

**B.Sc. BIOTECHNOLOGY**  
**FOURTH SEMESTER [SPECIAL REPEAT]**  
**CHEMISTRY-II**  
**BBT-403**

**SET**  
**A**

[USE OMR SHEET FOR OBJECTIVE PART]

Duration: 3 hrs.

Full Marks: 70

Time: 30 mins.

Marks: 20

( Objective )

Choose the correct answer from the following:

1 × 20 = 20

1. Keesom interaction is:
  - a. Dipole-dipole interaction
  - b. Dipole-induced dipole interaction
  - c. Induced dipole-induced dipole interaction
  - d. None of the above
2. Solubility of ethanol is highest in:
  - a. Propanol
  - b. Propane
  - c. Octane
  - d. Oil
3. Which is true about Latimer diagram?
  - a. Shows relative stability of different oxidation states
  - b. Shows standard reduction potential connecting various oxidation states of an element
  - c. Both a and b
  - d. None of the above
4. 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
5. Transition metal complexes are colored due to:
  - a. Variable oxidation state
  - b. Presence of partially filled d orbital
  - c. Splitting of d orbitals and transition of electrons between two different energy states
  - d. None of the above
6. 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
7. Find the paramagnetic species.
  - a. CN<sup>-</sup>
  - b. NO<sup>+</sup>
  - c. CO
  - d. O<sub>2</sub><sup>-</sup>
8. Find the diamagnetic species.
  - a. H<sub>2</sub>
  - b. H<sub>2</sub><sup>-</sup>
  - c. He<sub>2</sub><sup>+</sup>
  - d. He<sub>2</sub><sup>+</sup>

9. The hybridization of  $\text{XeF}_4$  is:
- $\text{sp}^3\text{d}$
  - $\text{sp}^3$
  - $\text{sp}^3\text{d}^2$
  - $\text{sp}^2$
10. Find the molecule having the highest bond order.
- $\text{O}_2^+$
  - $\text{O}_2^-$
  - $\text{O}_2^{2-}$
  - $\text{O}_2$
11. The formal charge of  $\text{O}_3$  molecule is:
- 1,+1,-1
  - 1,0,+1
  - +1,+1,-1
  - None of the above
12. Which of the following species are isoelectronic?
- $\text{N}_2, \text{CO}, \text{NO}^+$
  - $\text{O}_2, \text{N}_2, \text{CO}$
  - $\text{O}_2, \text{NO}, \text{CO}_2$
  - All of the above
13. The geometry of  $\text{BF}_3$  molecule is:
- Trigonal planar
  - Tetrahedral
  - Square planar
  - All of the above
14.  $[\text{Ni}(\text{CN})_4]^{2-}$  has which geometry?
- Square planar
  - Trigonal bipyramidal
  - Tetrahedral
  - None of the above
15. Fe atom in  $[\text{Fe}(\text{CN})_6]^{4-}$  is:
- $\text{dsp}^2$  hybridized
  - $\text{d}^2\text{sp}^3$  hybridized
  - $\text{sp}^3\text{d}^2$  hybridized
  - None of the above
16.  $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$  and  $[\text{Co}(\text{CN})_6][\text{Cr}(\text{NH}_3)_6]$  refers to:
- Polymerization Isomerism
  - Coordination Isomerism
  - Linkage Isomerism
  - None of the above
17. Trans-isomers are optically:
- Active
  - Inactive
  - Opaque
  - None of the above
18.  $[\text{Fe}(\text{CN})_6]^{4-}$  is a low spin complex, because  $\text{CN}^-$  is a:
- Strong field ligand
  - Weak field ligand
  - Ferromagnetic species
  - None of the above
19. Square planar complex is a special case of:
- Tetragonal bipyramidal complex
  - Tetrahedral complex
  - Octahedral complex
  - None of the above
20. Greater the CFSE of the complex,
- Smaller is the stability of the complex
  - Greater is the stability of the complex
  - It becomes optically active
  - 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  $O_2^-$  and  $O_2^+$  ions and calculate bond order, magnetic moment for each ion. 6+4=10  
b) Explain the structure of  $SF_6$  molecule using hybridisation.
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  $-42^\circ C$  but ethanol has  $78^\circ C$ ?  
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  $H_2O$ ,  $H_2S$ ,  $H_2Se$  and  $H_2Te$ . 3  
b) Calculate the formal charge of  $NO_2$  molecule. 3  
c) When does strong distortion occur in an octahedral complex? What are its impacts? 4
5. a) Draw the possible geometrical isomers of  $[Co(en)_2Cl_2]$ . Which one of them is optically active and why? 6+4=10  
b) Give a brief account of the optical activity of Trioxalato Chromate (III) ion.
6. a) Why  $He_2$  molecule does not exist? 2+3+3+2=10  
b) Define hydrogen bonding? Why o-nitro phenol is more volatile than p-nitro phenol?  
c) Calculate the bond order of  $N_2^+$  ion using molecular orbital energy level diagram.  
d) Mention the hybridization of the following molecules/ions.  
(i)  $CO_2$  (ii)  $CH_3^+$  (iii)  $CH_3^-$  (iv)  $PCl_5$
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) Discuss all types of Vander wall's forces seen in compounds showing examples. 4  
b) Write the postulates of VSEPR theory. 3  
c) Name the following according to IUPAC system. 3  
(i)  $K_4[Fe(CN)_6]$   
(ii)  $K[Ag(CN)_2]$   
(iii)  $[Cu(NH_3)_4]SO_4$

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