

Round: 8B

1. Ocean acidification poses a major threat to ocean wildlife. Briefly describe how one of the ions produced from dissolving carbon dioxide in water can affect marine pteropods.

Marine pteropods have calcium carbonate shells (1 pt). The acidification process creates H^+ ions (2 pts) that consume carbonate ions in the shells of pteropods which slowly dissolves their shells (1 pt).

2. In an attempt to reduce atmospheric carbon dioxide concentrations, iron addition experiments have been carried out in various marine locations. Describe how the addition of iron to the ocean could be used to sequester atmospheric carbon dioxide.

The addition of iron to certain marine locations stimulates phytoplankton growth and productivity (2 pts) which in turn absorbs carbon dioxide from the atmosphere (2 pts). Carbon sequestration occurs as planktonic organisms that absorb the carbon dioxide die, sink to the ocean floor (2 pts) and become buried in the sediment (2 pts).

3. Which of the iron-containing metalloproteins pictured below plays the most significant role in the sequestration of atmospheric carbon dioxide? Explain its biochemical function.

Figure 1: Ferredoxin

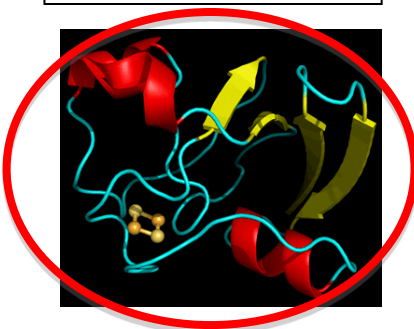


Figure 2: Myoglobin

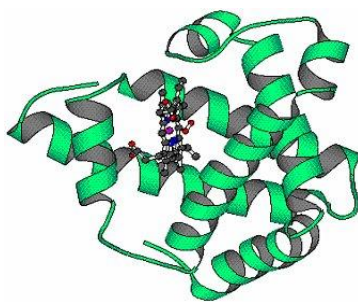
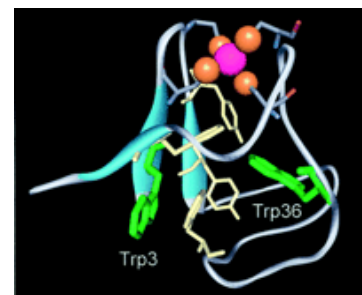


Figure 3: Rubredoxin



Correct protein: Figure 1: Ferredoxin (2 pts)

Accept either of the following for the explanation of biological function (2 pts)

- Ferredoxin is an enzyme cofactor in photosynthesis
- It mediates electron transfer in the photosystem complex in photosynthesis

4. Give an example of another trace metal that can be found in seawater from the North Pacific, and briefly describe how its concentration changes with depth.

*Accept any ONE of the following for a trace metal: Ni, Cu, Zn, and Cd (1 pt)
Trace metals such as Ni, Cu, Zn, or Cd show a very low concentration at the surface (1 pt) and gradually increases with depth until it reaches a maximum concentration (1 pt) between 1000 – 2000 m, after which the concentration no longer varies much with depth (1 pt).*

REFERENCES: Morel, F. M. M. and N. M. Price. 2003. The biogeochemical cycles of trace metals in the oceans. Science. 300(5621): 944-947. <http://www.pmel.noaa.gov/co2/story/What+is+Ocean+Acidification%3F>
<http://www.whoi.edu/oceanus/viewArticle.do?id=34167>