44-Karanpur, Near Luxmi Narayan Mandir, Dehradun
Contact: 8171000425, 7252022576
Web: www.genesis-tutorials.com
Email: info@genesis-tutorials.com

BIO – INORGANIC CHEMISTRY

1) **Metallo-proteins.**
   - Porphyrin Unit
   - Heme group
     - **Heme**
       - (1) → Hb
       - (2) → Mb
       - (3) → Cyto-Chromes.
       - (4) → Detailed functions.
     - **Non –Heme**
       - **(1)** → OIP & Enzymes
       - (2) → ISP
       - (3) → TSI

2) **Metallo –enzymes**
   - **(1)** → Carbonic anhydrase
   - **(2)** → Carboxypeptidase
   - **(3)** → Per-Oxidase
   - **(4)** → Catalase
   - **(5)** → Cyt-P-450
   - **(6)** → Xanthine oxidase
   - **(7)** → Aldehyde oxidase
   - **(8)** → Vit-B_{12} & Vit -B_{12} Coenzymes
   - **(9)** → Nitrite reductase.
   - **(10)** → Cyt-C-Oxidase
   - **(11)** → LADH

3) **Ion transport Across the Membrane**
   - → Na^+/K^+ Pump
   - → Ionophores

4) **Nitrogen Fixation**

5) Photosynthesis
   - (1) → Chlorophylls
   - (2) → PS-II & PS- I
   - (3) → Light & dark reactions.

- → Hb = Heamoglobin
- → Mb = Myoglobin
- → OIP = Oxo- bridged Iron Proteins
- → ISP = Iron Sulphur Proteins
- → LADH = Liver Alcohol Dehydrogenase
- → PS = Photosystem
- → Cyt = Cytochrome
- → TSI = Transport and Storage of Iron

44-Karanpur, Near Luxmi Narayan Mandir, Dehradun
Contact: 8171000425, 7252022576
Web: www.genesis-tutorials.com
Email: info@genesis-tutorials.com

S. No	Metal	Metallo-Enzymes and Metallo-Proteins (-ase & -in)
1)	Fe (Heme)	Heamoglobin (Hb), Myoglobin (Mb), **Cytochromes** (Cyt-a, b, c; Cyt-P-450, Cyt-C-oxidase), Peroxidase, Catalase, Nitrite reductase, Tryptophan –dioxygenase.
	Fe (Non- Heme)	**Oxo–Bridged Fe–Proteins (OIP) & Enzymes** {Hemerythrin (Hr),Methane –Mono-Oxigenase (MMO), Ribonucleo –Reductase (RR)}. **Iron- Sulfur –Proteins (ISP)** {Ferridoxins(Fd), Rubredoxins (Rd), Aconitase, Sulfite reductase, Hydrogenases, CO Dehydrogenase, Nitrogenase.}. **Transport and Storage of Fe (TSI)** {Ferritin, Apoferritin, Transferrin, Hemocydrin, Siderophore}, Pyrocatechase, Xanthine oxidase.
2)	Cu	**Blue-Copper-Proteins (BCP) or Cupredoxins** {Hemocyanin(Hc),Ceruloplasmin (Cp) Plastocyanins(Pc) Stellacyanins (Sc), Azurin, Tyrosinase, Oxigenase.}; Cytochrome-C-oxidase, **Super-Oxide-Dismutage** (SOD), Nitrite-reductase, Amine-oxidase, Laccase, Galactose oxidase, Ascorbate oxidase, Dopamine- β-hydroxylase, Metallothionein (MT).
3)	Co	Glutamate mutage, Methionine synthetase, Dioldehydrase, Dipeptidase (Co^{II}), Vitamin-B_{12}(Co^{III}).
4)	Mn	Arginase, Oxalo-acetate decarboxylate, PS-II, Phosphotransferase.

44-Karanpur, Near Luxmi Narayan Mandir, Dehradun
Contact: 8171000425, 7252022576
Web: www.genesis-tutorials.com
Email: info@genesis-tutorials.com

5)	Zn^{II}	Carbonic acid anhydrase, Carboxypeptidase, Liver Alcohol Dehydrogenase (LADH), Alkaline phosphatage, Metallothionein, Super-Oxide-Dismutase(SOD) **DNA –Polymerase,** RNA-Polymerase, Aldolases, Peptidases, Proteases, Phosphatases, Transcarbamylases, Transphosphorylases.
6)	Mg^{II}	Activates Phosphotransferases (in ATP) and Phospho hydrolases, DNA –Polymerase, PS-I.
7)	Mo	Nitrogenase, Xanthine oxidase, Nitrate reductase, DMSO reductase, Sulfite oxidase, Formate dehydrogenase, Aldehyde Oxidases
8)	W	Ferridoxin –Aldehyde –Oxido reductase.
9)	Na	Activates Sodium – specific –ATP ase.
10)	K	Activates Pyruvate phosphokinase and k-specific –ATP ase.

44-Karanpur, Near Luxmi Narayan Mandir, Dehradun
Contact: 8171000425, 7252022576
Web: www.genesis-tutorials.com
Email: info@genesis-tutorials.com

"Two Metal Systems"

1) Cyt –C-Oxidase → Fe(Heme) & Cu
2) Nitrite reductase → Fe(Heme) & Cu
3) Nitrogenase → Fe (Non-Heme) & Mo.
4) Xanthine oxidase → Fe (Non-Heme) & Mo.
5) Super –Oxide – Dismutage (Cu- Zn- SOD) → Cu^{II} and Zn^{II}.
6) Metallothionein (MT) → Cu^{II} & Zn^{II}
7) Phosphotransferases →Mn and Mg. (PS-II& PS- I, respectively)
8) DNA –polymerases → Zn^{II} and Mg^{II}

S.No	Metallo-Proteins (Fe containing)	Nature of Fe Heme (H) & Non–Heme (N)	No. of Fe atoms bound Per molecule	Valence state	Straight Function
1.	Heamoglobin (Hb)	H	4	Fe^{2+}	O_2 transport in plasma.
2.	Myoglobin (Mb)	H	1	Fe^{2+}	O_2 storage In muscles.
3.	Transferrin	N	2	Fe^{3+}	Iron transport via plasma.
4.	Ferritin	N	0-4500	Fe^{3+}	Iron storage in Cells.
5.	Hemosiderin	N	5000	Fe^{3+}	Iron storage in cells.
6.	Catalase	H	-	Fe^{2+}	Metabolism of H_2O_2.
7.	Cytochrome-C	H	1	Fe^{2+}/ Fe^{3+}	Terminal oxidation.
8.	Per-oxidase	H	-	Fe^{3+}/ Fe^{2+}	Metabolism of H_2O_2
9.	Cytochromes & oxidase	H	-	Fe^{2+}/ Fe^{3+}	Terminal oxidation.
10.	Flavoprotein –Dehydrogenase— oxidases and Oxygenases.	N	-	Fe^{2+}	Oxidation reactions & incorporation of molecular di-oxygen.(O_2)

44-Karanpur, Near Luxmi Narayan Mandir, Dehradun
Contact: 8171000425, 7252022576
Web: www.genesis-tutorials.com
Email: info@genesis-tutorials.com

	Metallo-enzymes (Mo-containing)	**Straight Function.**
1.	Nitrogenases	N_2 to NH_3
2.	Aldehyde oxidases	R-CHO to R-COOH
3.	Nitrate Reductase	NO_3^- to NO_2^-
4.	Sulfite oxidase	SO_3^{2-} to SO_4^{2-}
5.	Xanthine oxidase	Xanthine to Uric acid.
6.	Formate Dehydrogenase	HCO_2H^- to $CO_2 + H_2O$
7.	DMSO reductase	Me_2SO to Me_2S.
8.	Carbonic anhydrase (Zn)	CO_2 to HCO_3^-