

B.Sc. MICROBIOLOGY  
FOURTH SEMESTER [SPECIAL REPEAT]  
CHEMISTRY-II  
BMB-405  
[USE OMR SHEET FOR OBJECTIVE PART]

Duration: 3 hrs.

Time: 30 mins.

*Choose the correct answer from the following:*

- (Objective)
1. Keesom interaction is:  
a. Dipole-dipole interaction  
c. Induced dipole-induced dipole interaction  
b. Dipole-induced dipole interaction  
d. None of the above
2. Solubility of ethanol is highest in:  
a. Propanol  
c. Octane  
b. Propane  
d. Oil
3. Which is true about Latimer diagram?  
a. Shows relative stability of different oxidation states  
c. Both a and b  
b. Shows standard reduction potential connecting various oxidation states of an element  
d. None of the above
4. Which statement is not true about hydrogen bond?  
a. It is special type of dipole-dipole interaction  
c. It increases boiling point of polar protic compounds  
b. It forms between hydrogen and highly electropositive elements  
d. None of the above
5. Transition metal complexes are colored due to:  
a. Variable oxidation state  
c. Splitting of d orbitals and transition of electrons between two different energy states  
b. Presence of partially filled d orbital  
d. None of the above
6. Boiling point of a compound is related to:  
a. Vanderwall's force  
c. Both a and b  
b. Hydrogen bond  
d. None of the above
7. Find the paramagnetic species.  
a. CN<sup>-</sup>  
c. CO  
b. NO<sup>+</sup>  
d. O<sub>2</sub><sup>-</sup>
8. Find the diamagnetic species.  
a. H<sub>2</sub>  
c. He<sub>2</sub><sup>+</sup>  
b. H<sub>2</sub><sup>-</sup>  
d. H<sub>2</sub><sup>+</sup>

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Full Marks: 70

Marks: 20

$1 \times 20 = 20$

9. The hybridization of  $\text{XeF}_4$  is:  
a.  $\text{sp}^3\text{d}$       b.  $\text{sp}^3$   
c.  $\text{sp}^3\text{d}^2$       d.  $\text{sp}^2$
10. Find the molecule having the highest bond order.  
a.  $\text{O}_2^+$       b.  $\text{O}_2^-$   
c.  $\text{O}_2^{2-}$       d.  $\text{O}_2$
11. The formal charge of  $\text{O}_3$  molecule is:  
a.  $-1,+1,-1$       b.  $-1,0,+1$   
c.  $+1,+1,-1$       d. None of the above
12. Which of the following species are isoelctronic?  
a.  $\text{N}_2, \text{CO}, \text{NO}^+$       b.  $\text{O}_2, \text{N}_2, \text{CO}$   
c.  $\text{O}_2, \text{NO}, \text{CO}_2$       d. All of the above
13. The geometry of  $\text{BF}_3$  molecule is:  
a. Trigonal planar      b. Tetrahedral  
c. Square planar      d. All of the above
14.  $[\text{Ni}(\text{CN})_4]^{2-}$  has which geometry?  
a. Square planer      b. Trigonal bipyramidal  
c. Tetrahedral      d. None of the above
15. Fe atom in  $[\text{Fe}(\text{CN})_6]^{4-}$  is:  
a.  $\text{dsp}^2$  hybridized      b.  $\text{d}^2\text{sp}^3$  hybridized  
c.  $\text{sp}^3\text{d}^2$  hybridized      d. 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:  
a. Polymerization Isomerism      b. Coordination Isomerism  
c. Linkage Isomerism      d. None of the above
17. Trans-isomers are optically:  
a. Active      b. Inactive  
c. Opaque      d. None of the above
18.  $[\text{Fe}(\text{CN})_6]^{4-}$  is a low spin complex, because  $\text{CN}^-$  is a:  
a. Strong field ligand      b. Weak field ligand  
c. Ferromagnetic species      d. None of the above
19. Square planer complex is a s special case of:  
a. Tetragonal bipyramidal complex      b. Tetrahedral complex  
c. Octahedral complex      d. None of the above
20. 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
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**(Descriptive)**

Time : 2 hr. 30 mins.

Marks : 50

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

1. 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.
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) 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.  
(i) K<sub>4</sub>[Fe(CN)<sub>6</sub>]  
(ii) K[Ag(CN)<sub>2</sub>]  
(iii) [Cu(NH<sub>3</sub>)<sub>4</sub>]SO<sub>4</sub> 3
6. a) Why He<sub>2</sub> 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<sub>2</sub><sup>+</sup> ion using molecular orbital energy level diagram.  
d) Mention the hybridization of the following molecules/ions.  
(i) CO<sub>2</sub> (ii) CH<sub>3</sub><sup>+</sup> (iii) CH<sub>3</sub><sup>-</sup> (iv) PCl<sub>5</sub>
7. a) Draw the possible geometrical isomers of [Co(en)<sub>2</sub>Cl<sub>2</sub>]. 6+4=10  
Which one of them is optically active and why?  
b) Give a brief account of the optical activity of Trioxalato Chromate (III) ion.
8. a) Explain the molecular orbital energy level diagram of O<sub>2</sub> 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.

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