1. Sketch an idealized picture of the deep ocean circulation pattern. Identify areas of deep water formation and upwelling. (10%)
2. Sketch a map of the ocean currents in the north Pacific (10%)
3. Sketch a map of the surface current circulation in marginal seas surrounding Taiwan and describe the characteristics of basic hydrography (10%)
4. Discuss the types of marine pollutants and sketch a map of their pathways to the sea and food train transfer (10%)
5. Describe the role of marginal seas acting as a source or sink for atmospheric CO_2. How about the air-sea exchange of CO_2 in the East China Sea and South China Sea? Both marginal seas have different environmental setting, so that please illustrate the critical processes controlling the carbon cycling. (20%)
6. Describe and explain briefly the effect of the El-Niño event on the hydrographic and biological conditions of the South China Sea in the following diagram which data were observed at the SouthEast Asian Time-series Study (SEATS) station (18°N, 116°E) in the northern South China Sea (SCS) (20%)

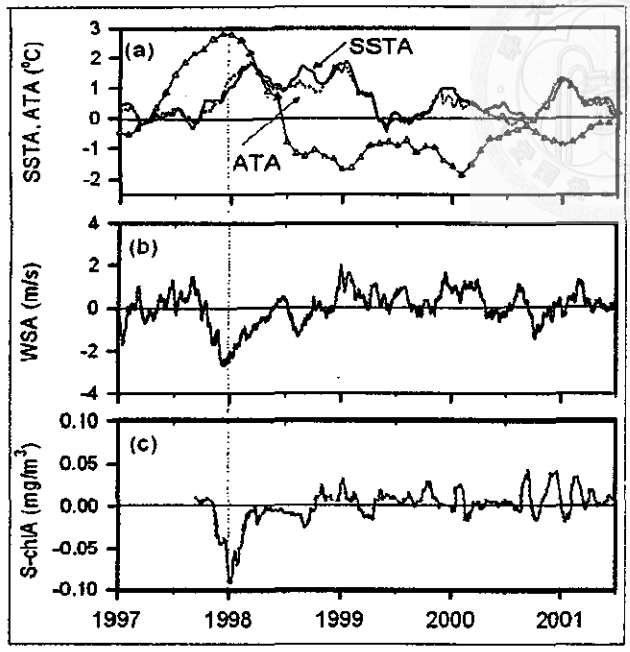

Figure: Anomalies in (a) SST (SSTA, -•–), AT (ATA, ...) and Nino 3.4 (-△-), (b) WS (WSA, -•–) and (c) S-chl (S-chlA, -•–) between 1997 to 2001. The vertical dashed lines through the figure indicate the times in the mature phase of the El-Niño.

(SST: Sea Surface temperature; AT: Air temperature; WS: Wind speed; S-chl: Surface chlorophyll-a)

7. Define and briefly explain the following terms: (20%)

a) Practical salinity.
b) Revelle factor
c) Lysocline
d) Denitrification
e) Primary production
f) New production
g) Biogeochemical cycling
h) Redfield ratio
i) Solubility pump
j) Continental shelf pump

試題隨卷繳回