

**B.Sc. BIOTECHNOLOGY  
FOURTH SEMESTER (REPEAT)  
CHEMISTRY-II  
BBT-403**

**SET  
A**

[USE OMR SHEET FOR OBJECTIVE PART]

Duration: 3 hrs.

Full Marks: 70

( Objective )

Time: 30 mins.

Marks: 20

Choose the correct answer from the following:

1 × 20 = 20

- Solubility of ethanol is highest in:  
a. Propanol  
b. Propane  
c. Octane  
d. Oil
- Which statement is not true about hydrogen bond?  
a. It is special type of dipole dipole interaction  
b. It forms between hydrogen and highly electropositive elements  
c. It increases boiling point of polar protic compounds  
d. None of the above
- Boiling point of a compound is related to:  
a. Vanderwall's force  
b. Hydrogen bond  
c. Both a and b  
d. None of the above
- Find the diamagnetic species.  
a.  $H_2$   
b.  $H_2^-$   
c.  $He_2^+$   
d.  $H_2^+$
- Find the molecule having the highest bond order.  
a.  $O_2^+$   
b.  $O_2^-$   
c.  $O_2^{2-}$   
d.  $O_2$
- Which of the following species are isoelectronic?  
a.  $N_2$ ,  $CO$ ,  $NO^+$   
b.  $O_2$ ,  $N_2$ ,  $CO$   
c.  $O_2$ ,  $NO$ ,  $CO_2$   
d. All of the above
- $[Ni(CN)_4]^{2-}$  has which geometry?  
a. Square planer  
b. Trigonal bipyramid  
c. Tetrahedral  
d. None of the above
- $[Co(NH_3)_6][Cr(CN)_6]$  and  $[Co(CN)_6][Cr(NH_3)_6]$  refers to:  
a. Polymerization Isomerism  
b. Coordination Isomerism  
c. Linkage Isomerism  
d. None of the above
- $[Fe(CN)_6]^{4-}$  is a low spin complex, because  $CN^-$  is a:  
a. Strong field ligand  
b. Weak field ligand  
c. Ferromagnetic species  
d. None of the above
- Greater the CFSE of the complex,  
a. Smaller is the stability of the complex  
b. Greater is the stability of the complex  
c. It becomes optically active  
d. None of the above

11. Keesom interaction is:
- Dipole-dipole interaction
  - Dipole-induced dipole interaction
  - Induced dipole-induced dipole interaction
  - None of the above
12. Which is true about Latimer diagram?
- Shows relative stability of different oxidation states
  - Shows standard reduction potential connecting various oxidation states of an element
  - Both a and b
  - None of the above
13. Transition metal complexes are colored due to:
- Variable oxidation state
  - Presence of partially filled d orbital
  - Splitting of d orbitals and transition of electrons between two different energy states
  - None of the above
14. Find the paramagnetic species.
- CN<sup>-</sup>
  - NO<sup>+</sup>
  - CO
  - O<sub>2</sub><sup>-</sup>
15. The hybridization of XeF<sub>4</sub> is:
- sp<sup>3</sup>d
  - sp<sup>3</sup>
  - sp<sup>3</sup>d<sup>2</sup>
  - sp<sup>2</sup>
16. The formal charge of O<sub>3</sub> molecule is:
- 1,+1,-1
  - 1,0,+1
  - +1,+1,-1
  - None of the above
17. The geometry of BF<sub>3</sub> molecule is:
- Trigonal planar
  - Tetrahedral
  - Square planar
  - All of the above
18. Fe atom in [Fe(CN)<sub>6</sub>]<sup>3+</sup> is:
- dsp<sup>2</sup> hybridized
  - d<sup>2</sup>sp<sup>3</sup> hybridized
  - sp<sup>3</sup>d<sup>2</sup> hybridized
  - None of the above
19. Trans-isomers are optically:
- Active
  - Inactive
  - Opaque
  - None of the above
20. Square planer complex is a special case of:
- Tetragonal bipyramidal complex
  - Tetrahedral complex
  - Octahedral complex
  - None of the above

**( Descriptive )**

Time : 2 hr. 30 mins.

Marks : 50

[ Answer question no.1 & any four (4) from the rest ]

1. a) Explain the molecular orbital energy level diagram of CO and NO molecules. 5  
b) What are the postulates of VSEPR theory? 5
2. a) Explain the significance and utility of Latimer diagram of an element in different oxidation states. 5+5=10  
b) Explain the origin of color observed in transition metal compounds, considering the crystal field theory.
3. a) How do intermolecular forces affect solubility? 3+3+4=10  
b) Why propane has boiling point of -42 °C but ethanol has 78 °C?  
c) Discuss how shape of molecules and number of electrons held by molecules affect Vander wall's force.
4. a) Explain the trend of boiling points of H<sub>2</sub>O, H<sub>2</sub>S, H<sub>2</sub>Se and H<sub>2</sub>Te. 3  
b) Calculate the formal charge of NO<sub>2</sub> molecule. 3  
c) When does strong distortion occur in an octahedral complex? 4  
What are its impacts?
5. a) Explain the molecular orbital energy level diagram of O<sub>2</sub><sup>-</sup> and O<sub>2</sub><sup>+</sup> ions and calculate bond order, magnetic moment for each ion. 6+4=10  
b) Explain the structure of SF<sub>6</sub> molecule using hybridisation.
6. a) Iron (Fe) reacts with perchloric acid (HClO<sub>4</sub>). Write down briefly the redox chemical changes occurring during this reaction and determine the thermodynamically feasible oxidation state of Fe. 6+4=10  
b) Why zinc (Zn) is colorless? Explain with proper diagram.
7. a) Why does Cu(II) form Square planer complexes rather than tetrahedral complexes? 4+6=10  
b) Give a brief account of the splitting of d-orbitals in an octahedral field.
8. a) What do you mean by the Jahn-Teller effect? 5+5=10  
b) State the rules of Nomenclature of Complexes.

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