

M.Sc. CHEMISTRY
FIRST SEMESTER
INORGANIC CHEMISTRY-I
MSC – 102

**SET
A**

[USE OMR SHEET FOR OBJECTIVE PART]

Duration : 3 hrs.

Full Marks : 70

Time: 30 min.

(Objective)

Marks: 20

Choose the correct answer from the following:

1X20=20

- For molecule with C_{3v} point group, the symmetry operations are E, $2C_3$ and $3\sigma_v$. The order of the group is -
 - 3
 - 4
 - 5
 - 6
- The sum of the diagonal element of the matrices for Identity operation E is -
 - 1
 - 2
 - 3
 - 4
- The bent NO_2^- ion belongs to the point group
 - C_{2v}
 - D_{2h}
 - D_{3h}
 - C_s
- If the characters are $\chi(C_3) = +1$, $\chi(C_2) = -1$, $\chi(\sigma_h) = 1$, for D_{3h} point group, The Mulliken symbol for the representation is -
 - A_1'
 - A_2''
 - A_1''
 - A_2'
- The number of IR active vibrational modes $\nu_{(CO)}$ in the molecule - Cis- $ML_2(CO)_2$ is -
 - 1
 - 2
 - 3
 - 0
- Arsenic poisoning causes
 - diarrhea
 - vomiting
 - Both a and b
 - None of the above
- Bismuth compounds are used for treatment of
 - Cancer
 - Arthritis
 - Gastric ulcer
 - None of the above
- Heptaplatin is a drug for treatment of
 - Gastric ulcer
 - Arthritis
 - Bipolar disorder
 - Cancer
- Cadmium is toxic due to
 - Its high affinity for nitrogen ligands
 - Its high affinity for sulphur ligands
 - Its ability to replace Zn^{2+} ions
 - Both b and c

10. $[\text{Gd}(\text{DTPA})(\text{H}_2\text{O})]^{2-}$ is used as
 a. Agent for imaging cancer cells
 b. Contrast agent for MRI
 c. Antibacterial agent
 d. None of the above
11. In the molecule H_2O , NH_3 and CH_4
 a. The bond angles are same
 b. The bond distances are same
 c. The hybridizations are same
 d. The shapes are same
12. The shape of the molecule XeO_2F_2 is
 a. Distorted octahedral
 b. Trigonal bipyramidal
 c. Square planar
 d. Tetrahedral
13. The number antibonding electrons in NO and CO according to MO theory are respectively
 a. 1,0
 b. 2,2
 c. 3,2
 d. 2,3
14. The molecule in which the bond order increases upon addition of an electron is
 a. O_2
 b. B_2
 c. P_2
 d. N_2
15. For homonuclear diatomic molecule, the bonding molecular orbital is
 a. σ_u lowest energy
 b. σ_u of second lowest energy
 c. π_g of lowest energy
 d. π_u of lowest energy
16. Archaea are a group of microorganisms that are similar to but evolutionarily distinct from
 a. bacteria
 b. Enzymes
 c. Proteins
 d. None of the above.
17. The functions of lipids include
 a. Storage of energy
 b. Destruction of energy
 c. Generation of energy
 d. None of the above.
18. The transport across membrane is achieved by proteins known as
 a. Haemoglobin pump
 b. Oxygen pump
 c. Ion pump
 d. None of the above.
19. The intermediates such as peroxides are not released during conversion of
 a. Molecular oxygen to water.
 b. Hydrogen peroxide to water.
 c. Hydrogen to water.
 d. None of the above.
20. The enzymes like Cytochrome-C, that catalyse the 4-electron reduction of molecular oxygen to water are called
 a. Salt pumps
 b. Electron pumps
 c. Proton pumps
 d. None of the above.

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(Descriptive)

[5]

Time : 2 hrs. 30 mins.

Marks : 50

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

1. a. Find systematically the point group of the molecule BF_3 . 3+3+2+
2=10
b. Explain the molecular orbital energy level diagram for O_2^- ion and mention the following
 - i. Number of unpaired electron
 - ii. Magnetic behavior
 - iii. Magnetic moment
- c. What are lipids? What are their functions?
- d. Write application of silver in daily life.
2. Find the Reducible and Irreducible representations for the planar molecule $\text{C}_5\text{H}_5\text{N}$ (C_{2v}) and hence the total number of IR active vibrations using symmetry principles. 10
3. a. With the help of matrices prove that $\text{C}_2 \times \sigma_{xz} = \sigma_{yz}$. 5+5=10
b. With help of examples describe how platinum complexes act as anticancer drugs and explain their interaction with cancer cells.
4. a. Write a note on anti-arthritis drug. 3+4+3
=10
b. What is chelation therapy? How some diseases are cured by this therapy?
c. What are imaging agents? Describe with examples how they are used to get a good MRI image.
5. a. Give one example of organometallic drug which is used to treat malaria and explain how it works? 3
7
b. Give an account of the calcium signaling proteins.
6. a. How are biologically essential elements classified? Give an account of the role of iron and tungsten as essential elements. 4
b. Why is a cobalt-based macrocyclic complex, rather than iron complex like haem, well suited for radical based rearrangements? 3
c. Why is it vital that the intermediate such as peroxides are not released during conversion of molecular oxygen to water? 3

7. a. Write two balanced equation for the oxidation of Fe^{2+} and $\text{C}_2\text{O}_4^{2-}$ by permanganate (MnO_4^-) in acid solution. 2+2+6
=10
- b. Arrange the following species in increasing order of bond length and bond order
 $\text{O}_2, \text{O}_2^+, \text{O}_2^{2-}, \text{O}_2^-$
- c. Mention the following for both the complexes $[\text{FeF}_6]^{3-}$ and $[\text{Ni}(\text{CN})_4]^{2-}$
- (i) IUPAC names
 - (ii) Oxidation state of both the central metal atom
 - (iii) Co ordination numbers
 - (iv) Geometry of both the complexes
 - (v) Hybridizations using valence bond theory(VBT)
 - (vi) Magnetic properties and magnetic moments
8. Explain the molecular orbital diagram for BF_3 molecule and B_2H_6 molecule. 5+5=10

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