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,

\[
\text{VO}^{2+} + 2\text{H}^+ + e^- \rightarrow \text{V}^{3+} + \text{H}_2\text{O} \quad E^o = 0.3 \text{ V}
\]

\[
\text{VO}_2^+ + 2\text{H}^+ + e^- \rightarrow \text{VO}^{2+} + \text{H}_2\text{O} \quad E^o = 1.0 \text{ V}
\]

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.