

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 環境科學與工程 科目代碼 2602 共 1 頁第 1 頁 \*請在【答案卷卡】內作答

- (1) Please compare the following terms and briefly explain their environmental meanings (50%)
- (A) Pollutants vs Contaminants
  - (B) Maximum Contamination Level vs Maximum Contamination Level Goal
  - (C) Primary vs Secondary air quality standard
  - (D) Oxidative Phosphorylation vs Substrate Level Phosphorylation.
  - (E) Nitrification vs Denitrification.
  - (F) Antagonism vs Synergism.
  - (G) Priority Pollutants vs Hazardous Air Pollutants
  - (H) Flocculant Settling vs Hindered Settling.
  - (I) Air Sparging vs Permeable Reactive Barrier.
  - (J) Estuary vs Wetland.
- (2) An analysis of water from a surface stream yields the following results
- |                                    |                                       |
|------------------------------------|---------------------------------------|
| $\text{Ca}^{2+} = 60 \text{ mg/L}$ | $\text{HCO}_3^- = 115 \text{ mg/L}$   |
| $\text{Mg}^{2+} = 18 \text{ mg/L}$ | $\text{SO}_4^{2-} = 108 \text{ mg/L}$ |
| $\text{Na}^+ = 7 \text{ mg/L}$     | $\text{NO}_3^- = 10 \text{ mg/L}$     |
| $\text{K}^+ = 20 \text{ mg/L}$     | $\text{Cl}^- = 20 \text{ mg/L}$       |
- (A) If an error of 7 percent is acceptable, should the analysis be considered complete? Discuss the possible reasons if the error is unacceptable (5%)
  - (B) Please calculate the weight of lime and soda ash needed to removal the hardness in a liter of water. (10%).
- (3) A typical side-loaded compactor truck has a capacity of  $5 \text{ m}^3$ . Estimate the maximum number of residences it can serve per week by assuming 3 trips per day and 4 days a week. (7%)
- (4) A wastewater contains trichloroethylene (TCE) with an initial concentration of  $1200 \mu\text{g/L}$ .
- (A) Please propose a chemical process that can effectively remove TCE in wastewater. (8%)
  - (B) According to the strategy you proposed, a batch reactor is used to treat TCE. The reaction of TCE is found to be first order, and the rate constant is  $0.25 \text{ d}^{-1}$ . Please determine the hydraulic retention time (HRT) required to convert 90% of TCE. (5%)
  - (C) Determine the HRT again if plug flow reactor is used to treat TCE. (5%)
- (5) Please answer the following questions:
- (A) Please derive the Stokes equation. (6 %)
  - (B) What is the settling velocity of a particle having a Stokes diameter of  $10 \mu\text{m}$  and a density of  $2.5 \text{ g/cm}^3$  in air at 1.0 atm and  $0^\circ\text{C}$ . The density and viscosity of air at  $0^\circ\text{C}$  are  $1.29 \text{ g/L}$  and  $170.8 \mu\text{poise}$ , respectively. (4%)