

BACHELOR OF ENGINEERING IN FOOD TECHNOLOGY AND BIOCHEMICAL
ENGINEERING EXAMINATION, 2018

1st Year, 1st Semester

INORGANIC AND ANALYTICAL CHEMISTRY

Time: 3 hrs

Full Marks: 100

Use separate Answerscript for each part

(50 marks for each part)

Part –I (50 Marks)

Answer Question no.1 and any four from the rest

1. (a) What is electron affinity?

(b) Define ionic potential

(c) Which one of the following is paramagnetic?

N₂, NO, CO, O₃

(d) What is halogen tablet?

(e) Among the following the maximum covalent character is shown by the compound

MgCl₂, FeCl₂, AlCl₃, SnCl₂

2 X 5 = 10

2.(a) What is lattice energy?

2

(b) Given the following information for calcium, fluorine and calcium fluoride . Calculate the second ionization energy for calcium

$\Delta H_{\text{sub}} = +178 \text{ kJ/mol}$

Bond dissociation energy for F₂ = +158 kJ/mol

1st Ionization energy = +590 kJ/mol electron affinity for F = -328 kJ/mol

lattice energy = -2630 kJ/mol

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- For CaF_2 , enthalpy of formation = -1215 kJ/mol 5
- (c) What are the hybridization of orbitals of N atom present in NO_3^- , NO_2^+ and NH_4^+ ?
3
- 3.(a) Using MOT diagram compare the bond energy and magnetic character of C_2 , C_2^+ and C_2^- 4
- (b) Draw the structure of following compounds according to VSEPR theory:
 IF_7 , XeF_6 , ClF_3 3X2=6
4. (a) Write notes on type I, type II and type III copper proteins 5
- (b) Discuss the function of Na^+/K^+ pump with diagram. 5
- 5.(a) Draw the structure of Hemoglobin and explain. 4
- (b) What is LCAO method? What are Fajans' rules? 2+2
- (c) What are the roles of Mg^{+2} present in chlorophyll? 2
- 6.(a) What is radius ratio rule? Calculate the limiting radius ratio for octahedral coordination
1+3
- (b) Explain the trend of ionisation potential for transition metal elements 3
- (c) Write Lewis structure of the following compounds 3
 HNO_3 , NO_2 , H_2SO_4

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Part –II (50 Marks)

Answer **Question no.1** and any four from the rest

1 (a) Why heavy metals are highly toxic in nature?

(b) What is bridging ligand? Give two examples.

(c) State Arrhenius definition of acids and bases with examples.

(d) What is the oxidation and coordination no. of $[\text{CoCl}_6]^{3-}$, and $[\text{Fe}(\text{CN})_6]^{4-}$ each of the following?

(e) Justify F^- ion is a strong base.

2 X 5 = 10

2 (a) What is conjugate acid base pair?

2

(b) Arrange the bases HS^- , F^- and I^- in order of increasing proton affinity

2

(c) Discuss Lewis Acid Base concept with suitable examples. What is demerits of this theory
2+1

(d) For the oxyacids, the acid strength increases with increase of electronegativity of the central atom. Justify it with suitable examples.

3

3.(a) What is the basic assumption adopted in crystal field theory?

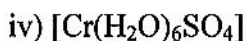
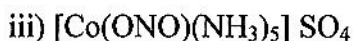
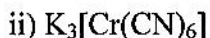
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(b) Calculate the crystal field stabilization energy for d^8 ion (Ni^{2+}) in octahedral and tetrahedral complexes. Use units of Δ^0 in both cases and which is the most stable?

4

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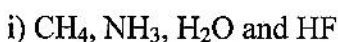
(c) Give IUPAC nomenclature of the following (any four) 4



4. (a) What is HSAB principle? Write down the basic features of hard and soft acids and bases with examples. 1+3

(b) HNO_3 , HCl , H_2SO_4 appear equally strong in water but their strengths differ in acetic acid medium. 2

(c) Arrange the following in the increasing order of their acidity with suitable explanation 2+2=4



5. (a) Write the toxic effect of As and indicate its coordination number. 2

(b) What is the importance of spectrochemical series? 3

(c) What is the geometry of the following two complexes $[\text{Ni}(\text{CN})_4]^{2-}$ and $[\text{NiCl}_4]^{2-}$ and give reasons for this. What is the difference in their magnetic property? 3

(d) What do you mean by Primary and Secondary valencies in Coordination chemistry? 2

6. (a) Justify HCl behaves as an acid in H_2O but not in C_6H_6 2

(b) Why magnitude of crystal field theory in tetrahedral complexes is less than octahedral field? What types of ligands are favourable for tetrahedral complexes? 4

(c) Calculate CFSE and magnetic moment value of the following complexes $[\text{Fe}(\text{CN})_6]^{4-}$ and $[\text{Fe}(\text{CN})_6]^{3-}$ 4