

**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

- What type of intermolecular forces are due to the attraction between temporary dipoles and their induced temporary dipoles?
  - Metallic bond
  - London dispersion
  - Hydrogen bond
  - Ionic bond
- Paramagnetism is due to:
  - Paired electrons
  - Unpaired electrons
  - Absence of magnetic field
  - All of the above
- Which one of the following does not have hydrogen bonding?
  - Ice
  - Ethanol
  - Hydrocarbon
  - Water
- The coordination number of the metal in the complex  $[\text{Cu}(\text{NH}_2\text{CH}_2\text{CH}_2\text{NH}_2)_2]^{2+}$  is:
  - 2
  - 3
  - 4
  - 6
- The oxidation state of the Chromium in the complex  $\text{K}_3[\text{Cr}(\text{CN})_6]$  is:
  - 3-
  - 3+
  - 6-
  - 6+
- The magnetic moment of the low spin complex  $[\text{Co}(\text{NH}_3)_6]^{3+}$  ion is:
  - 0
  - 1.73BM
  - 2.83BM
  - 3.9BM
- The Effective Atomic Number of the metal in the complex  $[\text{Cr}(\text{NH}_3)_6]^{3+}$  is:
  - 32
  - 33
  - 35
  - 36
- The number of Optical isomer possible for the complex *trans*- $[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$  is:
  - 0
  - 1
  - 2
  - 3
- The CFSE of Octahedral complex of  $d^3$  and  $d^8$  high spin complex is respectively:
  - $4/5\Delta_o$  and  $6/5\Delta_o$
  - $4/5\Delta_o$  and  $4/5\Delta_o$
  - $6/5\Delta_o$  and  $4/5\Delta_o$
  - $6/5\Delta_o$  and  $6/5\Delta_o$
- The hybridization required to explain the structure of tetrahedral structure is:
  - $\text{sp}^2$
  - $\text{dsp}^2$
  - $\text{d}^2\text{sp}^3$
  - $\text{sp}^3$

1. Which of the following is paramagnetic in nature?
  - a.  $O_2$
  - b.  $N_2$
  - c.  $O_2^{2-}$
  - d. All of the above
2. Which of the following is more electronegative elements?
  - a. F
  - b. Cl
  - c. Br
  - d. N
3. Which of the following molecule is linear?
  - a.  $CO_2$
  - b.  $H_2O$
  - c.  $SF_2$
  - d.  $N_2O$
4. According to MO theory for the species  $C_2$ :
  - a. Bond order is zero and it is diamagnetic
  - b. Bond order is two and it is diamagnetic
  - c. Bond order is two and it is paramagnetic
  - d. Bond order is zero and it is paramagnetic
5. Amongst of the following species the one having the highest bond strength is:
  - a.  $O_2$
  - b.  $O_2^{2+}$
  - c.  $O_2^+$
  - d.  $O_2^{2-}$
6. Which ionic solid is expected to have the highest melting point?
  - a. NaCl
  - b. KBr
  - c.  $CaF_2$
  - d. CaO
7. Which example below exhibits the largest bond angle?
  - a. Angle H-O-H in  $H_2O$
  - b. Angle F-Be-F in  $BeF_2$
  - c. Angle F-B-F in  $BF_3$
  - d. Angle Cl-C-Cl in  $CHCl_3$
8. Atomic radii of the 3d series show progressive decrease because:
  - a. Shielding effect decreases
  - b. Shielding effect increases
  - c. Nuclear charge increases
  - d. Both a and c
9. Which of the following hydrides which has the lowest boiling point?
  - a.  $NH_3$
  - b.  $PH_3$
  - c.  $SbH_3$
  - d.  $AsH_3$
10. Aluminium oxide ( $Al_2O_3$ ) is a:
  - a. Basic oxide
  - b. Amphoteric oxide
  - c. Neutral oxide
  - d. Amphoteric oxide

-- --- --

**( Descriptive )**

Time : 2 hr. 30 mins.

Marks : 50

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

1. a) What do you mean by the Jahn-Teller effect? 5+5=10  
b) State the rules of Nomenclature of Complexes.
2. Explain the Crystal Field Theory for octahedral complexes, showing splitting of orbital Energy and the factors that determines this splitting. 10
3. a) Explain the molecular orbital energy level diagram of CO and NO molecules. 5+5=10  
b) Define hydrogen bonding. What are the classification hydrogen bondings? Discuss with examples.
4. a) Which one among ammonia (NH<sub>3</sub>) and carbontetrachloride (CCl<sub>4</sub>) will dissolve in water and why? 5+5=10  
b) Give an example of a volatile organic mixture in which the hydrogen bonded to a carbon atom acts as H-bond donor and explain the reason behind this behaviour.
5. a) Explain the molecular orbital energy level diagram of oxygen and nitrogen molecule. 4+3+3=10  
b) Explain briefly why copper (Cu) does not react with acids.  
c) Draw the structure of possible isomer for the complex [Co(en)<sub>2</sub>Cl<sub>2</sub>]<sup>+</sup>
6. a) What are the postulates of VSEPR theory? 5+5=10  
b) Explain the hybridization of SF<sub>6</sub> and PCl<sub>5</sub> molecules on the basis of Valance bond theory.
7. 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.
8. Explain the possible structure of the complex [Cr(NH<sub>3</sub>)<sub>6</sub>]Cl<sub>3</sub> and [Cu(NH<sub>3</sub>)<sub>4</sub>]SO<sub>4</sub> with Valence Bond Theory, stating their magnetic properties. 10

= = \*\*\* = =