NPTEL Inorganic chemistry of life – *Principles and perspectives*

Week 5 - Assignment 5

W5_01. The ^{51}V NMR is well suited for identifying the its primary coordination sphere. What oxidation state is suited for this? What & how the primary coordination sphere is identified. Shine light on these aspects.

W5_02. Given the two redox reactions,

$VO^{2+} + 2H^{+} + e^{-} \rightarrow V^{3+} + H_2O \quad E^o = 0.3\ V$

$VO_2^{+} + 2H^{+} + e^{-} \rightarrow VO^{2+} + H_2O \qquad E^o = 1.0\ V$

Answer the following. (i) Identify the couple in (a) and also in (b). (ii) Compare both and tell which one of these redox couples is more favoured and why?

W5_03. During the superoxide dismutase activity of manganese enzyme, what type of oxidation state changes occur & why?

W5_04. At photosystem II, the two water molecules are converted to O_2 by the fourth manganese (i.e., the Mn that is located outside the cubane structure) and Ca^{2+}. If that were the case why should there be a tetra-manganese cluster. Give your reasons and then explain this in the context of the functioning of this enzyme at each pulse of the light.

W5_05. You have learned that the globin protein (in haemoglobin, Hb& myoglobin, Mb) prevents the formation of μ-oxo dimer. What is this μ-oxo dimer, how is it formed, how does the globin protein prevent its formation and what would be the end result if not prevented.

W5_06. Assuming that the O_2 stretching frequencies of free and bound to hemoglobin, hemerythrin and hemocyanin are ~1400, ~1150, ~850 and ~750 cm^{-1} respectively, comment on the nature of O_2 binding to these proteins and substantiate your answer accordingly