

國 立 清 華 大 學 命 題 紙

98 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 2402 共 1 頁第 1 頁 *請在【答案卷卡】內作答

1. Define and explain the following terms and, if necessary, write out the structural formula for each of the following compounds: (50%: 5 pts of each)
 - (A) Criteria air pollutants and nonattainment areas
 - (B) Secondary air pollutants and secondary maximum contaminant levels for drinking-water standards
 - (C) Baghouse and electrostatic precipitation (ESP)
 - (D) Draw a dose-response curve and mark LD_{50} and NOAEL
 - (E) HI and RfD
 - (F) Peroxyacetyl nitrate (PAN) and trihalomethanes (THMs)
 - (G) CFC-12 and HCFCs
 - (H) PAHs and PCBs
 - (I) Coding system for plastic bottles and describe at least five numbers (examples)
 - (J) Sketch a municipal wastewater treatment plant, labeling the major parts and explaining their functions
2. Describe the biogeochemical cycle of nitrogen in the aqueous environment with a figure. List and explain the major pathways in the nitrogen cycle, the chemical species that are transformed in each, and the species that accomplish each of the transformations. Explain why photochemical reactions have important implications for nitrogen availability in many aquatic ecosystems. (10%)
3. The water in a pond is reaerated. Reaeration occurs according to first-order kinetics with a rate of 0.034 day^{-1} . If the temperature of the stream is 15°C and the initial oxygen concentration 2.5 mg/L , how long (in days) does it take for the oxygen concentration to increase to 6.5 mg/L ? The Henry's law constant for oxygen in water at 15°C is $3.64 \times 10^4 \text{ atm/mol fraction}$. (10%)
4. The proposed air quality standard for ozone (O_3) is 0.08 ppm . (a) Express that standard in $\mu\text{g}/\text{m}^3$ at an urban monitoring station at 25°C and 1 atm . (b) At the elevation of Salt Lake City, the pressure is about 0.82 atm . Express the ozone standard at that pressure and at a temperature of 15°C . (10%)
5. Suppose an underground storage tank has been leaking for many years, contaminating the groundwater and causing a contaminant concentration directly beneath the site of 0.30 mg/L . The contamination is flowing at the rate of 0.150 m per day toward a public drinking water well 1.6 km away. The half-life of the contaminant is 10 years.
 - (a) Estimate the steady-state pollutant concentration expected at the well.
 - (b) If the slope (potency) factor for the contaminant is $0.02 \text{ (mg/kg-day)}^{-1}$ through oral route, estimate the cancer risk if a 70-kg person drank 2 L of this water per day for 10 years. (20%)