GEOL. 4060/5060: Oceanography Mid Term, Feb 25, 2008, 2:00pm

***Preamble**:*

*You must answer all questions, (in some cases only A **or** B). Each question has equal value. This is a closed book, 50-minute exam. Think and write clearly. Point form is fine but use logical phrasing.*

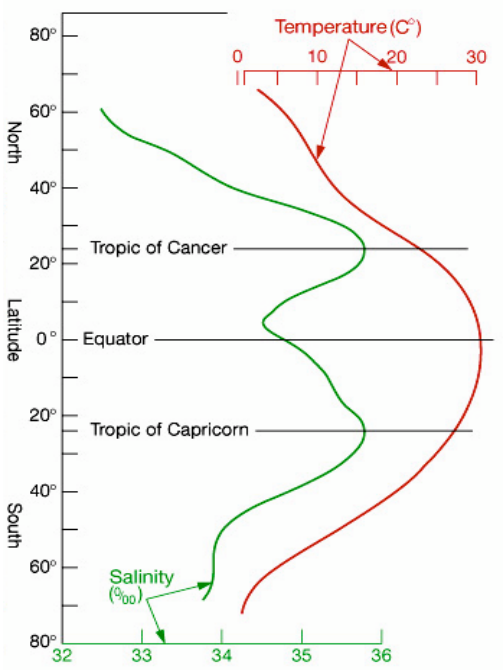
Q1. Answer part A **or** part B.

1A. How are continental shelves formed? … Submarine canyons formed? … Continental rises formed?.

Or

1B. Name four major and distinguishing features of a mid-ocean ridge and describe how these features develop.

Q2. Name and discuss the processes that affect seawater salinity. How do these processes explain the following seawater patterns:



Q3. Answer part A **or** part B.

3A. What is the following equation and what do the various terms mean?

$$\frac{du}{dt} = -\frac{1}{\rho}\left(\frac{dp}{dx} + \rho f v + \frac{d\tau_x}{dz} - F_x\right) \quad \text{where} \quad F_x = A_x\frac{\partial^2 u}{\partial x^2} + A_y\frac{\partial^2 u}{\partial y^2} + A_z\frac{\partial^2 u}{\partial z^2}$$

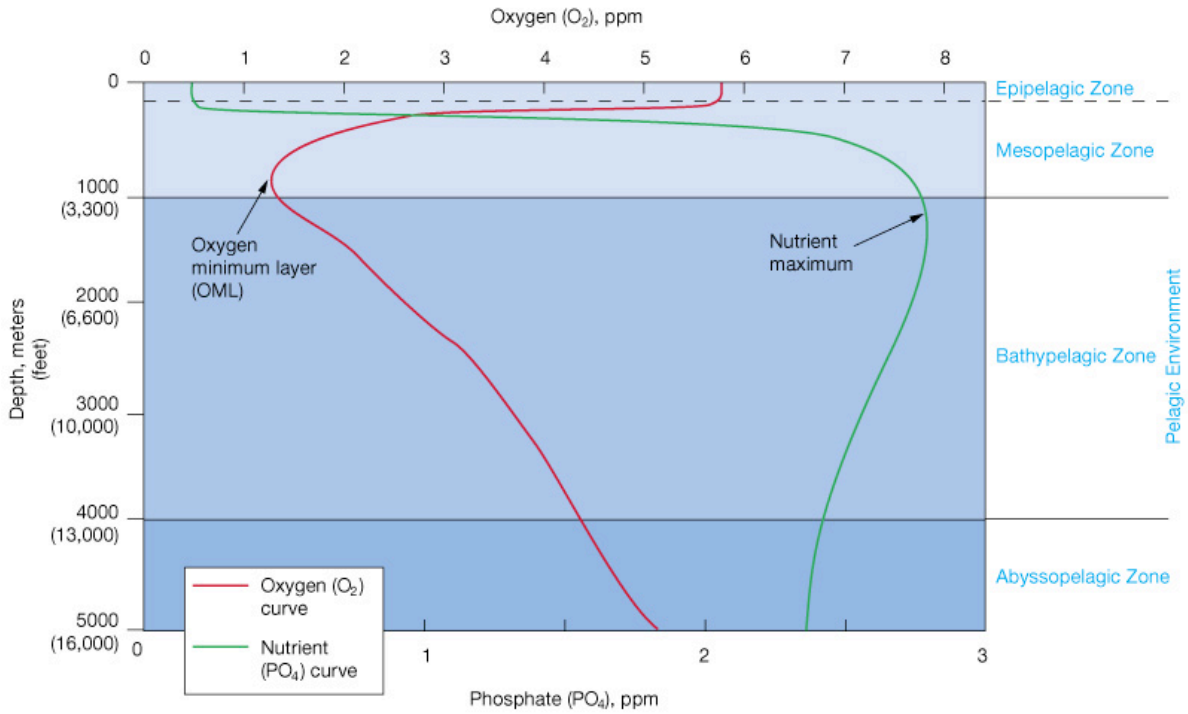
Or

3B. What is the following equation and what do the various terms mean?

$$\underbrace{\frac{\partial S}{\partial t}}_{1} = \underbrace{-\underbrace{\frac{\partial uS}{\partial x}}_{2} - \underbrace{\frac{\partial vS}{\partial y}}_{3} - \underbrace{\frac{\partial wS}{\partial z}}_{4}}_{7} + \underbrace{\underbrace{\frac{A_h}{\rho}\left(\frac{\partial^2 S}{\partial x^2} + \frac{\partial^2 S}{\partial y^2}\right)}_{5} + \underbrace{\frac{A_z}{\rho}\left(\frac{\partial^2 S}{\partial z^2}\right)}_{6}}_{8}$$

Q4. Answer part A or part B.

4A. Oxygen and nutrient profiles: What is the relationship between the oxygen profile and the nutrient profile in the figure? Why is there an oxygen minimum layer (OML)? Why are the surface waters and bottom waters relatively high in O_2? Why are surface waters depleted in many nutrients and reach a maximum deeper in the water column?



Or

4B. Why can water masses, such as Antarctic Bottom Water and North Atlantic Deep Water, be distinguished based on their T (temperature) and S (salinity) signatures? How can we take advantage of these signatures? For each of the following constituents of our oceans indicate whether it is a conservative or non-conservative property and under what circumstance it could be altered: nitrate, oxygen, temperature, salinity, and phosphate.

Q5. Answer part A or part B.

5A. What is Dynamic Topography? What is the relationship between dynamic topography and geostrophic currents.

Or

5B. What are major differences between the surface layer circulation in the Atlantic Ocean from both the Pacific Ocean and the Indian Ocean.