

本科共十六題，請標明題號，任選五題作答，每題各 20 分

題號：一 解釋名詞 20%

1-1 ecological succession

1-2 food chain

1-3 antagonism

1-4 bioaccumulation

1-5 biological community

題號：二 20%

今有一農藥工廠因操作不當導致農藥外洩，請問這些外洩之農藥在生態環境中如何散佈、傳輸及對生物之影響。

(背面仍有題目，請繼續作答)

三、

- 3-1. 比較說明同化作用(Anabolism)和異化作用(Catabolism)。(5%)
- 3-2. 舉例說明微生物之共生(Symbiosis)和共代謝(Cometabolism)。(5%)
- 3-3. 舉例說明微生物之無氧呼吸。(5%)
- 3-4. 說明微生物代謝過程產生ATP的方式。(5%)

四、

- 4-1. 繪圖說明自然界氮的循環。(10%)
- 4-2. 繪圖說明利用下列生物作為活性污泥法的操作指標。  
輪蟲、游泳性纖毛蟲、有柄纖毛蟲和鞭毛蟲。  
以時間為橫軸，BOD和生物相對數量為縱軸。(6%)
- 4-3. 說明下列微生物的特性與重要性。(4%)  
*Zoogloea ramigera*, *Escherichia coli*,  
*Sphaerotilus natans*, *Giardia sp.*

5. 下列有一組土壤樣分析數據，對土壤中重金屬鎘作了免費之調查，試推求其平均值及標準差？(單位  $\mu\text{g}/\text{g}$ ) (20%)

序號	1	2	3	4	5	6	7	8	9	10
濃度	15	20	35	21	23	30	32	19	22	16

6. 試說明模糊理論之本質與模糊理論及灰色理論有何不同？(20%)

(背面仍有題目,請繼續作答)

分析化學

7. (20%) A 0.4800-g sample containing  $(\text{NH}_4)_2\text{C}_2\text{O}_4$  and inert materials was dissolved in water and made strongly alkaline with KOH, which converted  $\text{NH}_4^+$  to  $\text{NH}_3$ . The liberated  $\text{NH}_3$  was distilled into exactly 50.00 mL of 0.05035 M  $\text{H}_2\text{SO}_4$ . The excess  $\text{H}_2\text{SO}_4$  was back-titrated with 11.25 mL of 0.1214 M NaOH. Calculate (a) the % N (fw = 14.007 g) and (b) the %  $(\text{NH}_4)_2\text{C}_2\text{O}_4$  (fw = 124.10 g) in the sample.

8-1. (10%) Please define the following terms:

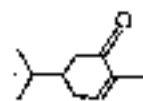
- Buffer Capacity
- Cathode
- Galvanic cell
- Standard Hydrogen Electrode (--- You need to draw a diagram)

8-2. (10%) Use activities to calculate the solubility of  $\text{Ba}(\text{IO}_3)_2$  in a 0.0380 M solution of  $\text{Mg}(\text{IO}_3)_2$ . The thermodynamic solubility product for  $\text{Ba}(\text{IO}_3)_2$  is  $1.57 \times 10^{-9}$ . ( $f_{\text{Ba}^{2+}} = 0.38$ ,  $f_{\text{IO}_3^-} = 0.78$ .)

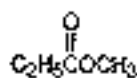
有機化學

9-1 (10%) 請依 IUPAC 規則寫出下列化合物之英文名稱。

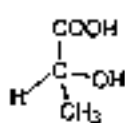
a.



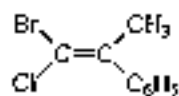
b.



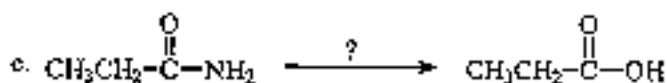
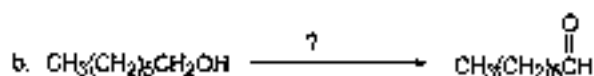
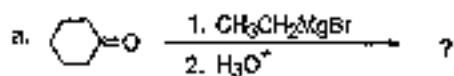
c.



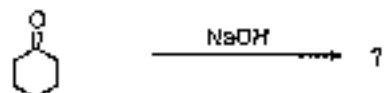
d.



9-2 (10%) 完成下列反應 (a = 4%, b = 3%, c = 3%)



10-1 (8%) 何謂 Aldol Condensations? 利用下列反應為例, 逐步寫出 Aldol Condensation 之反應機制(mechanism)。

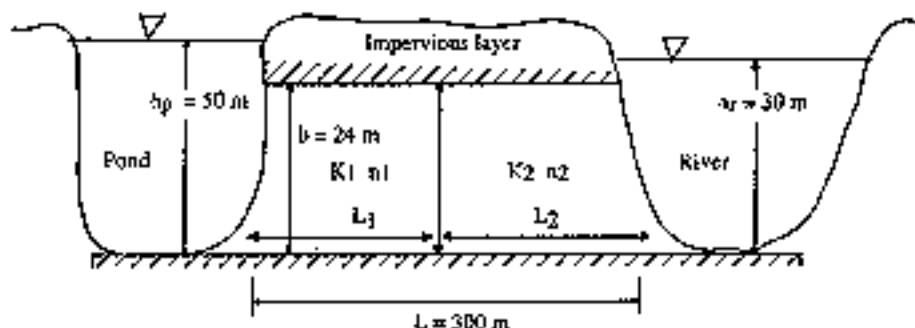


10-2 (8%) 以 1,3-丁二烯與氫化氫之反應為例, 說明何謂 1,4-加成反應(1,4-addition), 並逐步寫出其反應機制(mechanism)。

10-3 (4%) 何謂 Saytsev Rule (亦作 Zaitsev Rule)? 請舉一習例說明。

(背面仍有題目, 請繼續作答)

- 十一、A tank of conservative chemical carried by a truck (tanker) was released into the pond shown below. You may assume that the chemical instantaneously mixed with the pond water and then moves with the water horizontally without dispersion. [Notes:  $K$  = hydraulic conductivity,  $n$  = porosity,  $b$  = aquifer thickness, and  $h$  = hydraulic head.]



$$K_1 = 1.0 \times 10^{-3} \text{ m/s} \quad L_1 = 150 \text{ m} \quad n_1 = 0.35$$

$$K_2 = 6.9 \times 10^{-4} \text{ m/s} \quad L_2 = 150 \text{ m} \quad n_2 = 0.25$$

- 11-1 Calculate the effective hydraulic conductivity,  $K$ , for the case. (7 分)  
 11-2 How long does it take for the chemical to reach the river? (7 分)  
 11-3 Estimate the portions of the aquifers which has been contaminated at the time of 5 days after the accident. (6 分)

十二、

- 12-1. Radon is one of the important indoor air pollutants in some area. What is the major risk concern of human health associated with indoor radon? What are the major sources of radon in a house with basement? What are the methods to control radon gas in home? (10 分)  
 12-2. Explain "greenhouse effect" of the atmosphere and the reason to cause it, and name three gases that may cause the effect. (5 分)  
 12-3. Explain "eutrophication" in reservoirs and lakes, and name the major pollutants to cause it. (5 分)

13. 試述「永續發展」(sustainable development)的意義。

並以台灣地區水資源邁向永續發展的課題為例，闡述目前問題與列舉可能改善的方法與策略。(20%)

14. 試述導致「溫室效應」的主要氣體包括哪些？各氣體的排放源為何？且以抑制  $CO_2$  排放量為例，列舉可能的因應策略為何？(20%)

(背面仍有題目，請繼續作答)

15. Initially at 300K and 1 atm pressure, 1 mol of an ideal gas undergoes an irreversible isothermal expansion in which its volume is doubled, and the work it performed is  $500 \text{ J mol}^{-1}$ . What are the values of  $q$ ,  $\Delta H$ ,  $\Delta G$  and  $\Delta S$ ? What would  $q$  and  $w$  be if the expansion occurred reversibly? (Gas constant  $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1} = 0.08206 \text{ dm}^3 \text{ atm K}^{-1} \text{ mol}^{-1}$ ) (20%)
16. For a second order reaction  $A + B \rightarrow \text{products}$ , if the initial concentration  $[A]_0 = [B]_0 = a$ , find the relationship between half-life ( $t_{1/2}$ ) and rate constant ( $k_2$ ). (20%)