cation? Consider a precipitation to be quantitative when all but 1 part in 10000 of the ions has been removed from solution. K_{sp} of $\text{Fe}(\text{OH})_3 = 2.0 \times 10^{-39}$ and $\text{Mg}(\text{OH})_2 = 7.1 \times 10^{-12}$

2. (a) Write down the Nernst equation for a half-cell and explain the meaning of every term in it. 2

(b) E° values for the $\text{Fe}(\text{III}) / \text{Fe}(\text{II})$ system is 0.77 V and that for the $\text{Sn}(\text{IV}) / \text{Sn}(\text{II})$ system is 0.15V. Write down the net redox reaction and find out the magnitude of the equilibrium constant of the reaction. 3

(c) The E° value of the $\text{Cu}^{2+}/\text{Cu}^0$ half-cell is 0.34 V and that of the $\text{Cu}^{2+}/\text{Cu}^0$ half-cell is 0.15V. Find out the E° of the Cu^4/Cu^0 half-cell. 2

(d) Draw the structures of BDS in its reduced and oxidized forms and mention their colors. 3

(3)

UNIT—3052-I

3. Answer *all* questions.

(a) What type of bonding pattern is found in $[\text{MO}_2\text{Cl}_8]^{4-}$?
Mention its magnetic moment value. 3+1

(b) Draw M·O diagram of O_2 molecule. 3

(c) Draw the structure of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ and comment on the nature of water molecules associated with it. 3

(OR)

(d) Draw the structure of ice. Mention its anomalous behavior at 4°C . 3

4. (a) Li forms LiO , Na forms Na_2O_2 while K, Rb and Cs form MO_2 —explain the observations. 2

(b) The stability of 18-Crown-6 follows the order : $\text{Ca}^{2+} < \text{Sr}^{2+} < \text{Ba}^{2+}$ — explain. 2

(c) Is it likely that a compound $\text{N}_2^+ \text{PtF}_6^-$ could be formed as in the case of $\text{O}_2^+ \text{PtF}_6^-$ 2

(d) What is phase transfer catalysis? Give one example of the use of K-crown ether complex in the phase transfer catalysis. 2

(e) The complexes $[\text{Be}(\text{CAAC})_2\text{Cl}_2]$ (cyclic (CAAC=alkyl) (amino) carbene) contain very short Be-C bonds and linear C-Be-C coordination geometry. How would you explain such observations? 2

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