

系所組別：環境工程學系甲組

考試科目：環境化學及環境微生物學

考試日期：0307，節次：2

※ 考生請注意：本試題  可  不可 使用計算機**Problem Sets for Environmental Chemistry**

- 一、 **Water Softening.** The goal of a lime-soda softening plant is to remove hardness from the water by precipitation of  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  ions, respectively. However, this is achieved by adding lime (calcium hydroxide) and soda ash (sodium carbonate) to the water. So, if one of the goals is to remove  $\text{Ca}^{2+}$ , why is calcium in the form of lime added to the water? (10 pts).
- 二、 **Endocrine disruptors.** Please define "endocrine disruptors" and explain their mechanisms causing human health problems. Please identify/list endocrine disruptors from the following compounds: (1) nonylphenol, (2) para-dichlorodiphenyltrichloroethane, (3) dioxin, (4) di-2-ethylhexyl phthalate, (5) tributyl tin. (15 pts).
- 三、 **Solubility.** Polychlorinated biphenyls (PCBs) are a mixture of over 200 individual compounds and these pollutants have been spread widely throughout the environment. If the concentration of PCB-105 (one of the individual compounds) was  $300 \text{ pmole/m}^3$  in the air above a large lake and the concentration in the surface water of the lake was  $100 \text{ pmole/m}^3$ , would this compound tend to move from the water into the air or from the air into the water? Please clearly explain your answer using the following information: The Henry's law constant for this compound is  $10 \text{ mole/L-atm}$  and assume the air/water temperature is  $25^\circ\text{C}$ . (10 pts).
- 四、 **Chemical Reaction Kinetics.** A treatability study is run to investigate the rate at which a hazardous chemical can be treated. The following data are collected at  $25^\circ\text{C}$ . (a) Is this a zero-, first- or second-order reaction? (b) What is the rate constant for this reaction? (c) What is the half-life for this reaction? (d) How long will it take for 99% of the chemical to be removed? (15 pts).

Time (days)	Concentration of Chemical (mg/L)
0	10000
1	8100
3	5600
5	3600
7	2200
10	1400

(背面仍有題目,請繼續作答)

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- (a) Sludge bulking
- (b) Anammox process
- (c) Cometabolism
- (d) Reductive dechlorination
- (e) Anaerobic digestion pathway
- (f) *Methanosaeta*
- (g) Fluorescence *in situ* hybridization
- (h) Chemoorganoheterotroph

**六. Analysis of indicator microorganisms is the current practice to monitor the fecal contamination, ensuring the safety of drinking water. Traditionally, the indicator microorganisms are analyzed by the incubation method with selective media.**

- (a) Which three of related bacterial groups are commonly used as indicator microorganisms for drinking water quality? (6%)
- (b) Please describe the analytical procedure of the indicator microorganism in detail. (10%)

**七. Please indicate five possible microbial interactions that possibly take place in the biological wastewater treatment process (10%)**