

Part A (Submit it with you answer script)

Name: _____

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Multiple Choice questions

14 x 1 = 14

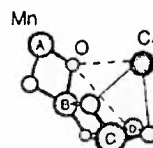
1. In Photosystem II which of the combination of oxidation state of Mn is found in the actual resting state (S_1) of the Mn_4Ca Cluster

- (a) $Mn^{III}_2Mn^{IV}_2Ca$
- (b) $Mn^{III}_3Mn^{IV}Ca$
- (c) $Mn^{III}Mn^{IV}_3Ca$
- (d) Mn^{III}_4Ca

2. The following differences are found in the OEC active site by EXAFS and XRD then which of the option is most appropriate?

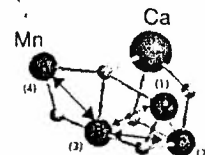
- (a) The tyrosine radical has oxidized the OEC in the XRD structure
- (b) The EXAFS structure has Mn^{III}_4Ca
- (c) The XRD structure is of a more reduced Mn^{III} than the EXAFS structure
- (d) The EXAFS structure has more bound water than the XRD structure

(a) Model III from EXAFS



Mn-O/N distances ~1.9 Å
 Mn-Mn distances
 AB, BC, CD 2.7 - 2.8 Å
 BD 3.3 Å
 Mn-Ca distances
 2 to 3 interactions around 3.4 Å
 2 to 1 interactions around 3.9 Å

(b) 1.9 Å XRD



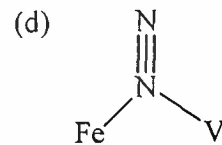
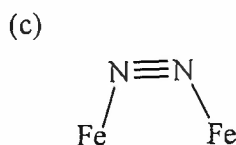
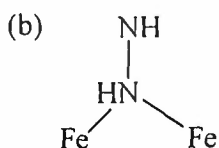
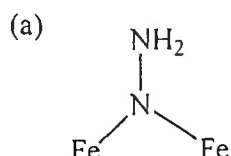
Mn-O/N distances ~2.2 Å
 Mn-Mn distances
 AB, BC, CD 2.8 - 3.0 Å
 BD 3.3 Å
 Mn-Ca distances
 3 interactions around 3.4 Å
 1 interaction around 3.9 Å

3. Vanadate acts to minimize insulin resistance in Diabetes type-II because
- (a) The tetrahedral structure of vanadate is quite similar to phosphate
 - (b) The vanadium has more affinity for the hormone insulin
 - (c) The vanadium goes and binds to the glucose receptor as a result of its tetrahedral structure similar to phosphate
 - (d) The trigonal bipyramidal geometry is more stabilized by vanadium compared to phosphate
4. In nitrate reductase the enzyme active site is oxidized by whom and reduced by whom out of the following combinations
- (a) Nitrate and FAD
 - (b) Nitrite and heme unit
 - (c) Nitrate and heme unit
 - (d) Nitrite and FAD

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5. Based on the recent evidences which of the following diagrams best represents the Fe-V nitrogenase enzymes mode of action



6. Hydrophobic interaction leads to the binding of a drug to a protein pocket. This is governed by
- (a) Gain in enthalpy
 - (b) Loss of entropy and enthalpy
 - (c) Gain of entropy
 - (d) Gain of entropy and enthalpy
7. The changes which occur when O₂ binds to hemerythrin?
- (I) One Fe atom is oxidized (II) Both the Fe atoms are oxidized (III) O₂ binds to one Fe atom and is also hydrogen bonded (IV) O₂ binds to both the Fe atom and is also hydrogen bonded
- (A) I, III and IV
 - (B) II, III and IV
 - (C) only II
 - (D) II and III
8. Consider the following statements for *deoxy*-hemerythrin and *deoxy*-hemocyanin:
- a) They are involved in O₂ transport in biological systems
 - b) They contain two metal ions in their active site
 - c) Active site metal centres are bridged by amino acid residues
 - d) They prefer to bind only one O₂ per active site

The correct statements are: (A) a, c and d (B) a, b and d (C) b, c and d (D) a and c

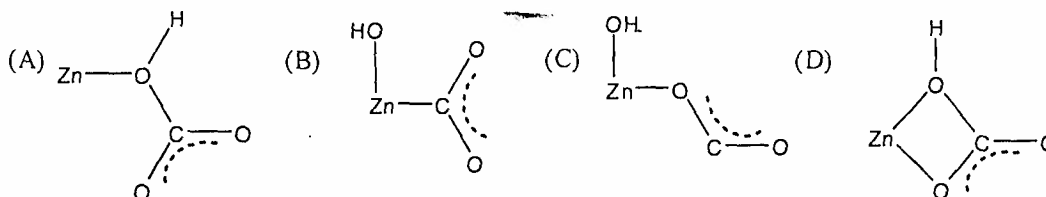
9. The Fe-N_{porphyrin} bond distances in the deoxy and oxy-hemoglobin, respectively are:
- (A) ~2.0 and ~2.0 Å
 - (B) ~2.1 and ~2.0 Å
 - (C) ~2.2 and ~2.3 Å
 - (D) ~2.3 and ~2.5 Å

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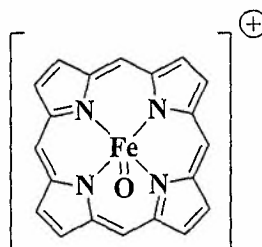
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10. The correct set of the biologically essential elements is:
 (A) Fe, Cu, Co, Ru
 (B) Cu, Mn, Zn, Ag
 (C) Fe, Mo, Cu, Zn
 (D) Fe, Ru, Zn, Mg
11. In bacterial rubredoxin, the no. of iron atoms, sulphur bridges and cysteine ligands are:
 (A) 2, 2, 4
 (B) 2, 2, 2
 (C) 1, 0, 4
 (D) 4, 4, 4
12. Under physiological condition, oxygen is binding to *deoxy*-hemoglobin and *deoxy*-myoglobin, the binding curve and its pH dependence, respectively are-
 (A) Hyperbolic and pH independent; Sigmoidal and pH dependent
 (B) Sigmoidal and pH independent; hyperbolic and pH dependent
 (C) Sigmoidal and pH dependent; hyperbolic and pH independent
 (D) Hyperbolic and pH dependent; Sigmoidal and pH independent
13. At pH=7, the zinc(II) ion in carbonic anhydrase reacts with CO₂ to give-



14. Oxidized form of enzyme catalase (structure A); prepared by the reaction of [Fe(P)]⁺ (P=porphyrin) with H₂O₂, has green color because



A (Substituents on ring are removed for clarity)

- (A) Oxidation state of iron changed from Fe^{III} to Fe^{IV}
 (B) Fe^{IV} is coordinated with anionic tyrosinate ligand in axial position
 (C) Porphyrin ring is oxidized by one electron
 (D) π - π^* transition appears in the visible region