國立臺北科技大學九十五學年度碩士班招生考試

系所組別：3210 環境規劃與管理研究所甲組

第一節 環境工程 試題

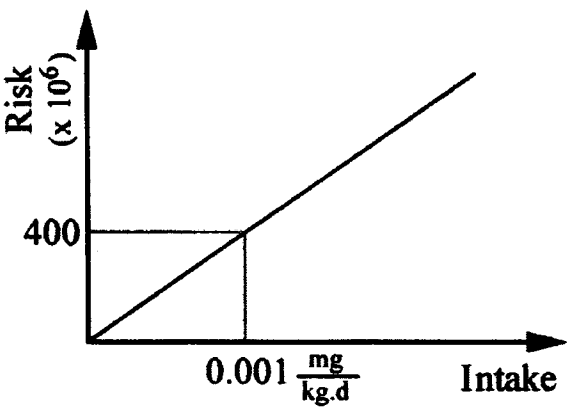
填 准 考 證 號 碼

注意事項：

1. 本試題共 9 題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。
4. 中、英文作答皆可。

1. A surface water contains a suspended solids concentration of 10.3 mg/L. Ferric chloride is added to the water to reduce the suspended solids concentration to 1.02 mg/L. To accomplish this 35 mg/L of ferric chloride is added to the water. The flowrate through the plant is 2.3 m^3/s. What is the dry weight of sludge (in kg) produced each day? **(10%)**

2. Consider a carcinogenic volatile organic compound (VOC) with the dose-torisk curve shown below. If 70-kg people breathe 30 m^3/day of air containing 10-3 mg/m^3 of this VOC 350 days of the year during 30 years of their 70-year lifetime, what is the cancer risk? **(10%)**



3. When determining the saturation concentration of dissolved oxygen in a river where wastewater is discharged, it is best to use the upstream or downstream temperature? Why? **(10%)**

4. Suppose the molar ratio of CO/CO_2 in a vehicle exhaust plume is measured to be 0.25. Calculate

   a) the air/fuel mass ratio, **(5%)** and

   b) the mass of CO emitted per mass of fuel burned (g/kg) using the following combustion stoichiometery. **(5%)**

$$CH_{1.8} + n(O_2 + 3.78N_2) \rightarrow aCO + bCO_2 + 0.9H_2O + 3.78nN_2$$

   c) Calculate what would be the stoichiometric air/fuel mass ratio. **(5%)**

   d) Is this an example of fuel rich or fuel lean combustion, and what other pollutant that is not shown in the equation above is likely to be produced from this combustion? **(5%)**

5. A sedimentation basin in a local water treatment plant is designed to handle a water flow rate of 0.2 m^3/s. The basin is rectangular, with a length of 32 m, a width of 8 m, and a depth of 4 m. Assume the density of particles, ρ_p, settling in the basin is 2.5 g/cm. Consider a particle settling in a fluid. The forces acting on the particle are those of gravity, buoyancy and drag. Please derive an expression for the terminal settling velocity, V_{ts}. Make assumption if necessary. **(10%)**

6. There are totally $1.6x10^6$ tons/year aluminum cans generated, and 63% of them are recycled. Related information about energy use and CO_2 emission is listed in the following table.

Source	Primary Energy (kJ/kg)	CO_2 Emissions (kg/kg)
Bauxite (this is where new aluminum comes from)	235,000	13.1
Recycled (this is what the 63% recycled aluminum uses)	5,150	0.48

   a) Find the total primary energy required to make all the cans used in 1 year. **(5%)**

   b) Find the reduction in CO_2 emissions from recycling. **(5%)**

7. Consider the storage of beverages in polyethylene terephthalate (PET) bottles, with the same recycling rate as in the problem above. The mass of one aluminum can is 16g and the mass of one PET bottle of same content is 20g. The primary energy for the production of new PET, the "production" of recycled PET, and the molding of the bottle is 83 MJ/kg, 20 MJ/kg, and 22 MJ/kg, respectively.

   a) Using the total primary energy as an indicator, determine which container has the greatest environmental burden. Explain your answer. **(5%)**

   b) Is the primary energy a good indicator of environmental burden? What other indicators might be useful when considering the broader impacts of these containers on environment and health? **(5%)**

注意：背面尚有試題

8. During a sunny summer day, the chemistry of photochemical smog is governed, in first approximation, by the following two reactions:

$NO_2 + O_2 \rightarrow NO + O_3$ with rate $k_f = 1.2\ 10^{-4}$ / (ppm x hour)
$NO + O_3 \rightarrow NO_2 + O_2$ with rate $k_r = 1300$ / (ppm x hour)

The following concentrations are measured: $[NO_2] = 0.2$ ppm, $[NO] = 0.02$ ppm, $[O_2] =$ 20% and $[O_3] = 0.1$ ppm. Is the ozone concentration growing or decaying? **(10%)**

9. What are the main perspectives of design reviews for pollution control equipment? **(10%)**