

Chapter 1 Solutions

- 1) Had nickel been discovered in urease fifty years earlier, it might merely have been labeled an impurity. However, this discovery, once proven, would have demonstrated that metal ions can participate directly in enzymatic catalysis at a much earlier point in time. Metalloproteins would have been sought more aggressively – in short, earnest study in bioinorganic chemistry would have begun half a century earlier!
- 2) Anemia arises in blood cells from a reduced ability to transport dioxygen. Organisms can transport dioxygen by hemoglobin, hemerythrin or hemocyanin. The first two contain one or two iron ions in the active site, respectively. The third, hemocyanin, binds dioxygen at a bimetallic copper active site. A lobster, which is a mollusk, utilizes hemocyanin; in the context of this problem, anemia is due to insufficient hemocyanin in the blood cells. Thus, you should give your pet lobster a copper, not an iron, supplement.
- 3) Since the only oxidation state available to zinc is +2, the metal itself cannot act as a site for electron transfer (i.e. participate as a donor or an acceptor). However, a zinc-containing protein can still modulate or effect electron transfer. Cysteine contains a thiol side chain under physiological conditions, but is deprotonated when bound to zinc under the same conditions. In this way, zinc can modulate the nucleophilicity and oxidation potential of the cysteine sulfur. If two cysteines bind to a zinc ion, a disulfide bond can form with the concomitant release of two electrons.
- 4) Cardiolyte contains ^{99m}Tc , which is a metastable isotope of technetium with a half-life of 6 hours. A short-half life means that cardiolyte will release detectable particles in high contrast quickly and will not linger in the patient's tissue. A quick and strong signal-to-noise ratio and a lack of a prolonged radioactive presence are ideal qualities for an imaging agent.