

1. Terminologies commonly used in Chemical Oceanography (20%)

- (1) List major components of seawater. (5%)
- (2) Draw a depth profile of the concentration variation of a conservative-type element in the ocean. (5%)
- (3) Draw a depth profile of the concentration variation of a nutrient-type element in the ocean. (5%)
- (4) Briefly describe iron-limitation hypothesis [Hint: related to high-(micro) nutrient, low-chlorophyll areas]. (5%)

2. Oxygen concentrations in seawater. (40%)

- (1) Describe the importance of oxygen in the ocean. (5%)
- (2) Based on figure 1, how does the oxygen concentration in seawater vary with depths, latitudes and between the two ocean basins? (10%)
- (3) Plot an oxygen depth profile controlled only by oxygen solubility. Use the oxygen solubility provided in Table 1 and the temperature profile provided in figure 2. (10%)
- (4) Discuss the difference between the measured (Fig. 1 b, ATL 10°N) and your plotted profile. (10%)
- (5) List all possible factors controlling the concentration of oxygen in the ocean. (5%)

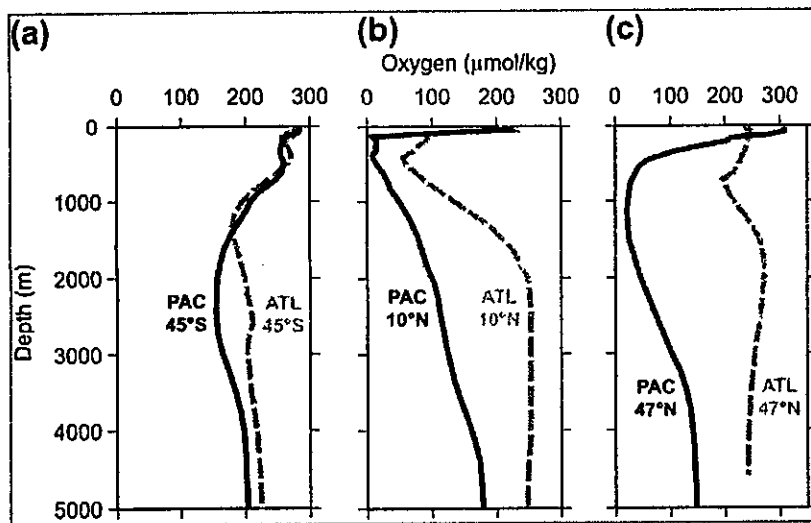


Figure 1. Oxygen concentrations in seawater.

t°C	μmol kg ⁻¹
0	346.5
5	308.1
10	274.8
15	247.7
20	225.2
25	206.3
30	190.3

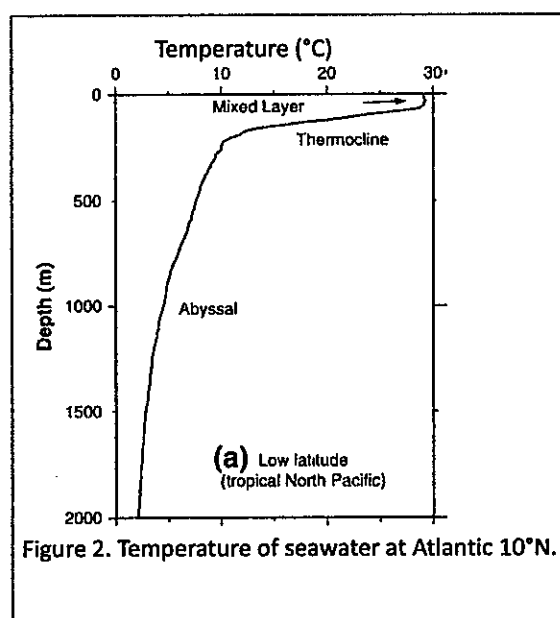


Figure 2. Temperature of seawater at Atlantic 10°N.

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3. CO₂ in the ocean. (40%)

- (1) Based on figure 3, how does CO₂ concentration vary with time in the atmosphere, and in the Station Aloha seawater (i.e. Subtropical North Pacific)? [Hints: seasonal variations versus long-term trend]. (10%)
- (2) What happens when CO₂ dissolves in seawater? [Hint: bicarbonate and carbonic acid] (10%)
- (3) List all possible factors controlling the CO₂ concentrations in the ocean. (5%)
- (4) Why would the increase in ocean CO₂ concentrations result in a decrease in pH? (10%)
- (5) Does the ocean water at Station Aloha become "acidic" in 2008? Why or why not? (5%)

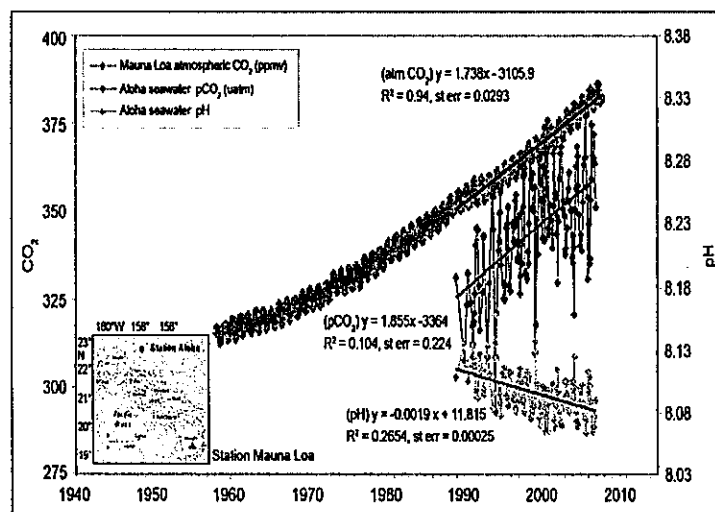


Figure 3. CO₂ concentrations in the atmosphere and CO₂ & pH in North Pacific seawater.

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