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1. The ligand system present in vitamin B₁₂ is : [NET JUNE 2011]
 (a) Porphyrin (b) Corrin (c) Phthalocyanine (d) Crown ether
2. Carboxypeptidase contains: [NET JUNE 2011]
 (a) Zn(II) and hydrolyses CO₂.
 (b) Zn(II) and hydrolyses peptide bonds.
 (c) Mg(II) and hydrolyses CO₂.
 (d) Mg(II) and hydrolyses peptide bonds.
3. Superoxide dismutase contains the metal ions [NET DEC 2011]
 (a) Zn(II) and Ni(II) (b) Cu(II) and Zn(II)
 (c) Ni(II) and Co(III) (d) Cu(II) and Fe(III)
4. The reduction of nitrogen to ammonia, carried out by the enzyme nitrogenase, needs. [NET DEC 2011]
 (a) 2 electrons (b) 4 electrons (c) 6 electrons (d) 8 electrons
5. A metal ion that replace manganese (II) ion in mangano-proteins without changing its function, is [NET DEC 2011]
 (a) Fe(II) (b) Zn(II) (c) Mg(II) (d) Cu(II)
6. In bacterial rubredoxin, the number of iron atoms, sulfur bridges and cysteine ligands are [NET DEC 2011]
- | | Fe atom | sulfur bridge | cysteine | |
|-----|---------|---------------|----------|--|
| (a) | 4 | 4 | 4 | |
| (b) | 2 | 2 | 4 | |
| (c) | 2 | 2 | 2 | |
| (d) | 1 | 0 | 4 | |
7. The oxidation state of iron in met-hemoglobin is [NET JUNE 2012]
 (a) Three (b) Two (c) Four (d) Zero
8. The changes (from A–D given below) which occur when O₂ binds to hemerythrin are [NET JUNE 2012]
- (A) One iron atoms is oxidized
 (B) Both the iron atoms are oxidized
 (C) O₂ binds to one iron atom and is also hydrogen bonded.
 (D) O₂ binds to both the iron atoms and is also hydrogen bonded.
- (a) B and C (b) B and D (c) A and D (d) A and C



9. In photosynthetic systems the redox metalloproteins involved in electron transfer are cytochrome (cyt, b), cytochrome bf complex (cyt bf) and plastocyanin (PC). The pathway of electron flow is [NET JUNE 2012]
- (a) PC → cyt b → cyt bf (b) cyt bf → cyt b → PC
(c) cyt b → cyt bf → PC (d) PC → cyt bf → cyt b
10. The correct set of the biologically essential elements is, [NET DEC 2012]
- (a) Fe, Mo, Cu, Zn (b) Fe, Cu, Co, Ru (c) Cu, Mn, Zn, Ag (d) Fe, Ru, Zn, Mg
11. Based on the behaviour of the metalloenzymes, consider the following statements [NET DEC 2012]
- (A) In the enzymes, the zinc activates O_2 to form peroxide species.
(B) In the enzymes, the zinc activates H_2O and provides a zinc bound hydroxide.
(C) In the oxidases, the iron activates O_2 to break the bonding between the two oxygens.
(D) Zinc ion acts as a nucleophile and attacks at the peptide carbonyl
- (a) A and B (b) B and C (c) C and D (d) A and D
12. Fe^{2+} – porphyrins fail to exhibit reversible oxygen transport and cannot differentiate CO from O_2 . However, the hemoglobin is free from both these pitfalls. Among the following
- (A) Fe^{2+} – porphyrins undergo μ -oxodimer formation and the same is prevented in case of the hemoglobin.
(B) Fe–CO bond strength is much low in case of hemoglobin when compared to the Fe^{2+} –porphyrins.
(C) While Fe–CO is linear, Fe– O_2 is bent and is recognized by hemoglobin
(D) The interlinked four monomeric units in the hemoglobin are responsible to overcome the pitfalls.
- The correct set of statements is [NET DEC 2012]
- (a) A and B (b) A and C (c) C and D (d) B and D
13. The coordination geometry of copper(II) in the type I copper protein plastocyanin is: [NET JUNE 2013]
- (a) Square planar (b) tetrahedral
(c) octahedral (d) distorted tetrahedral
14. The metal ions present in the active site of nitrogenase enzyme co-factor are [NET JUNE 2013]
- (a) Fe, Mo (b) Fe, W (c) Fe, Cu (d) Fe, Ni
15. For the metalloprotein hemerythrin, the statement that is NOT TRUE is [NET JUNE 2013]



- (a) There are two ion centres per active site.
 (b) Both iron centres are hexacoordinated in the active state.
 (c) One iron is hexacoordinated while the other is pentacoordinated in the active state.
 (d) It is found in marine invertebrates.
16. High dose of dietary supplement ZnSO_4 for the cure of Zn deficiency [NET DEC 2013]
 (a) reduces myoglobin
 (b) increases iron level in blood
 (c) increases copper level in brain
 (d) reduces copper, iron and calcium levels in body
17. If an enzyme fixes N_2 in plants by evolving H_2 , the number of electrons and protons associated with that, respectively are [NET JUNE 2014]
 (a) 6 and 6 (b) 8 and 8 (c) 6 and 8 (d) 8 and 6
18. Molybdoenzymes can both oxidize as well as reduce the substrates, because [NET JUNE 2014]
 (a) Mo(VI) is more stable than Mo(IV)
 (b) Mo(IV) can transfer oxygen atom to the substrate and Mo(VI) can abstract oxygen atom from the substrate
 (c) Conversion of Mo(VI) to Mo(IV) is not favoured
 (d) Mo(VI) can transfer oxygen atom to the substrate and Mo(IV) can abstract oxygen atom from the substrate.
19. The cooperative binding of O_2 in hemoglobin is due to [NET JUNE 2014]
 (a) a decrease in size of iron followed by changes in the protein conformation
 (b) an increase in size of iron followed by changes in the protein conformation
 (c) a decrease in size of iron that is NOT accompanied by the protein conformational changes
 (d) an increase in size of iron that is NOT accompanied by the protein conformational changes
20. The extent of π -electron conjugation in macrocyclic rings of (1) heme, (2) coenzyme B_{12} and (3) chlorophyll follows the order. [NET DEC 2014]
 (a) (1) > (3) > (2) (b) (1) > (2) > (3) (c) (3) > (1) > (2) (d) (2) \approx (1) > (3)
21. Identify correct statements for mercury as an environment pollutant. [NET DEC 2014]
 A. Carbanionic biomethylation converts it to MeHg^+
 B. Thiol group of cysteine has strong affinity for mercury
 C. Mercury containing industrial catalyst release caused Minamata disaster
 The correct answer is



- (a) A and B (b) A and C (c) B and C (d) A, B and C
22. Under physiological condition, oxygen is binding to deoxyhemoglobin and deoxymyoglobin, the binding curve and its pH dependence, respectively, are **[NET DEC 2014]**
 (a) Sigmoidal and pH dependent ; (b) Hyperbolic and pH independent ;
 hyperbolic and pH independent sigmoidal and pH dependent
 (c) Sigmoidal and pH independent; (d) Hyperbolic and pH dependent;
 hyperbolic and pH dependent sigmoidal and pH independent
23. Match the metalloproteins in column-A with their function in column-B **[NET DEC 2014]**
- | Column -A | Column -B |
|----------------------------------|--|
| I. Oxygemocyanin | A. Hydrolysis of C-terminal peptide bond |
| II. Carbonic anhydrase | B. Methylation |
| III. Cytochrome P ₄₅₀ | C. Conversion of CO ₂ to H ₂ CO ₃ |
| IV. Carboxy-peptidase A | D. Oxidation of alkene |
| | E. Oxygen storage |
| | F. Oxygen transport |
- The correct answer is
 (a) I-F; II-C; III - D; IV-A (b) I-E; II-C; III-A; IV-F
 (c) I-F; II-B ; III-C; IV-A (d) I-E; II-D; III-C; IV-A
24. The Fe-Nporphyrin bond distances in the deoxy and oxy-hemoglobin, respectively, are **[NET JUNE 2015]**
 (a) ~ 2.1 and 2.0 Å (b) ~ 2.0 and 2.0 Å (c) ~2.2 and 2.3 Å (d) ~ 2.3 and 2.5 Å
25. The total number of metal ions and the number of coordinated imidazole units of histidine in the active site of oxy-hemocyanin, respectively, are **[NET JUNE 2015]**
 (a) 2Cu²⁺ and 6 (b) 2Fe²⁺ and 5 (c) 2Cu⁺ and 6 (d) Fe²⁺ and 3
26. The biological functions of cytochrome P₄₅₀ and myoglobin are, respectively **[NET DEC 2015]**
 (a) Oxidation of alkene and O₂ storage
 (b) O₂ transport and O₂ storage
 (c) O₂ storage and electron carrier
 (d) electron carrier and O₂ transport
27. Deoxy-hemocyanin is **[NET DEC 2015]**
 (a) heme protein and paramagnetic
 (b) colorless and diamagnetic



- (c) O₂ transporter and paramagnetic
 (d) blue colored and diamagnetic

28. match the metalloprotein in Column-A with its biological function and metal centre in Column-B.

Column -A

Column -B

[NET DEC 2015]

(A) hemoglobin

(I) electron carrier and iron

(B) cytochrome b

(II) electron carrier and copper

(C) vitamin B₁₂

(III) O₂ transport and copper

(D) hemocyanin

(IV) Group transfer reactions and cobalt

(V) O₂ storage and cobalt

(VI) O₂ transport and iron

The correct match is

(a) A-VII, B-I, C-IV and D-III

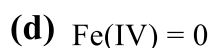
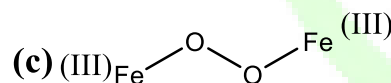
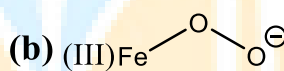
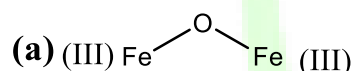
(b) A-V, B-I, C-IV and D-III

(c) A-VI, B-V, C-I and D-II

(d) A-V, B-VI, C-II and D-IV

29. In the absence of bound globin chain, heme group on exposure to O₂ gives the iron-oxygen species

[NET JUNE 2016]



30. Match the metal given in Column -A with its medicinal use as a compound in Column -B

Column-A

Column -B

[NET JUNE 2016]

(A) Gd

(I) Cancer

(B) Au

(II) Maniac depression

(C) Pt

(III) MRI contrast agent

(D) Li

(IV) Arthritis

Correct match is

(a) A-II ; B-III; C-IV; D-I

(b) A-IV; B-II; C-I, D-III

(c) A-III; B-IV; C-I ; D-II

(d) A-I; B-II; C-III; D-IV

31. Correct combination of number and size of rings present in a metal ion-porphine complex

(including metal ion bearing chelate rings) is

[NET JUNE 2016]

(a) four 5-membered and four 6-membered



- (b) two 5-membered and six 6-membered
 (c) six 5-membered and two 6-membered
 (d) five 5-membered and three 6-membered
32. In the catalytic hydration of CO_2 by carbonic anhydrase, CO_2 first interacts with [NET DEC 2016]
 (a) OH group of the active site of the enzyme and then with zinc
 (b) H_2O of the active site of the enzyme and then with zinc
 (c) zinc of the active site of the enzyme and then with OH group
 (d) zinc of the active site of the enzyme and then with H_2O
33. The number of inorganic sulphur (or sulphide) atoms present in the metalloprotein active sites of rubredoxin, 2-iron ferredoxin and 4-iron ferredoxin, respectively, are [NET DEC 2016]
 (a) 0, 2 and 4 (b) 2, 4 and 3 (c) 0, 4 and 2 (d) 0, 2 and 3
34. From the following transformations, [NET DEC 2016]
 A. Epoxidation of alkene
 B. Diol dehydrase reaction
 C. Conversion of ribonucleotide-to-deoxyribonucleotide
 D. 1, 2-carbon shift in organic substrates
 those promoted by coenzyme B_{12} are
 (a) A and B (b) B, C and D (c) A, B and D (d) A, B and C
35. Match the items in column A with the appropriate items in column B [NET DEC 2016]

Column A		Column B	
(A)	Metallothioneins	(i)	cis - $[\text{Pd}(\text{NH}_3)_2\text{Cl}_2]$
(B)	Plastocyanin	(ii)	Cysteine rich protein
(C)	Ferritin	(iii)	Electron transfer
(D)	Chemotherapy	(iv)	Iron transport
		(v)	Iron storage
		(vi)	Carboplatin

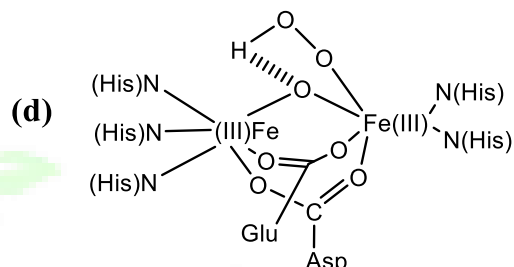
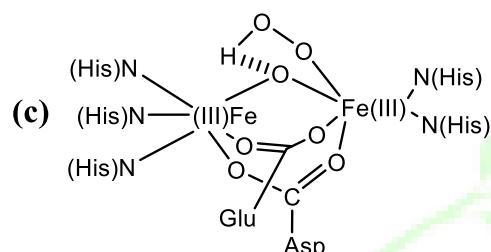
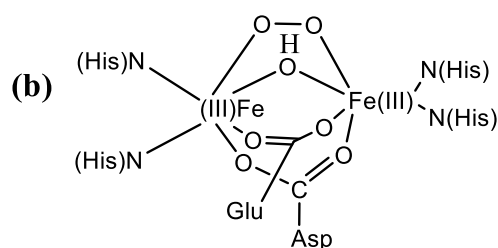
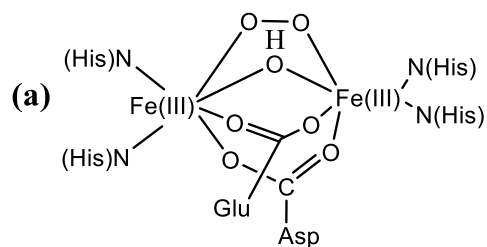
The correct answer is

- (a) (A) - (ii) ; (B) - (iii); (C) - (v) ; (D) - (iv)
 (b) (A) - (ii) ; (B) - (iii); (C) - (iv); (D) - (i)
 (c) (A) - (ii) ; (B) - (iii) ; (C) - (v) ; (D) - (vi)
 (d) (A) - (iii); (B) - (v) ; (C) - (vi); (D) - (ii)



36. The resonance Raman stretching frequencies (in cm^{-1}) of the bound O_2 species in oxy-hemerythrin and oxy-hemoglobin, respectively, are [NET JUNE 2017]
 (a) ~ 850 and 1100 (b) ~750 and 850 (c) ~ 850 and 850 (d) ~ 1100 and 850
37. In vitro reaction of an excess of O_2 with free heme B in aqueous medium the end product is [NET JUNE 2017]
 (a) hematin
 (b) $[\text{O}_2^- - \text{Fe(III)}]$ -protoporphyrin [X]
 (c) heme B(O_2)
 (d) oxoferrylprotoporphyrin -IX cation radical
38. Consider the following statements for metallothioneins : [NET JUNE 2017]
 A. they contain about 30% cysteine residues
 B. They prefer to bind soft metal ions such as Cd(II) , Hg(II) and Zn(II)
 C. They are involved in electron transfer reactions
 D. They are low molecular weight proteins
 Correct statements are
 (a) A, B and C (b) A, B and D (c) A, C and D (d) B and C
39. Consider the following statements for deoxy-hemerythrin and deoxy-hemocyanin : [NET JUNE 2017]
 A. They are involved in O_2 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 O_2 per active site
 the correct statements are
 (a) A, B and D (b) A, C and D (c) B, C and D (d) A and C
40. The correct statement for cytochrome c is [NET DEC 2017]
 (a) It is a non-heme protein
 (b) The coordination number of iron in cytochrome c is five
 (c) It is a redox protein and an electron carrier
 (d) It can store or carry dioxygen
41. The active site structure for oxy-hemerythrin is : [NET DEC 2017]





42. The number of inorganic sulfides in cubane like ferredoxin and their removal method, respectively, are [NET DEC 2017]
- (a) eight and washing with an acid (b) four and washing with a base
 (c) eight and washing with a base (d) four and washing with an acid
43. For the catalytic activity of Cu and Zn containing enzyme, superoxide dismutase, what is / are the correct statement(s) ? [NET JUNE 2018]
- (A) Cu and Zn both are essential
 (B) Only Cu is essential
 (C) Zn is essential and Cu may be replaced by any other divalent metal atom
 (D) Zn may be replaced by any other divalent metal atom
- (a) A only (b) C only (c) D only (d) B and C
44. Consider the following statements for the oxygenation of hemocyanine : [NET JUNE 2018]
- (A) Oxidation state of both copper atoms changes by two
 (B) It becomes intense blue from colorless
 (C) Dioxygen is reduced to O_2^{2-} .
 (D) The $\mu-\eta^2 : \eta^2$ bond forms between each oxygen and copper atoms.
- The correct statements are :
- (a) (A) and (C) (b) (B) and (C) (c) (A), (B) and (C) (d) (B), (C) and (D)
45. The chelate rings made by macrocyclic ligand in vitamin B₁₂ are [NET DEC 2018]
- (a) One five-membered and three six-membered
 (b) Two five-membered and three six-membered



(c) Three five-membered and one six-membered

(d) Four Six-membered

46. Match the items given below in the three columns :

[NET DEC 2018]

Metalloprotein		Species coordinated to metal centre(s)		Resonance Raman O-O stretching frequency (cm^{-1})	
(A)	Oxymyoglobin	(I)	$\eta^2:\eta^2\text{-O}_2^{2-}$	(X)	844
(B)	Oxyhemocyanin	(II)	HO_2^-	(Y)	803
(C)	Oxyhemerythrin	(III)	O_2^-	(Z)	1105

Correct matches :

(a) A-III-Z, B-I-Y, C-II-X

(b) A-II-Y, B-I-X, C-III-Z

(c) A-III-Y, B-I-Z, C-II-X

(d) A-I-X, B-II-Y, C-III-Z

47. The metal transferred by bacteria and fungi using siderophores/siderochromes is

[NET JUNE 2019]

(a) Mo

(b) Cu

(c) Fe

(d) Zn

48. Consider the following statements with respect to Cytochrome P-450

[NET JUNE 2019]

(A) It has histidine coordinated to iron centre

(B) It is a membrane bound metalloenzyme

(C) It has Fe(III) ion in the resting state of the enzyme

The correct statement(s) is/are

(a) A,B

(b) A, C

(c) B,C

(d) A only

49. Consider the following transformation reactions in the context of co-enzyme B₁₂ [NET JUNE 2019]

(A) 1, 2-Carbon shift

(B) Hydration of CO₂

(C) Benzene to phenol

(D) Dimethyl sulfide to dimethyl sulfoxide

The correct statement (s) for co-enzyme B₁₂ is / are

(a) A, C, D

(b) A, B only

(c) B, C only

(d) A only

50. Choose the correct statements for oxymyoglobin and cytochrome P₄₅₀ (resting state) from the following :

[NET DEC 2019]

A. Both contain dianion of protoporphyrin-IX

B. They have same fifth-ligand bonded to metal centre from the protein backbone

C. They contain single active site

D. They contain metal ion in +3 oxidation state

(a) A, B and C

(b) A, C and D

(c) A, B and D



51. Complex (es) which has/have unpaired electron(s) that is equal to that of iron center in oxymyoglobin is/are [NET DEC 2019]



(Given : ox = oxalato)

Correct answer is

- (a) A and B (b) B and D (c) C only (d) C and D
52. Match Column I, II and III : [NET DEC 2019]

Column I (metal)		Column II (enzyme)		Column III (end product)	
A	Ni	i	Carbonic anhydrase	X	Uric acid
B	Zn	ii	Xanthine oxidase	Y	Methane
C	Mo	iii	Coenzyme F ₄₃₀	Z	Carbonic acid

The correct match is

- (a) A-iii-Y; B-i-Z; C-ii-X (b) A-iii-Y, B-ii-X; C-i-Z
 (c) A-ii-X; B-i-Y; C-iii-Z (d) A-i-X; B-iii-Z, C-ii-Y
53. The metal transferred by bacteria and fungi using siderophores/siderochromes is [NET DEC 2019]
- (a) Mo (b) Cu (c) Fe (d) Zn

54. Consider the following statements with respect to Cytochrome P-450 [NET DEC 2019]

- (A) It has histidine coordinated to iron centre
 (B) It is a membrane bound metalloenzyme
 (C) It has Fe(III) ion in the resting state of the enzyme

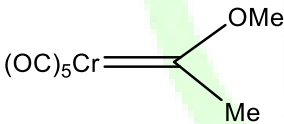
The correct statement(s) is/are

- (a) A,B (b) A, C (c) B,C (d) A only
55. Consider the following transformation reactions in the context of co-enzyme B₁₂ [NET DEC 2019]
- (A) 1, 2-Carbon shift (B) Hydration of CO₂
 (C) Benzene to phenol (D) Dimethyl sulfide to dimethyl sulfoxide

The correct statement (s) for co-enzyme B₁₂ is / are

- (b) A, C, D (b) A, B only (c) B, C only (d) A only
56. I₂ is violet in the solid as well as in gas phase. However in acetone or ethanol, it turns brown. Choose the correct statement(s) for this colour change [NET NOV 2020]
- (a) Dissociation of I₂ in atomic state



- (b) Interaction of low-lying σ^* -orbital of iodine with lone pair of O (solvent)
 (c) Formation of a charge-transfer complex
 (a) (a) Only (b) (b) Only (c) (a) and (b) Only (d) (b) and (c) only
57. During the binding of O_2 to myoglobin (consider 'heme' in xy-plane), the molecular orbital of O_2 and atomic orbital of Fe involved in the formation of the σ -bond is **[NET NOV 2020]**
 (a) π^* and d_z^2 (b) π^* and d_{xz} (c) π and d_{xz} (d) π and d_z^2
58. In the catalytic cycle of Cytochrome P450, the generation of [(porphyrin) $^+$ Fe IV (O)] from [(porphyrin)Fe III (OOH)] involves **[NET NOV 2020]**
 (a) One electron oxidation of [(porphyrin)Fe III (OOH)]
 (b) Formation of the intermediate [(porphyrin)Fe IV (OH)]
 (c) Homolytic O-o cleavage of [(porphyrin)Fe IV POOH]
 (d) Heterolytic O-o cleavage of [(porphyrin)Fe III (OOH)]
59. Consider an octahedral complex Ma_2b_2cd , where a, b, c and d are monodentate ligands, The number of enantiomeric pairs for the complex is **[NET FEB 2022]**
 (a) One (b) two (c) three (d) Four
60. Consider the following statement(s) in the context of organometallic complex (X): **[NET FEB 2022]**
- 
- A. The carbene ligand donates two electrons to the metal and accepts d electrons to make a π -bond
 B. The C (carbene) is nucleophilic
 C. Rotation around the Cr=C(OMe)Me double bond has low barrier (< 10 kcal/mol)
- Correct statement(s) is/are:
 (a) A and B (b) A only (c) A and C (d) B and C
61. The number of electrons involved in the enzymatic action of cytochrome c oxidase, carbonic anhydrase and photosynthetic oxygen evolving complex, respectively, are **[NET SEP 2022]**
 (a) 2,0,4 (b) 4,0,4 (c) 4,1,0 (d) 2,0,2
62. The number of moles of Mg-ATP needed for the reduction of one mole of nitrogen by nitrogenase enzyme is **[NET SEP 2022]**
 (a) 8 (b) 16 (c) 6 (d) 2

ANSWER KEY

1. B	2. B	3. B	4. *	5. C	6. D	7. A	8. A	9. C	10. A
11. B	12. B	13. D	14. A	15. B	16. D	17. B	18. D	19. A	20. A



21. D	22. A	23. A	24. A	25. A	26. A	27. B	28. A	29. A	30. C
31. A	32. A	33. A	34. B	35. C	36. A	37. A	38. B	39. A	40. C
41. C	42. D	43. C	44. D	45. A	46. A	47. C	48. C	49. D	50. D
51. C	52. C	53. C	54. C	55. D	56. D	57. A	58. D	59. B	60. A&C
61. B	62. B								

SOLUTION

1.
Ans. (b)
Sol. Vitamin B₁₂ molecule is built-around a corrin ring containing cobalt (III) atom.

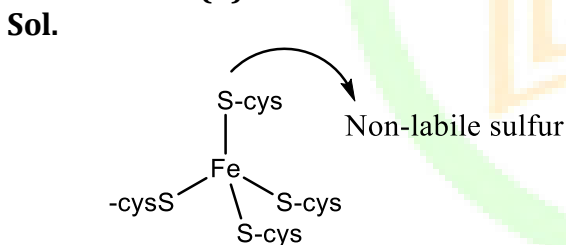
2.
Ans. (b)
Sol. Carboxypeptidase enzyme contains Zn⁺² ion and it cleaves (hydrolyses) the carboxy terminal amino acid from a peptide chain.

3.
Ans. (b)

4.
Ans.

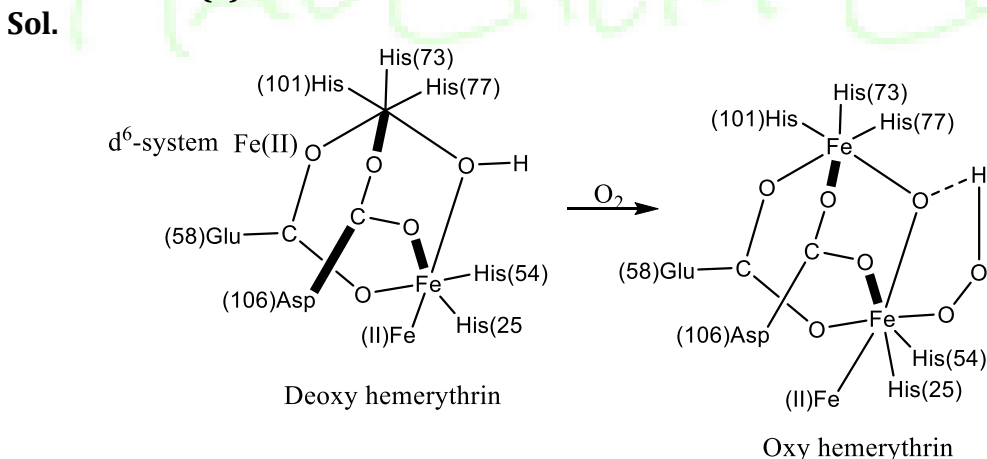
5.
Ans. (c)

6.
Ans. (d)



7.
Ans. (a)

8.
Ans. (a)



9.

Ans. (c)

 Sol. $\text{NAD}^+ \leftarrow$ Biological reductant

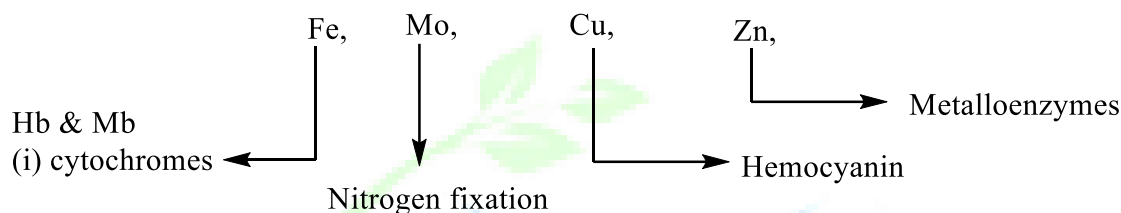

Flavo-protein


 $\text{cyt.b} \rightarrow \text{cyt.c} \rightarrow \text{cyt.c}_1 \rightarrow \text{cyt.c oxidase}$

10.

Ans. (a)

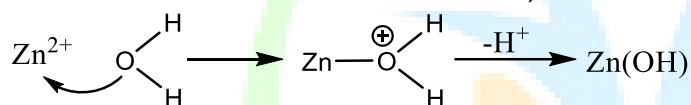
Sol.



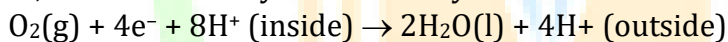
11.

Ans. (b)

Sol. Because zinc is a Lewis acid and hence,

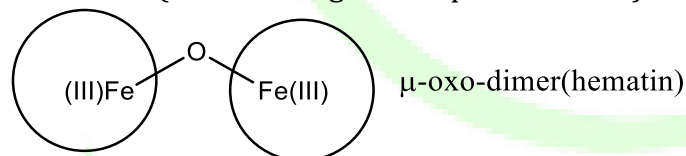


So, correct option is (b)

 However, oxidase are enzyme that catalyse the reduction of $\text{O}_2 \rightarrow \text{H}_2\text{O}$ or H_2O_2 .


12.

Ans. (b)

 Sol. Free heme (i.e. without globular protein chain) it forms μ -oxodimer) i.e.

 Which is unable to bind O_2 .

13.

Ans. (d)

Sol. The coordination geometry of copper(II) in copper(I) protein plastocyanin is distorted tetrahedral.

14.

Ans. (a)

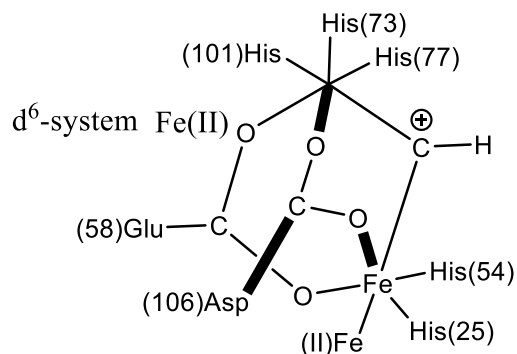
Sol. Nitrogenase enzyme cofactor contains Fe, Mo also known as Iron-molybdenum cofactor.

15.

Ans. (b)

Sol.





Deoxy hemerythrin

In Hemerythrin, one iron centre is pentacoordinated and is hexacoordinated. And iron exist at peractive site found in mariene invertebrates.

16.
Ans. (d)

17.
Ans. (b)

Sol. $N_2 + 8H^+ + 8e^- + 16 ATP \rightarrow 2NH_3 + H_2 + 16ADP + 16Pi$

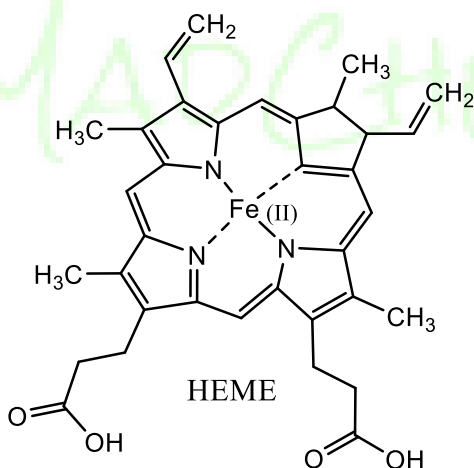
18.
Ans. (d)

19.
Ans. (a)

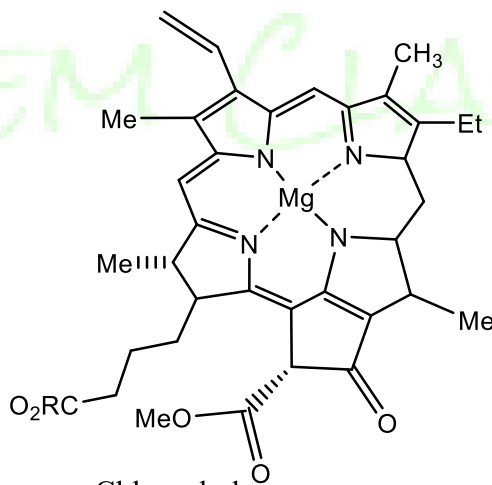
Sol. The movement of iron atom and imidazole side chain of histidine toward the porphyrin plane results in breaking of some of the salt bridges. The breaking of these salt bridges reduces the strain in hemoglobin molecule. Therefore, the oxyform of hemoglobin is called relaxed state (i.e., R state). The T form of deoxyhemoglobin discourages the addition of first dioxygen molecule.

The bonding of one dioxygen molecule to a subunit of hemoglobin reduces the steric hindrance in the other subunits due to breaking of salt bridges) and therefore encourages the third as well as fourth subunits. This is called cooperative mechanism.

20.
Ans. (a)
Sol.

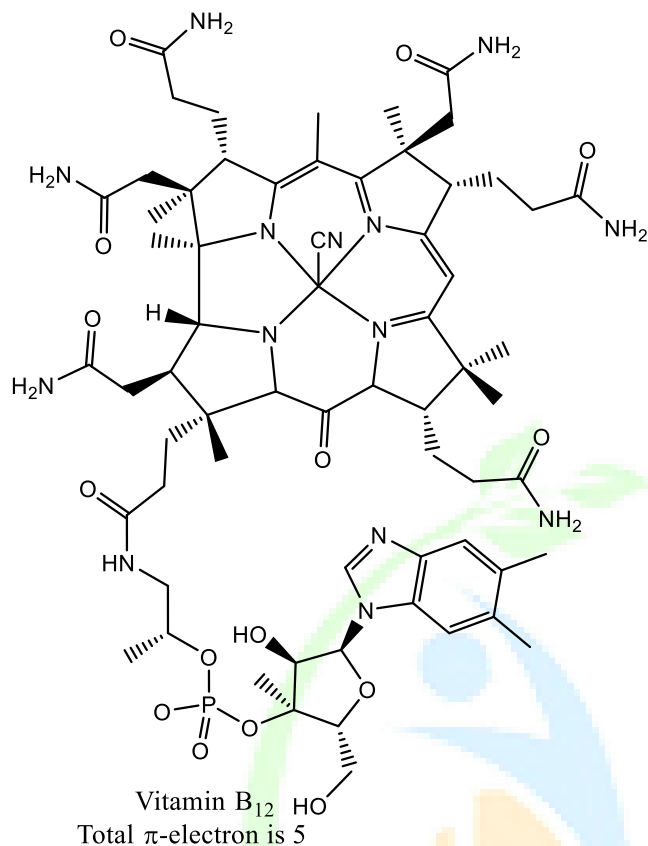


Total 11 π -electron in nucrocyclic ring



Chlorophyl
Total 11 π -electron in microcyclic ring

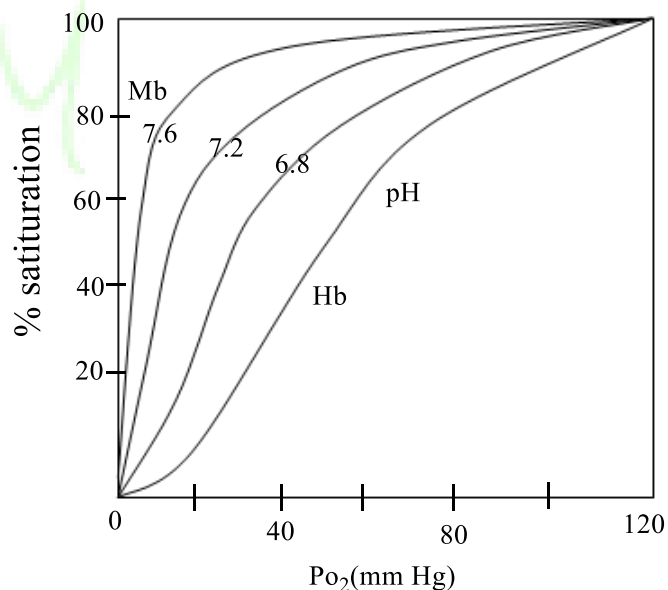




21.
Ans. (d)

Sol. In 1956, in Japan minamata disaster had been broken out in coastal area. This is a neurological syndrome caused by mercury pollution. The Hg^{++} get converted into MeHg^+ by carbonic blomethylation. Which form strong bonding with thiol ($-\text{SH}$) group of protein having cysteine amino acid. Hence, A, B and C are correct.

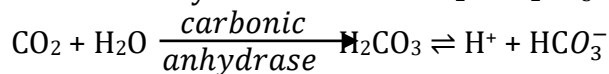
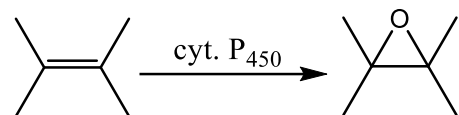
22.
Ans. (a)
Sol.



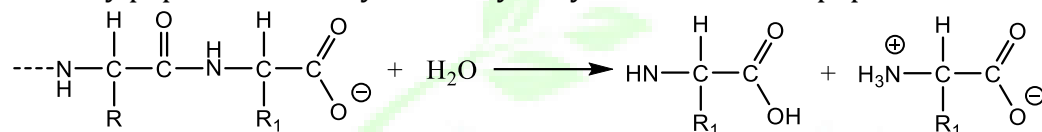
23.

Ans. (a)
Sol. Oxyhemocyanin stables as oxygen carrier.

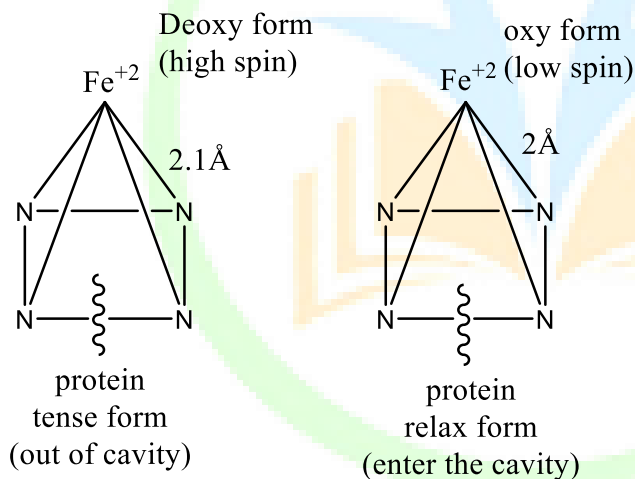
Carbonic anhydrase

 Carbonic anhydrase converts CO_2 to H_2CO_3 .

 cytochrome P_{450} oxidizes alkene to epoxide.


Carboxy peptidase A catalyzes the hydrolysis of C-terminal peptide bond.

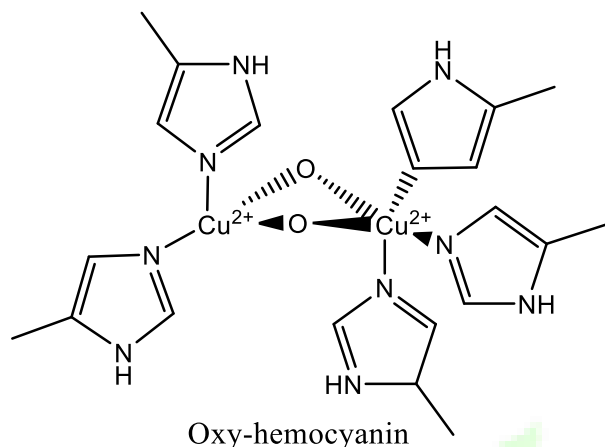


24.

Ans. (a)
Sol.


25.

Ans. (a)
Sol. Oxy-hemocyanin are proteins that transport oxygen throughout the bodies of some invertebrate animals. These metalloprotein contain two copper atoms that reversibly bind a single oxygen molecule (O_2).

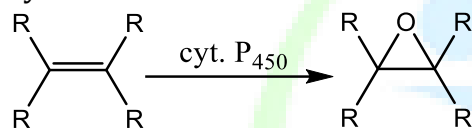



The total of six coordinated imidazole units of histidine present in the active site of oxy-hemocyanine.

26.

Ans. (a)

Sol. Cytochrome P450 function as monooxygenase and catalyses the insertion of oxygen in substrate

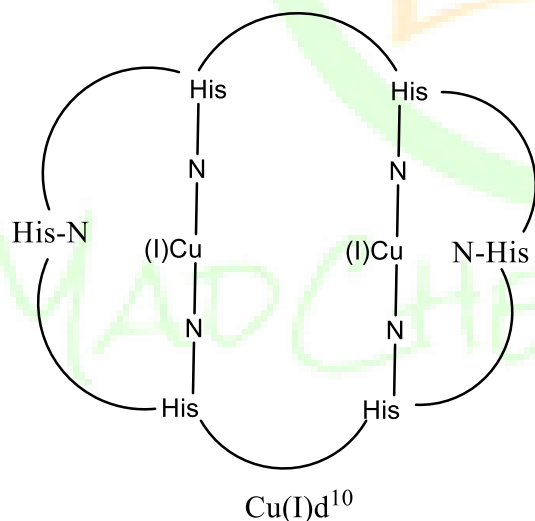


Myoglobin is found in tissue and store the oxygen in tissue transported by Hae moglobin.

27.

Ans. (b)

Sol. In deoxyhaemocyanin Cu is in Cu(I) state i.e. have $d^{10}s^0$ configuration therefore it colourless and diamagnetic. Diamagnetism is due absence of unpaired electrons and colourless is due to no d-d transition as all the orbitals are filled.



28.

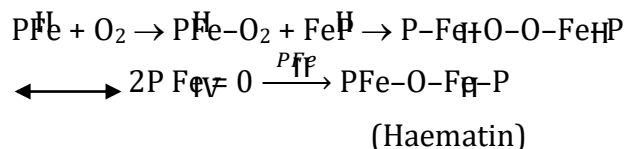
Ans. (a)

Sol. Hb \Rightarrow it functions as O_2 transfer and contain Fe as active centre.Cytochrome. b \Rightarrow it functions as electron transfer and contain FeVitamin B_{12} \Rightarrow it is responsible for group transfer reaction and contain cobalt.Haemocyanin \Rightarrow it is a non-haem, non-iron, copper containing protein and function as O_2 transport system .

29.

Ans. (a)

Sol. Absence of globin chain following reaction is occur



30.

Ans. (c)

Sol. Pt-complex used as anticancer drug

Au-complex used as antiarthritis agent

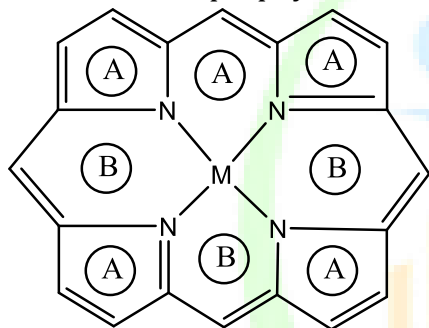
Gd-complex used in MRI as contrast agent due to their strong paramagnetic behaviour

Li-complex used in Mariaic depression

31.

Ans. (a)

Sol. Structure of m-porphyrine complex can be shown as



Here, (A) represents = five membered ring

(B) represents = six membered ring

Thus, these are four 5-membered ring and four 6-membered ring.

32.

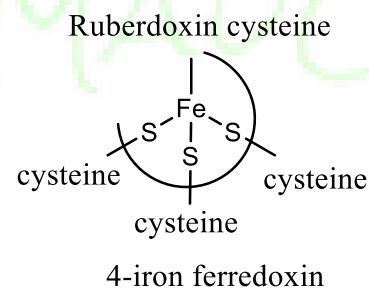
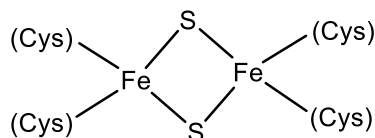
Ans. (a)

 Sol. In carbonic anhydrase OH group first attack on CO₂ and then CO₂ interact with Zn.

33.

Ans. (a)

Sol.


 2-iron ferredoxin Fe₂Se₂


Ans. (c)

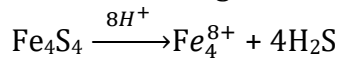
Sol. In oxyhemerythrin, both the Fe are present as Fe(III) and there is presence of hydrogen bonding and dioxygen bind to only one Fe.

42.

Ans. (d)

Sol. Cubane like ferredoxin is Fe_4S_4 .

It has four inorganic sulfide which can be removed by treatment with acid.



43.

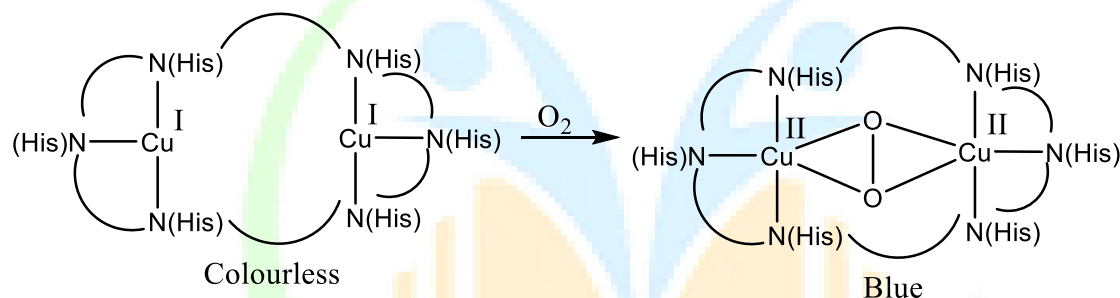
Ans. (c)

Sol. The Cu^{2+} ion is essential that can not be replaced by other metal atom while retaining activity. On the other hand, the Zn^{2+} ion can be replaced by other divalent metals atom such as Co or Cd with retention of most of the activity.

44.

Ans. (d)

Sol.



(I) In oxygenation of hemocyanin each Cu atom is oxidized by one.

(II) It becomes intense blue from colourless due to LMCT (O_2^{2-} to Cu^{2+})

(III) O_2 is reduced to O_2^{2-} because each Cu is oxidized by one.

(IV) The O_2^{2-} binds to two Cu atoms in the $\mu\text{-}\eta^2:\eta^2$ manner.

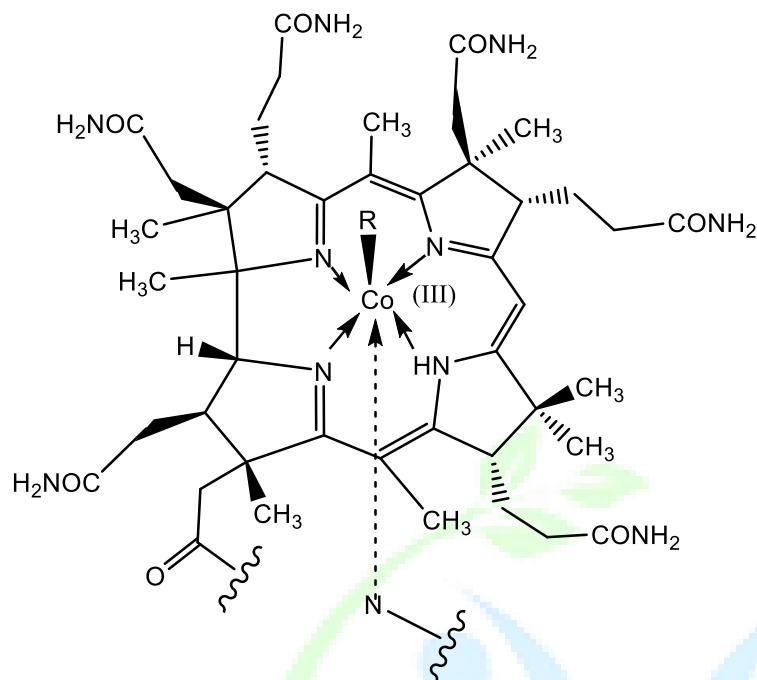
45.

Ans. (a)

Sol.

MADCHEM CLASSES





46.

Ans.

(a)

Sol.

 $\text{Oxymyoglobin} \rightarrow \text{O}_2^- \rightarrow 1105 \text{ cm}^{-1}$
 $\text{Oxyhemocyanin} \rightarrow \eta^2 : \eta^2 \text{O}_2^{2-} \rightarrow 803 \text{ cm}^{-1}$
 $\text{Oxyhemerythrin} \rightarrow \text{HO}_2^- \rightarrow 844 \text{ cm}^{-1}$

47.

Ans.

(c)

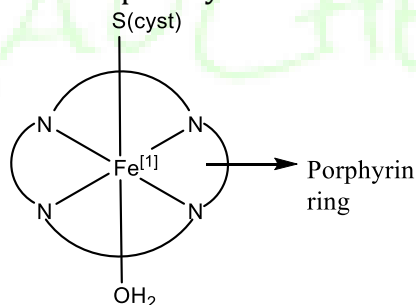
Siderophores/siderochromes are small, high-affinity iron-chelating compounds secreted by microorganisms such as bacteria and fungi and serving to transport iron across all membranes.

48.

Ans.

(c)

Sol. Cytochrome P-450 is a membrane bound metalloenzyme. The function of most cytochrome P-450 enzyme is to catalyze the oxidation of organic substrate. In the active site of cytochrome P-450, iron is in +3 oxidation state and it is in octahedral geometry whereas the basal plane is composed of four N atoms from the porphyrin ring, fifth position is occupied by a cysteine moiety and sixth position is occupied by H_2O molecule.



Cytochrome P-450

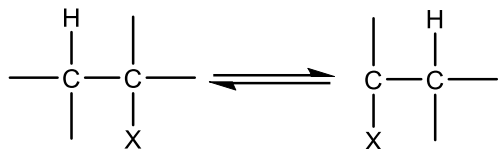
49.

Ans.

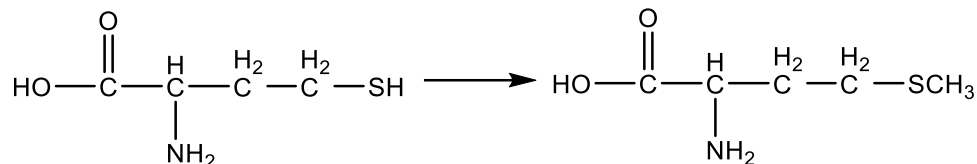
(d)

Sol. • Coenzyme Vit-B₁₂ was the first organometallic compound discovered in living systems. This coenzyme catalyses 1,2-rearrangement





- Coenzyme B₁₂ readily accepts a methyl group or hydroxyl methyl group (bound to Co) that can be transferred to add a carbon to a substrate.



- Coenzyme B₁₂ reduces -CH(OH) group to -CH₂ group

50.

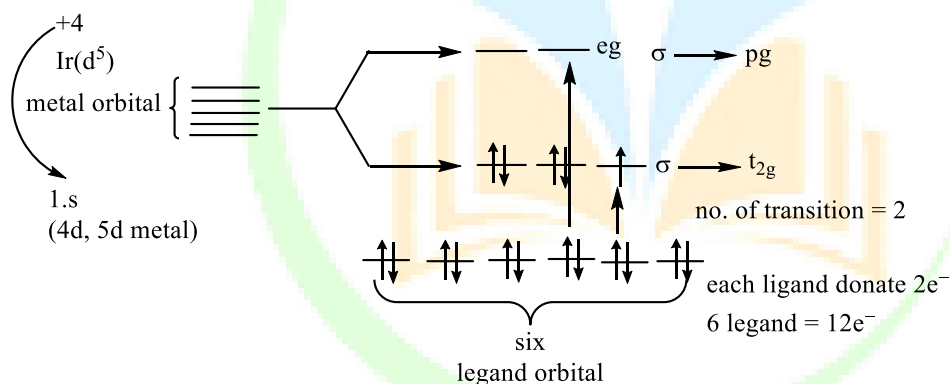
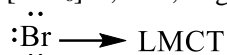
Ans. (d)

Sol. Down the group bond angle ↓es. If central atom is more E.N than bonded atom then bond angle ↑es or vicevassar. NF₃ > SbCl₃ > SbF₃.

51.

Ans. (c)

Sol. [IrBr₆]⁻², Ir⁺⁴, High O.S,



52.

Ans. (c)

53.

Ans. (c)

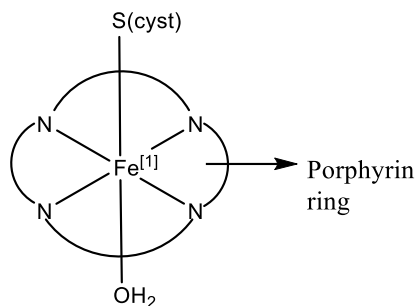
Sol. Siderophores/siderochromes are small, high-affinity iron-chelating compounds secreted by microor-ganisms such as bacteria and fungi and serving to transport iron across all membranes.

54.

Ans. (c)

Sol. Cytochrome P-450 is a membrane bound metalloenzyme. The function of most cytochrome P-450 enzyme is to catalyze the oxidation of organic substrate. In the active site of cytochrome P-450, iron is in +3 oxidation state and it is in octahedral geometry whereas the basal plane is composed of four N atoms from the porphyrin ring, fifth position is occupied by a cysteine moiety and sixth position is occupied by H₂O molecule.

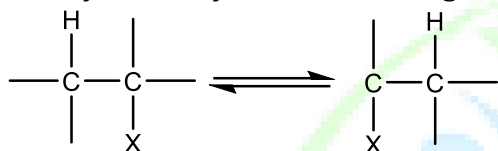




Cytochrome P-450

55.
Ans. (d)

Sol. • Coenzyme Vit-B₁₂ was the first organometallic compound discovered in living systems. This coenzyme catalyses 1,2-rearrangement

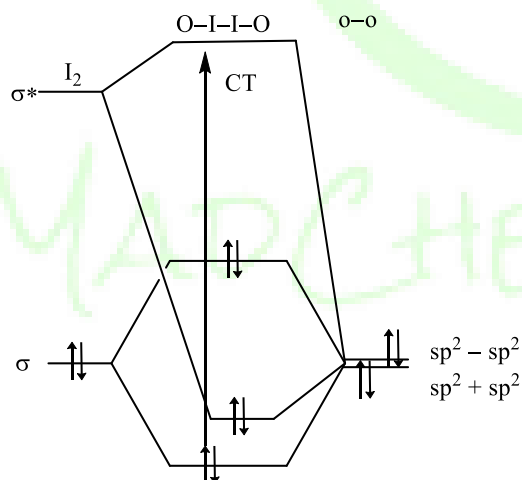


• Coenzyme B₁₂ readily accepts a methyl group or hydroxyl methyl group (bound to Co) that can be transferred to add a carbon to a substrate.



• Coenzyme B₁₂ reduces -CH(OH) group to -CH₂ group

56.
Ans. (d)
Sol.

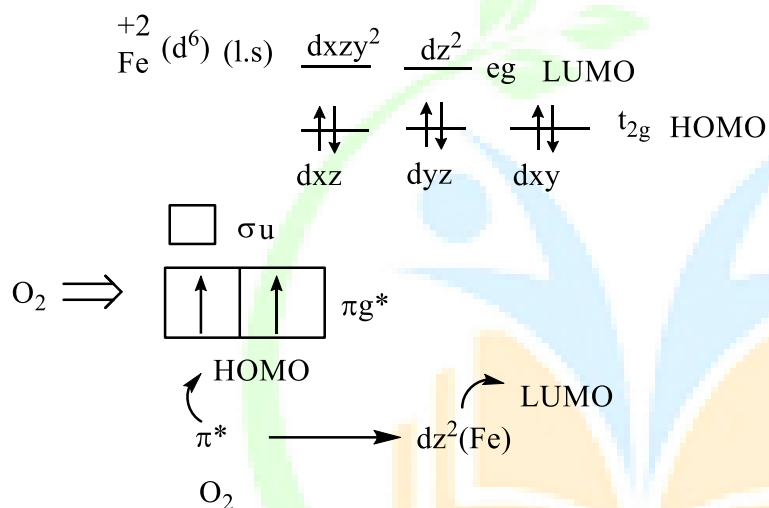
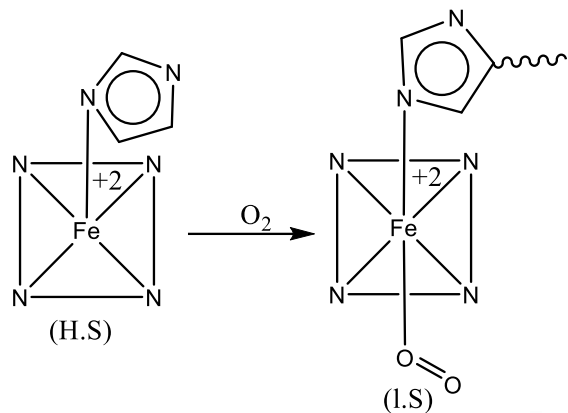


The Interaction of I₂ with the carbonyl group of ketone

A partial molecular orbital energy level diagram for the σ & σ^* orbital of I₂ with the appropriate combinations of the sp^2 orbital on the two O atoms. The charge Transfer Transition is labelled CT.

57.
Ans. (a)
Sol.

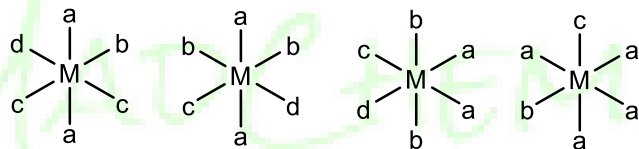




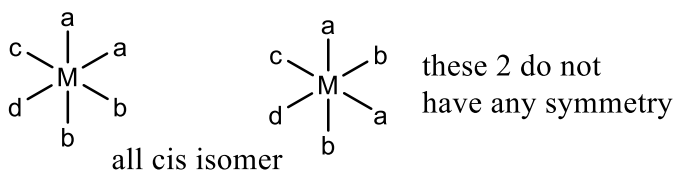
58.
Ans. (d)

59.
Ans. (b)

Sol. $\text{Ma}_2\text{b}_2\text{cd}$



all 4 have one plane

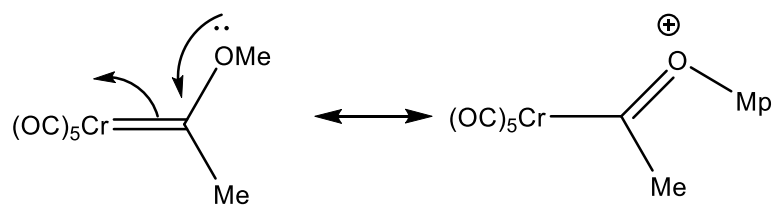


So the form enantiomeric pair

60.
Ans. (a) & (c)



Sol.



Carbene donate two electron Fischer carbene is electrophilic As them is nesonance the double bond conversion barrier is low.

61.

Ans. (b)

Sol. Carbonic anhydrase is not involved in e^- Transport
cytochrome C – Oxidase –

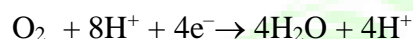
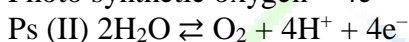


Photo synthetic oxygen = $4e^-$

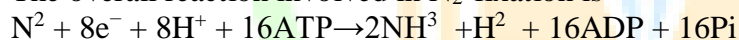


62.

Ans. (b)

Sol. Some of the plants, especially the roots of legumes live in symbiotic association with N_2 -fixing bacteria. They can fix nitrogen into biologically usable forms. This phenomenon is called symbiotic nitrogen fixation. The enzyme nitrogenase is required to fix atmospheric nitrogen. The molecule of nitrogen is reduced by the addition of hydrogen atoms provided by a reducing agent like NADPH_2 . It produces dimide (N_2H_2), hydrazine (N_2H_4) and finally ammonia (NH_3) is formed.

The overall reaction involved in N_2 -fixation is



Thus, one mole of nitrogen is converted into two molecules of ammonia. For producing 1 molecule of ammonia, 8 ATPs are needed. So, for fixing one mole of N_2 , 16 ATPs are used.

MADCHEM CLASSES

