

NAME:

December 3, 2010

EAS-4300 Oceanography Extra-credit study questions

The questions may have more than one answer so it is important that you explain when asked to do so. However try to be brief and succinct.

There are questions on 5 topics. You can gain up to a total of 9 points on your midterm score.

This homework is due Monday December 6 at class time. Bring a printed copy to hand in.

WARNINGS:

- 1) No late homework will be accepted under any circumstance.**
- 2) If you cannot make it to class you need to email your homework to the TA by 10:00AM Monday morning.**

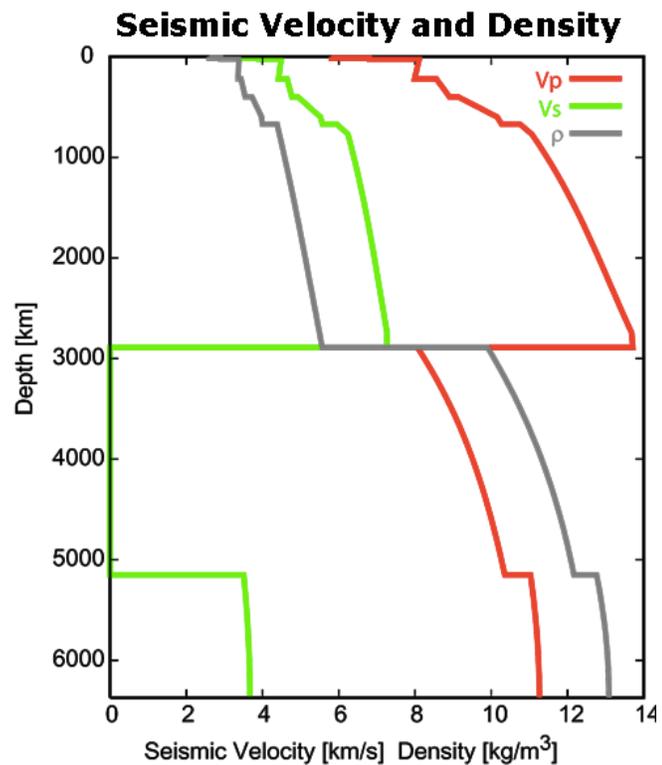
1. OCEAN PHYSIOGRAPHY AND PLATE TECTONICS (2 pt.)

A) Discuss the different layers of the Earth from the surface of the planet to the core in terms of both their chemical and physical properties.

B) List and explain the type of seismic waves, and how they are used to learn about the earth interior.

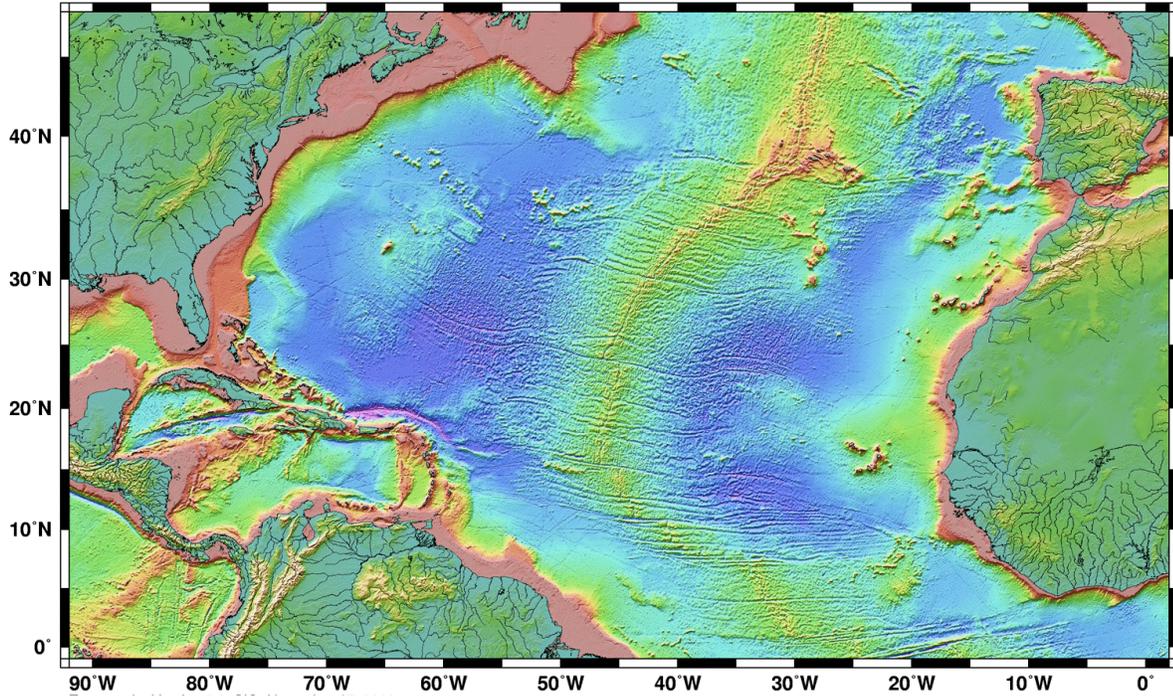
C) The diagram below shows the velocity of two types of seismic waves. Label the waves and explain what happens in each layer where the waves velocity exhibit a sharp change. What can we infer from this diagram about the different internal layers of the Earth?

Combining information from many seismic waves we can get a detailed internal structure of the earth.

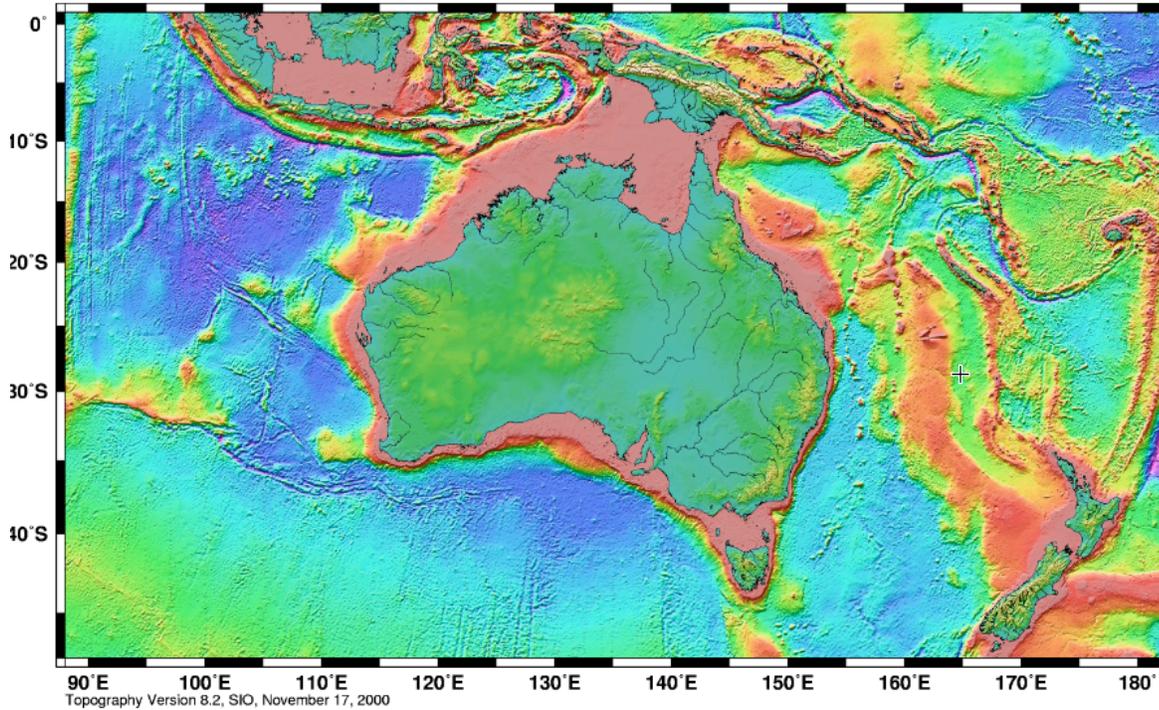


D) Below is are two topographic map (Map1 & Map2) obtained from satellite data of the ocean floor at very high resolution.

MAP1



MAP2



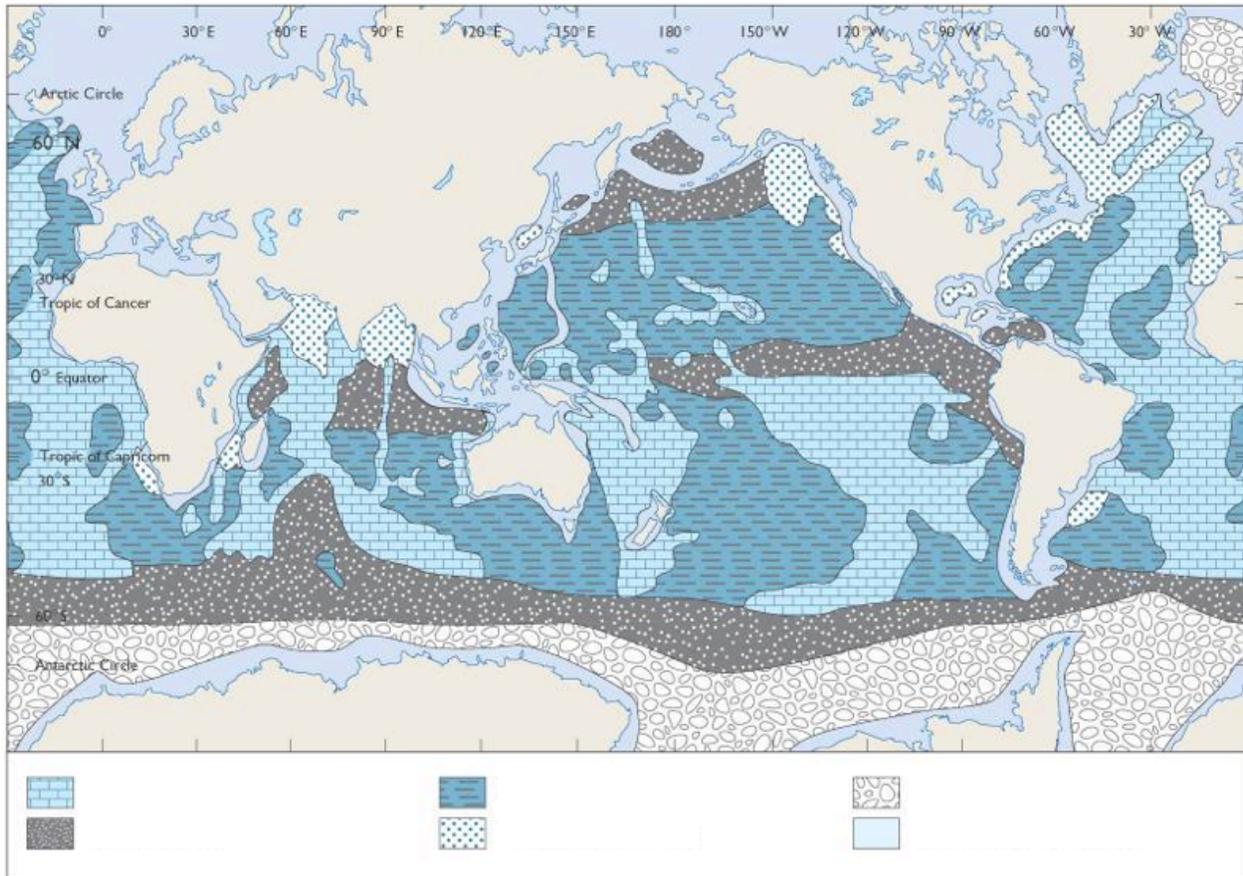
D1) Describe how satellites are able to measure the depth of the ocean floor and discuss how this is different from ship-based depth sounding.

D2) On each map label the main physiographic elements such as and briefly describe their characteristics.

D3) Label and discuss major structures that are important for understanding plate tectonics (e.g. type of plate boundaries, direction of movement of plate when possible to determine, volcanic arcs).

2. MARINE SEDIMENTATION (1 pt.)

A) Below is a map showing the distribution of 6 type of marine sediments.



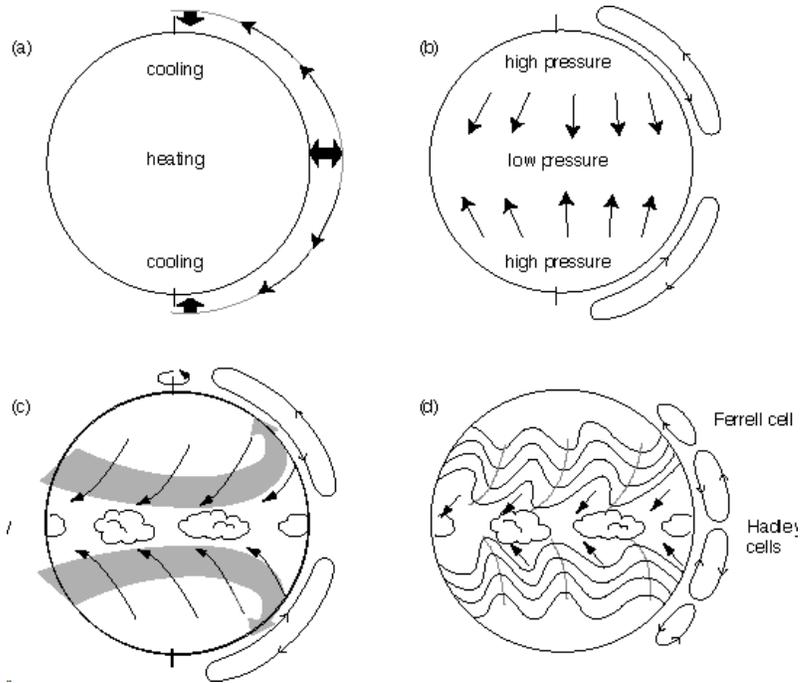
(a) DEEP-SEA SEDIMENT DISTRIBUTION

B) Label and identify on the map the type of marine sediment and describe what they are.

C) What factors determine the pattern of the siliceous oozes. Explain.

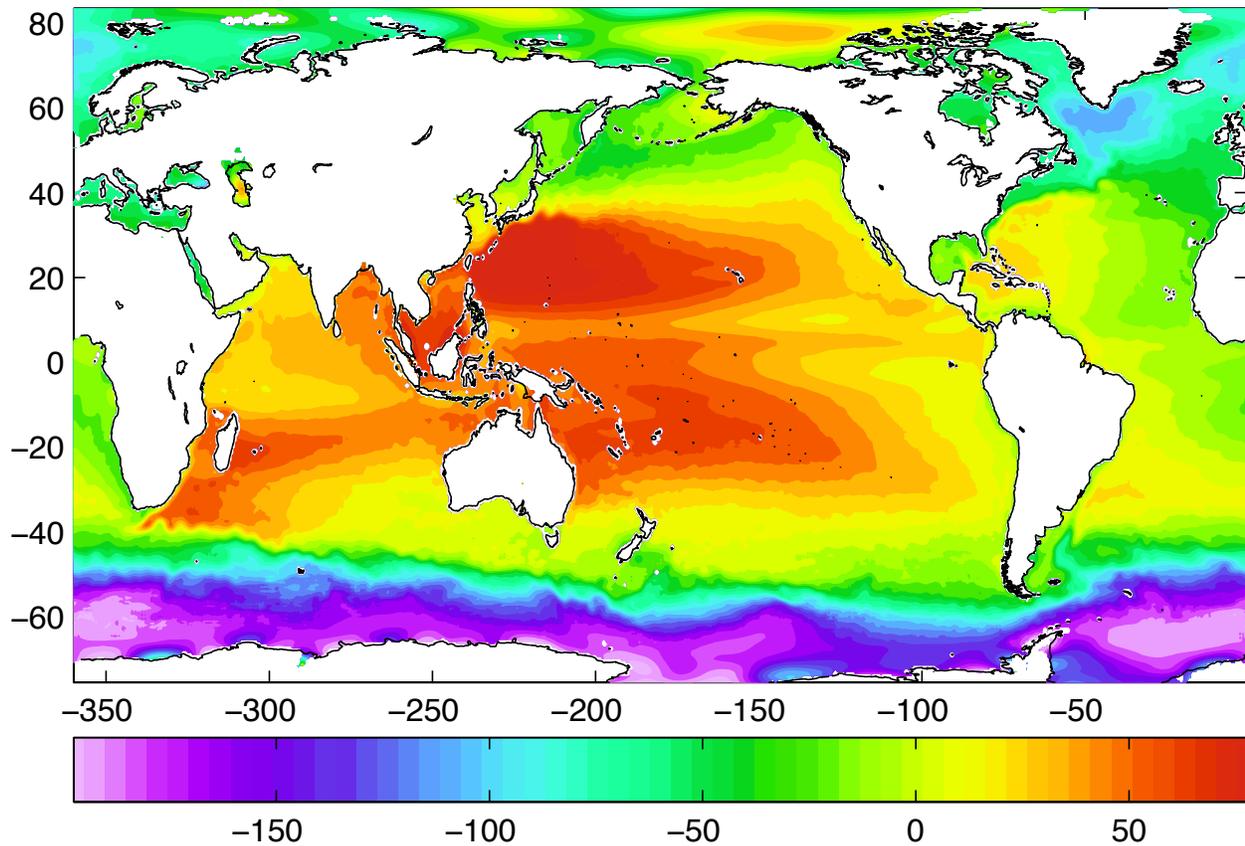
3. ATMOSPHERIC and OCEAN CIRCULATION (3 pt.)

A) Briefly describe the four conceptual steps needed to explain the mean circulation of the atmosphere as we discussed in class (see diagram on the right for help a,b,c,d). Careful: not all steps include rotation. As you list the 4 steps indicate when and how the trade winds and westerly winds are established. (Write on the back of the page if needed).



B) The map below shows a of mean Sea Level Height obtained by combining satellite and drifter observations.

B1) Draw the geostrophic currents that are consistent with the pressure gradients associated with this sea level map.



B2) Label the main gyre circulations that are evident in this map, the main western boundary current with their names, and the eastern boundary currents.

B3) What is the difference between geostrophic currents and Ekman currents? What is the difference between Ekman currents and Ekman transport?

C) Ocean vortices can persist in the ocean for a very long time (many years). In the map below draw the balances of forces for a cyclonic low-pressure and anticyclonic high pressure systems in the northern hemisphere. Draw also the sense of rotation for each case and explain the reason why they last for such a long time.

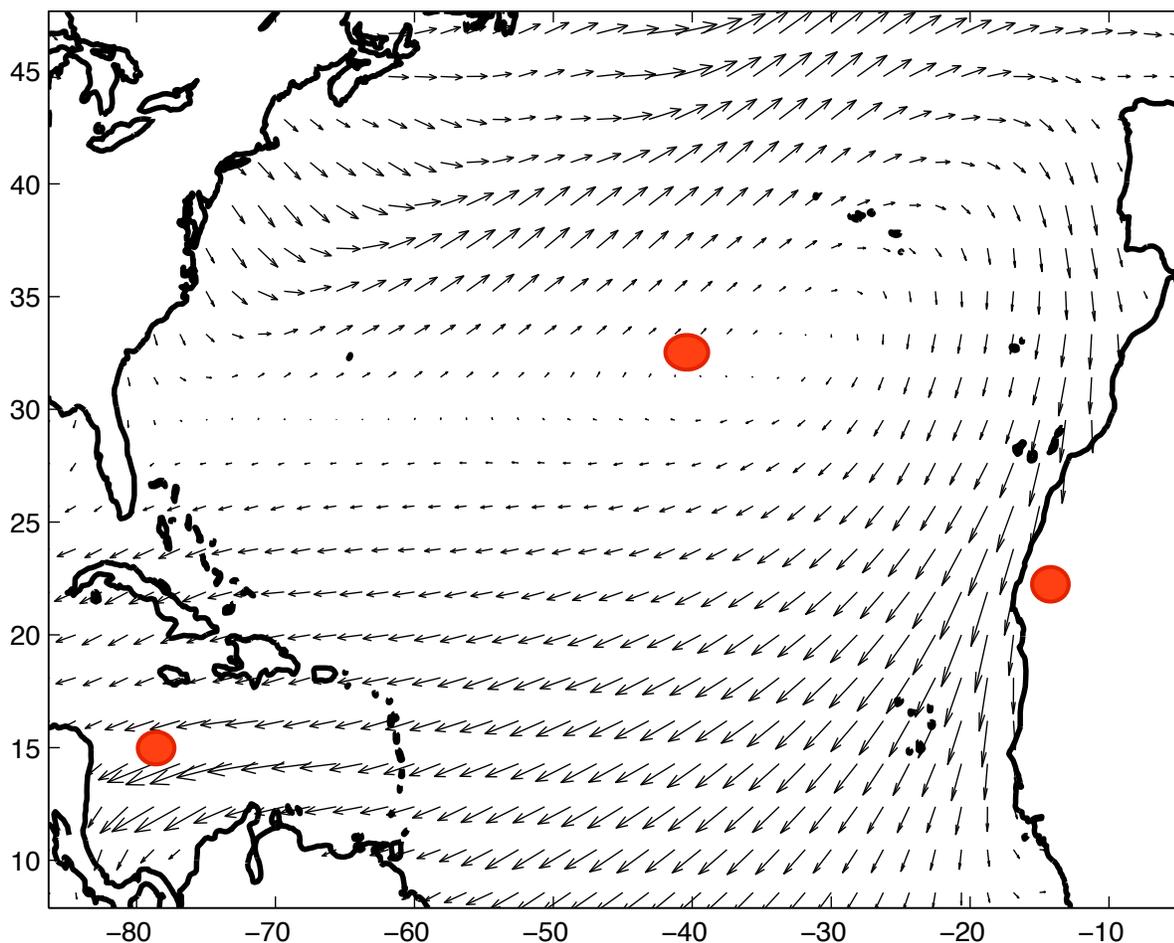
Vortices



Low Pressure System

High Pressure System

D) Below is a map of surface wind stress over the ocean. Draw the Ekman currents that are consistent with these winds. At the red locations draw an arrow indicating the direction of the Ekman transport and label if it is a region of upwelling or downwelling.

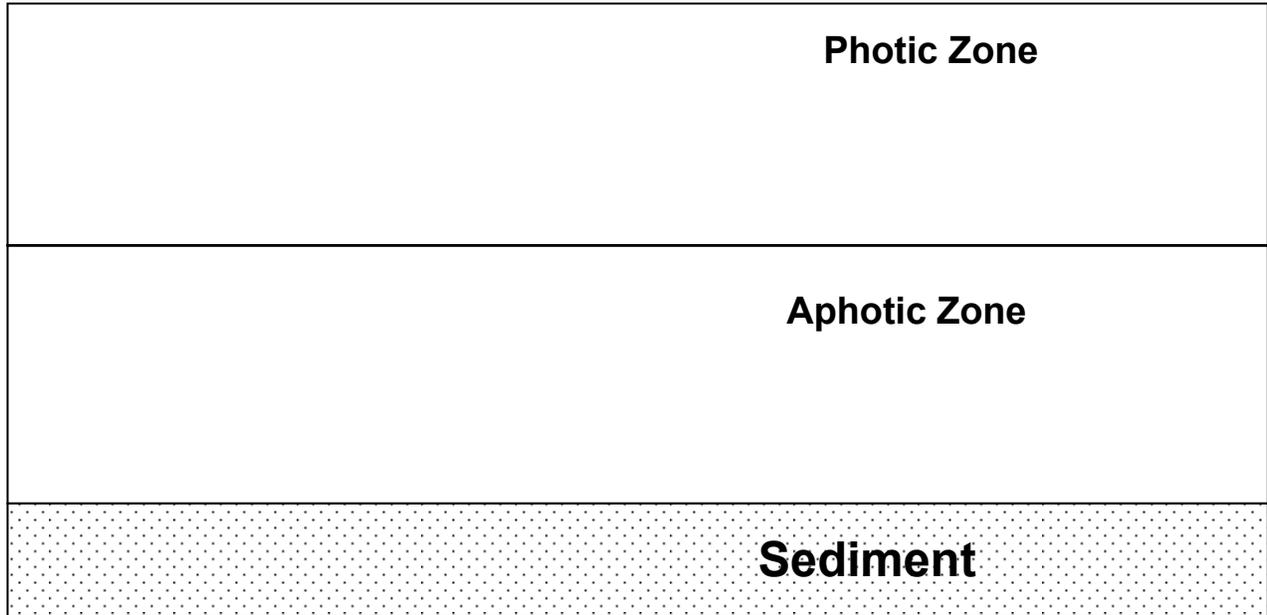


4. BIOLOGICAL OCEANOGRAPHY (1 pt.)

A) In the diagram below draw a schematic of nutrient cycling in the biological system and sediment in the ocean. In the arrows you will draw indicate if the transfer of mass is associated with organic or inorganic matter.

A1) With a different color insert in the diagram where nitrogen fixation and denitrification occur.

Draw Nutrient Cycling Diagram

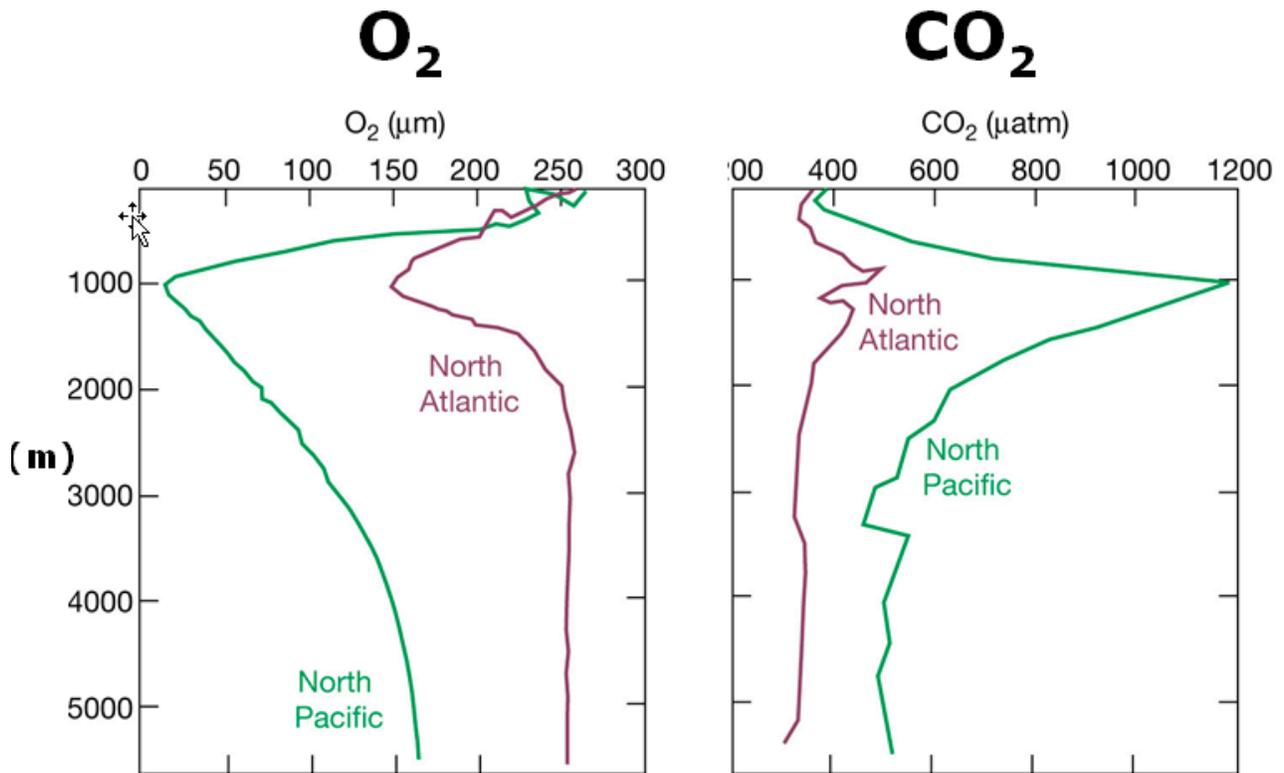


B) Discuss briefly the role of bacteria in nutrient cycling.

C) Also what special property makes bacteria vital in hydrothermal vents?

5. CARBON CYLCE (2 pt.)

A) Below are typical profiles of oxygen and carbon dioxide in the Atlantic and Pacific Ocean.

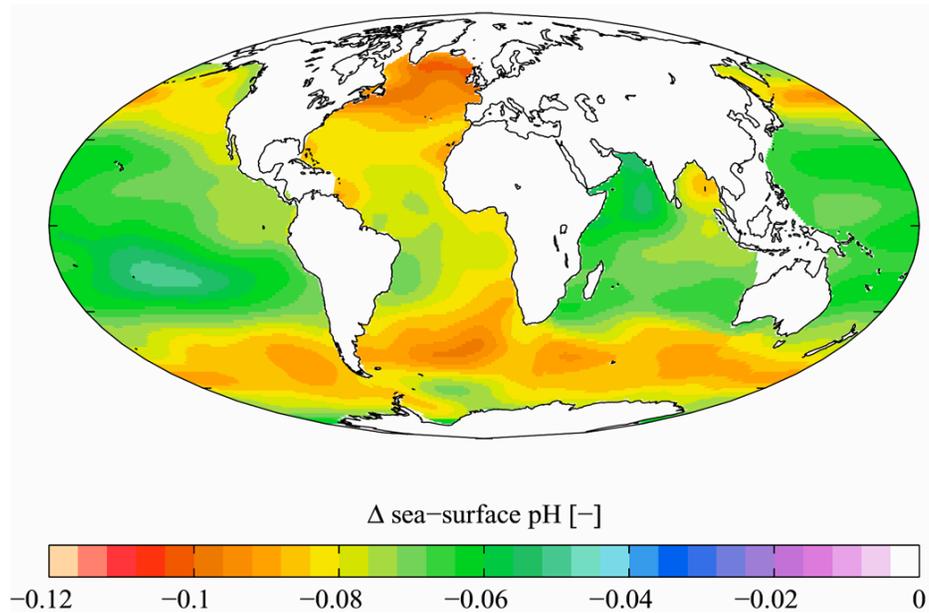


A1) Describe the physical/chemical/biological dynamics that contribute to shaping these profiles.

A2) Explain why the deep North Pacific oxygen content is so much lower than the Atlantic.

B) Below is a map of ocean acidification trends.

**Ocean Acidification: Change in pH
between 1751 and 1994
(up another ~10% if until 2009)**



B1) Explain the global trend in the ocean pH towards more acidic conditions.

B2) Explain why the North Atlantic and the Southern Ocean exhibit stronger trends in pH.