

國 立 清 華 大 學 命 題 紙

97 學年度 生醫工程與環境科學 系(所) 乙(環境分子科學) 組碩士班入學考試

科目 環 境 化 學 科目代碼 2605 共 1 頁第 1 頁 \*請在【答案卷卡】內作答

- (1) Please define or explain the following terms (30%)
- (A) Ionic liquid
  - (B) Breakpoint chlorination
  - (C) Schulze-Hardy rule
  - (D) Emerging pollutants
  - (E) Critical micellar concentration (CMC)
  - (F) Industrial ecology
- (2) Bicarbonate buffer is the major buffering system in natural water. In summer time, the pH values of the natural water with an alkalinity of 2 mM increases from 7.0 to 10.0.
- (A) Please calculate the change in concentrations of  $[\text{CO}_2^*]$ ,  $[\text{HCO}_3^-]$ , and  $[\text{CO}_3^{2-}]$ . (10%)
  - (B) Please calculate the buffer capacity. (5%)
- (3) Marine and riverine sediments are typical environmental porous materials which can accumulate contaminants onto the surface or interstitial water. The methane concentration in interstitial water in sediment samples was found to be 150 mg/L at STP.
- (A) Please describe the formation processes of sediments. (5%)
  - (B) Assuming that the methane was produced by the fermentation of organic matter,  $\{\text{CH}_2\text{O}\}$ . What weight of organic matter was required to produce the methane in a liter of the interstitial water? (5%)
- (4) A number of processes are being used to remove gaseous pollutants from fuel from stack gas after combustion. Limestone is often used to neutralize sulfur dioxide produced from the combustion of coal. Now  $100 \text{ m}^3$  of coal containing 2% S was burned daily. Please calculate the mass of limestone needed for neutralizing sulfur dioxide if gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) is the final product. (10%)
- (5) Please plot the emission of pollutants from exhaust gas of car as a function of air/fuel ratio. Use octanol as an example, verify your results. (10%)
- (6) Adsorption is one of the important processes influencing the fate and transport of metal ions in soils.
- (A) Why are only clay minerals concerned for adsorption? (7%)
  - (B) Please discuss the adsorption ability of hard metal ions, soft metal ions and anions onto the surface of clay soil. (8%)
- (7) The Winkler method is the most often used method for determination of dissolved oxygen in solution. Please write the equation of Winkler method in the presence and absence of oxygen in solution (10%).