1. Please describe the types of vertical profiles of dissolved elements in the ocean and their controlling processes and give 5 examples (e.g., elements) in each case (20%)

2. Please answer the following questions (20%):

   (1) Calculate the solubility of elemental mercury (Hg^0) for an atmospheric Hg^0 concentration of 3 ng/m^3 at the 25 ^{0}C surface freshwater at the following conditions:

   a. pK_H (Henry coefficient) = 2.6 (partial pressure Hg vapor (atm)/(mole fraction Hg dissolved))
   b. R (gas constant) = 0.082 (L · atm)/(mole · K)
   c. Mole weight of Hg: 200.6

   (2) Calculate the % saturation of Hg when the Hg^0 concentration in water is about 200 fM (10^{-15}M) and explain the result for the direction of the flux of Hg^0 across the air-water interface.

3. Describe and explain briefly the effect of the East Asian monsoon on the gaseous elemental mercury (GEM) concentration over the South China Sea (SCS) in the following diagram which data were observed during the SouthEast Asian Time-series Study (SEATS) cruises in the northern SCS (20%)

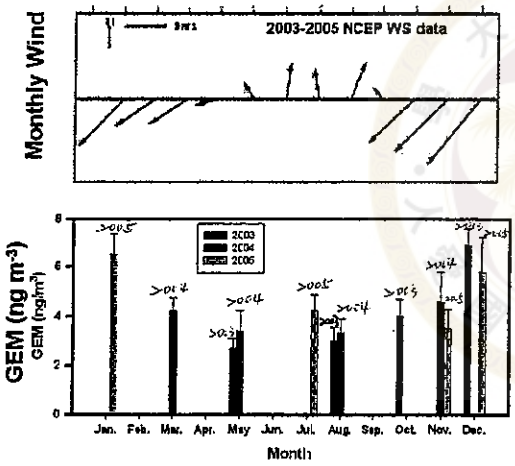

Figure: Summary of (a) climatology monthly wind field data (2003~2005) provided by the NCEP (National Center for Environmental Prediction) and (b) monthly averaged GEM over the northern SCS data for 12 cruises between 2003 to 2005. Errors are ±1 SD.

4. Please calculate the concentrations of the different forms of inorganic carbon in one seawater sample if this sample was found to have the following properties: TA (total alkalinity): 2.3 meq/L (assume as same as carbonate alkalinity); TCO_2 (total inorganic carbon) = 2.1 mM and the following constants: α: 0.34 (mole/L/atm), pK_1'=6, pK_2'=9 (20%).

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

a) Rule of constant proportion.
b) Thermohaline circulation
c) Apparent oxygen utilization
d) Denitrification
e) Chemosynthesis
f) New production
g) Biogeochemical cycling
h) Redfield ratio
i) Carbonate alkalinity
j) Residence time of elements in sea water

試題必須隨卷繳回