(1) Why is carbon used as the universal currency of biomass?
(2) What are the two coupled biological reactions that drive the carbon biogeochemical cycle? What additional biotic and abiotic reactions occur that influence the carbon cycle? What is the form of most carbon dioxide (DIC) in the oceans? Why?
(3) What are the major sources, sinks and pools of carbon in the global carbon cycle? Which pools are influenced by biology?
(4) What is the biological pump and how does it work? What are the implications of this carbon pumping?
(5) What factors influence the biological pump?
(6) What is the size and composition of DOC? How does its concentration compare to amount of “living” carbon? to DIC?
(7) What is its distribution in the ocean? What are the typical concentrations?
(8) How do DOC concentrations change over time? What is driving this change?
(9) How do DOC concentrations change across ocean basins? Why?
(10) What is producing/removing DOC?
(11) What fraction of DOC is characterized? What fraction is labile / refractory?
(12) What percentage of “new” production is DOC?
(13) How does DOC directly and indirectly contribute to the biological pump?
(14) Why are nitrogen and phosphorous the major nutrients required by cells?
(15) What are the various redox states of major nitrogen species? (What species of nitrogen are involved?)
(16) List the major biological transformation of nitrogen. What reactions liberate energy? Which require energy? What about the presence of oxygen? What organisms are involved?
(17) Draw the marine nitrogen cycle. What are the major pools, fluxes?
(18) Draw a typical depth profile of NO$_3$, DON and N$_2$ in the ocean? What processes are driving these patterns?
(19) What is “new” production? How is this concept linked to the microbial loop? How is new production calculated? What fraction of NPP is new? What processes are driving new production at station ALOHA?
(20) What is nitrogen fixation? Where is it occurring? Why is it not more prevalent in the oceans?
(21) Draw the marine phosphorous cycle. In what two ways does it differ from the nitrogen cycle?
(22) Draw a typical depth profile of SRP and DOP in the ocean? What processes are driving these patterns?
(23) What is the Redfield ratio? What are its applications and implications?
(24) Why is iron required by photosynthetic cells?
(25) What is the Redfield ratio, including iron?
(26) Where is iron limiting in the oceans?
(27) What techniques were used to test iron as a limiting nutrient?