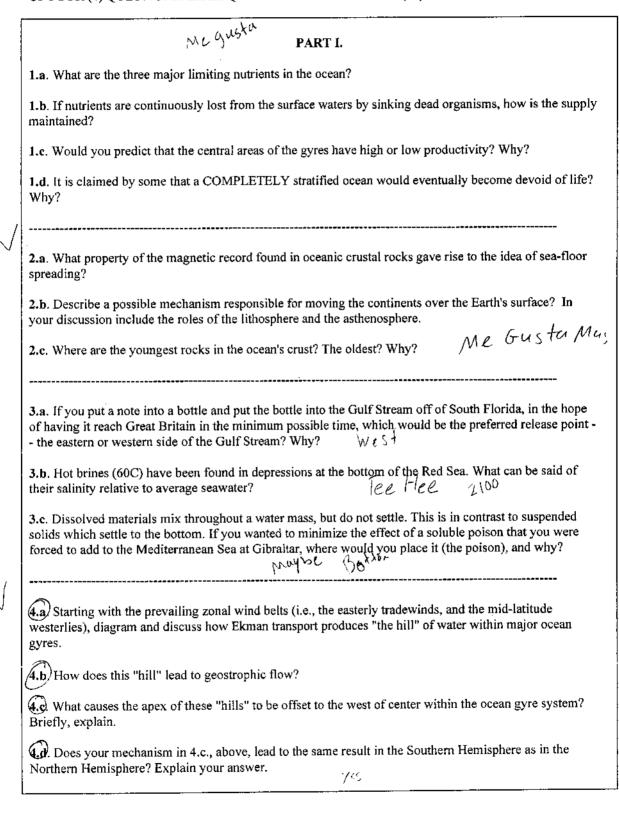
INSTRUCTIONS. PART I AND PART II EACH CONTAIN FOUR QUESTIONS. ANSWER TWO (2) QUESTIONS FROM PART I. ANSWER TWO (2) QUESTIONS FROM PART II. ANSWER A TOTAL OF FOUR (4) QUESTIONS. EACH QUESTION IS WORTH FIFTY (50) POINTS.



## PART II.

- 5.a. In the open ocean away from coastal areas, rank the following regions in terms of phytoplankton productivity: 1) tropics; 2) polar regions; and 3) temperate and sub-polar zones [i.e., which has greater(lesser) productivity?]. Give reasons for your rankings.
- 5.b. Plot the seasonal progression (i.e., over a year) of phytoplankton biomass for the three regions in 5.a., above -- tropics, polar, and temperate/sub-polar.
- **5.c.** What is the compensation depth? How does this interact with other parameters in phytoplankton bloom formation?
- 6.a. Name two important physical characteristics of the deep-sea environment. How are these physical characteristics important for organisms living in the deep sea?
- **6.c.** What is a hydrothermal vent and how is it formed? Draw a diagram. What is the source of primary productivity at hydrothermal vents?
- 7.a. Define what is meant by the term "rocky intertidal"? Name three organisms that live in the rocky intertidal.
- 7.b. What is meant by the phrase "zonation in the rocky intertidal"? Give an example.
- 7.c. What limits the success of organisms in the high intertidal? In the low intertidal? How are these limits related to zonation (see 7.b., above)?
- 8.a. Food webs (or food chains) consist of species acting at several trophic levels. Briefly, define what is meant by the term "trophic level". Give an example of a trophic level in a specific food web (or food chain).
- 8.b. Individuals at a given trophic level are inefficient. Only a small fraction of the energy at one level is made available to the next trophic level. What are the specific processes (or specific mechanisms) that make this transfer less than 100% efficient?
- **8.c.** If a killer whale is a third level carnivore, how much phytoplankton biomass (in kilograms) is required to add each kilogram of new biomass of the whale? Include a diagram.