



國立中央大學九十學年度碩士班研究生入學試題卷

所別: 環境工程研究所 甲組 科目: 環境化學及環境微生物學 共 2 頁 第 1 頁

第一部份: 環境化學共五題每題十分

1. The chemical structures of a number of different compounds are shown in Table 1. Use this to answer the following questions in general terms (e.g., gas, liquid, solid; very low, low moderate, high).

Table 1
Structures of Various Compounds

No.	Name	Structure	State	Water solubility	Lipid Solubility
A	Ethane	H_3C-CH_3			
B	Benzene				
C	Citric acid	$\begin{array}{c} OH_2-COOH \\ \\ HOOC-C-CH_2COOH \\ \\ OH \end{array}$			
D	Anthracene				
E	Glyphosate	$\begin{array}{c} O \\ \\ HOOC-CH_2-N-CH_2-P-OH \\ \quad \\ H \quad OH \end{array}$			

- What is the physical state of these substances under normal conditions of temperature and pressure?
- Which of the compounds would you expect to be soluble in water?
- Which of the compounds would you expect to be soluble in biota lipid (lipophilic)?

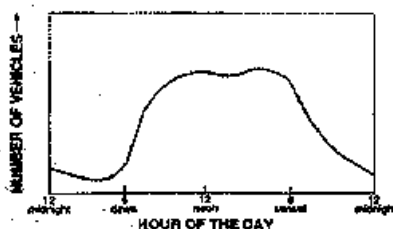
2. A bioassay has been carried out on shrimp in aquaria and the following data attained after 24 hours:

No. of shrimp surviving (out of 200/ aquarium)	Concentration in aquarium water ($\mu g/L$)
200	11.0
164	14.5
124	19.1
72	21.9
22	30.2
0	57.5

Plot this data out and graphically estimate the LC_{50} and LC_{20}

- Carbon dioxide dissolves in water to form carbonic acid. Calculate the pH of pure water that is in equilibrium with carbon dioxide in the atmosphere at $25^\circ C$. Dry air contains 0.0314% CO_2 by volume; the vapor pressure of water at $25^\circ C$ is 0.03 atm, Henry's law constant for CO_2 is $29 \text{ atm mol}^{-1} L^{-1}$; and the dissociation constant in the carbonic acid-bicarbonate system is 4.45×10^{-7}
- Many smog components are produced by motor vehicle exhaust gases. The general 24-hour cycle of motor vehicle traffic is shown in Figure 1. Draw possible patterns for NO (the main nitrogen oxide in vehicle exhaust), NO_2 , PAN, and explain the reasons behind these patterns.

Figure 1 The general 24-hour cycle of motor vehicle traffic.



注意: 背面有試題

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5. You are a member of a team evaluating an industrial site with contaminated soil. Your task is to evaluate the potential for the soil contaminants to contaminate the groundwater. You have been able to collate the property data on the contaminant as in the table below:

Compound	Vapor pressure (mm Hg)	Water solubility (mm L ⁻¹)	Soil sorption coefficient, K _{oc}
Phenol	0.2	67,000	2
Styrene	9.5	280	120
Tetrachloroethane	5	2900	480
Chloropyrifos	1.9×10 ⁻⁵	2	13,000

Evaluate the possibility of ground water contamination by these compounds.

第二部分

環境微生物試題

簡要回答下列各子題 (每子題 2 分, 合計 50 分)

- 一、活性污泥槽內之原生動物除能捕食細菌及攝食部份可溶性有機物外, 原生動物與細菌間之互動關係促進了水質之淨化作用, 試說明其他五項互動關係 (1-1, 1-2, 1-3, 1-4, 1-5)。
- 二、試以活性污泥槽法與滴濾池比較懸浮生物法與固定生物膜法間之異同:
 - 2-1 說明活性污泥出現之生物種類
 - 2-2 說明滴濾池出現之生物種類
 - 2-3 比較說明兩者各生物間比增殖速率差異性大小
 - 2-4 比較說明活性污泥與懸浮生物系統其中之一有較長生物鏈之原因
 - 2-5 比較說明何者污泥量較大之原因
- 三、河川自污水排入點以下微生物之物種遷移, 數量變化反映水質淨化過程, 試回答下列問題:
 - 3-1 列舉出現在排放點以下與淨化有關之微生物物種
 - 3-2 說明微生物間之依存關係
 - 3-3 舉例說明水質逐漸淨化 (基質減少) 後, 部份微生物之生存策略
 - 3-4 說明影響微生物遷移過程之環境因子
 - 3-5 水質淨化前後之微生物相之差異
- 四、微生物生長之溫度與活性效應與 proteins 及 lipids 有關, 試回答下列問題:
 - 4-1 Lipids 之 melting point 與其何種組成之某特性有關
 - 4-2 上述關係如何影響微生物之生存溫度與存活力
 - 4-3 Prokaryotes 如 photosynthetic bacteria 為何不能在高於 70-75°C 下生長
 - 4-4 溫度對 proteins 如何影響
 - 4-5 溫度對 proteins 之影響如何影響到微生物之生存
- 五、解釋下列名詞:
 - 5-1 優養化
 - 5-2 湖泊之層化作用
 - 5-3 紅潮
 - 5-4 生長係數 (growth yield)
 - 5-5 比生長率 (specific growth rate)

