

**STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI-86**  
**(For candidates admitted during the academic year 2019 – 20 & thereafter)**

**SUBJECT CODE: 19CH/PC/SI14**

**M.Sc. DEGREE EXAMINATION, NOVEMBER 2022**  
**BRANCH IV- CHEMISTRY**  
**FIRST SEMESTER**

**COURSE : MAJOR CORE**

**PAPER : STRUCTURAL INORGANIC CHEMISTRY**

**TIME : 3 HOURS**

**MAX.MARKS :100**

**Section – A**

**Answer all the Questions:**

**(20 x 1 =20 marks)**

**Choose the correct answer:**

1. Which of the following ionic crystals has ccp structure?  
(a) Rutile                      (b) Wurtzite                      (c) Zinc blende                      (d) None of these
2. Perovskites have the formula unit of  
(a)  $ABO_2$                       (b)  $ABO_3$                       (c)  $ABO_4$                       (d)  $AB_2O_4$
3. Which among the following is not a 18-electron complex?  
(a)  $Fe(CO)_5$                       (b)  $Mo(CO)_6$                       (c)  $Mn_2(CO)_{10}$                       (d)  $V(CO)_6$
4. The catalyst used in the Wacker process is  
(a)  $Co_2(CO)_8$                       (b)  $[PdCl_4]^{2-}$                       (c)  $PtCl_2$                       (d)  $(Ph_3P)_3RhCl$
5. The general formula of 12-tungstoheteropoly anions is  
(a)  $[X^{n+}W_{12}O_{36}]^{(8-n)-}$                       (b)  $[X^{n+}W_{12}O_{38}]^{(8-n)-}$                       (c)  $[X^{n+}W_{12}O_{40}]^{(8-n)-}$                       (d)  $[X^{n+}W_{12}O_{42}]^{(8-n)-}$

**State whether True or False:**

11. In a three dimensional unit cell the vertex atom is shared by 4 cells, and hence contributes  $\frac{1}{4}$  atom per cell.
12. The secondary diffraction commonly occurs during the electron diffraction measurements.
13. The ligands, which have both filled orbitals and empty  $\pi$ -orbitals are known as  $\pi$ -acceptor ligands.
14. The catalysts are classified as homogeneous if they are insoluble in the reaction medium and heterogeneous if they are soluble.
15. The arachno framework structures obey the electronic formula  $2n+6$ .

**Match the following:**

- |                      |                              |
|----------------------|------------------------------|
| 6. Sphalerite        | (a) Polymers                 |
| 7. X-ray diffraction | (b) Metal-carbon double bond |
| 8. Carbenes          | (c) Cobalt carbonyl          |
| 9. Oxo process       | (d) Zinc sulphide            |
| 10. Silicones        | (e) Debye-Scherrer equation  |

**Answer in one or two sentences:**

16. Draw the structure of allyl ligand representing its hapticity.
17. What is the main difference between X-ray scattering and neutron scattering?
18. What are organometallic compounds?
19. Write the role of  $\text{CuCl}_2$  in Wacker process.
20. Give the preparation of closo carboranes.

**SECTION –B****Answer any five questions:****(5 x 8 = 40)**

21. Discuss the superconduction by  $\text{YBa}_2\text{Cu}_3\text{O}_7$  and its structure.
22. Discuss the relationship between ferro, piezo- and pyroelectricity.
23. Describe the antiferromagnetic behavior of  $\text{MnO}$  with the help of neutron diffraction studies.
24. Give the structure of  $\text{Fe}_3(\text{CO})_{12}$ . Show that each Fe atom of  $\text{Fe}_3(\text{CO})_{12}$  conforms to the 18-electron rule.
25. Discuss the principle and Meissner effect of superconductors. Give any two applications of superconductors.
26. Discuss in detail the cyclo oligomerization of acetylene using a nickel catalyst.
27. What are heteropoly acids? Discuss the structural aspects of heteropoly acid anions of tungsten.

**SECTION –C****Answer any two questions:****(2 x 20 = 40)**

28. (a) Describe the salient features of  $\text{ReO}_3$  structure. (10)  
(b) How does band theory explain the conducting behavior of solids as conductors, insulators and semiconductors (10)
29. (a) Describe the structure and bonding of alkyl and alkenyl complexes (10)  
(b) What is Wilkinson's catalyst? Describe the catalytic cycle involved in the hydrogenation of alkene with Wilkinson's catalyst. (10)
30. (a) Describe the mechanism involved in the synthesis of acetic acid from methanol. (10)  
(b) Explain the synergistic effect of bonding in metal carbonyls and metal nitrosyls (10)

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