

應考說明：

1. 環境科學由下列科目組成：

生態學、微生物學、統計學、分析化學、有機化學、環境地質學、
環境管理、物理化學。

每科各出二題，每題二十分，由考生選答五題。

2. 考生選答題目請務必在作答試卷第一行註記題號。

例：作答題號 (一)、(四)、(七)、(十)、(十四)。

3. 作答超出五題或未註記題號者以作答次序前五題計分，超出部分不計分。

題號：一、何謂生態系統 (Ecosystem)？^(生態學) 請說明生態系統由那些部份所組成，並敘述彼此間之相互關係。(20%)

題號：二、解釋名詞 (20%)

二-1. Biological Indicator

二-2. symbiosis

二-3. bioaccumulation

二-4. ecological density

二-5. biocondensation

(微生物學)

三、解釋名詞 (20%)

- 3-1 紅潮 (4%)
- 3-2 IMViC 試驗 (4%)
- 3-3 硝化作用 (4%)
- 3-4 糖解作用 (4%)
- 3-5 生物復育 (4%)

四、問答題 (20%)

- 4-1 哪些微生物會造成飲用水的臭味問題。(5%)
- 4-2 有機物的厭氧分解與好氧分解，
在電子接受者與能量的獲得有何差異。(5%)
- 4-3 繪圖說明硫酸還原菌與硫氧化菌在管壁腐蝕所扮演的角色。(5%)
- 4-4 說明光合異營菌在能源和碳源的利用。(5%)

(統計學)

五、已知鹽水溪每年之最估流量成常態分配，歷年之紀錄如下表，求再限期十年發生一次之估流量值。(20%)

年代	78	79	80	81	82	83	84	85	86
估流量 cms	3.9	6.5	6.8	5.8	7.9	4.7	7.2	5.9	5.6

六、已知台南市五年發生一次之暴雨強度與降雨延時如下表，求其降雨強度公式， $I=a/(b+t)$ 。(20%)

t, min	5	10	15	20	30	40	60
I, mm/hr	160	150	130	120	110	90	80

(分析化學)

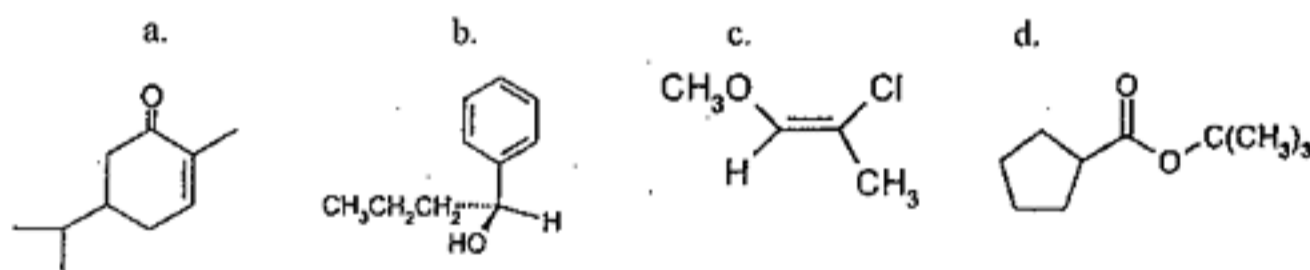
- 七、(7-1) Calculate the pH of a 0.050 M solution of acetic acid. The K_a of acetic acid is 1.80×10^{-5} . (8%) (7-2) Derive a titration curve for the titration of 50.00 mL of 0.0500 M NaOH with 0.1000 M HCl. You calculate the pH values at
- Initial point
 - After addition of 10.00 mL of reagent
 - At equivalence point
 - 0.10 mL beyond the equivalence point (12%)

- 八、(8-1) Define the following terms and give an example for each term.
- systematic error
 - gross error
 - end point
 - argentometric method
 - cathode (10%)

- (8-2) A solution that is 0.400 M in formic acid and 1.00 M in sodium formate is a buffer solution. (K_a of formic acid is 1.80×10^{-4})
- What is a buffer solution? What are the applications of buffer solutions in analytical chemistry?
 - Derive the equation for pH value of a buffer solution, then calculate the pH for this solution. (10%)

(有機化學)

- 九、(9-1) 請依 IUPAC 規則用英文命名下列化合物 (12%)



- (9-2) 請用一反應式為例說明 LiAlH_4 之用途。(4%)
 (9-3) 請用一反應式為例說明何謂 regiospecific reactions。(4%)

- 十、(10-1) 以 CH_3CHO 和 $\text{NaOCH}_2\text{CH}_3$ 之反應為例，逐步詳細說明其反應機制 (reaction mechanism) 並且寫出生成物。(10%)
 (10-2) 請以簡單化學測試來區別下列化合物 (10%) — hexane, cyclohexene, benzene, acetaldehyde

(環 境 地 質 學)

十一、

11-1 The equation $\nabla^2 h = \frac{S}{T} \frac{\partial h}{\partial t}$ is employed to describe the movement of ground water under some specific conditions. This equation is derived from the continuity equation based on several assumptions. Please name the assumptions for this equation. (5 分)

11-2 The equation shown in (11-1) is a kind of diffusion equation. What is the diffusion coefficient in the equation? (3 分)

11-3 What is the purpose of a slug test? What is its advantages over pumping tests when using in a contaminated site? (5 分)

11-4 Neuman (1972) showed that the following equation can be used to describe groundwater movement while pumping water in a fully-penetrating well in unconfined aquifers. Define each term in the equation. (5 分)

$$K_r \frac{1}{r} \frac{\partial}{\partial r} \left(r \frac{\partial h}{\partial r} \right) + K_v \frac{\partial^2 h}{\partial z^2} = S_s \frac{\partial h}{\partial t}$$

11-5 There are two mechanisms that might be involved in the water production in (11-4), name the two mechanisms. (2 分)

十二、

12-1 Define isotropic and homogeneous aquifer formations. (5 分)

12-2 The Thiem solution is employed to obtain hydraulic parameters for an unconfined aquifer using draw down information collected from pumping tests. How many wells do you need for this case, including pumping and observation wells? What are the parameters that you may be able to obtain? (5 分)

12-3 Sanitary landfill is one of the important method to treat municipal solid waste. What are the important engineering practices that need to be done to minimize the environmental pollution caused by the method? (5 分)

12-4 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? (5 分)

(環境管理)

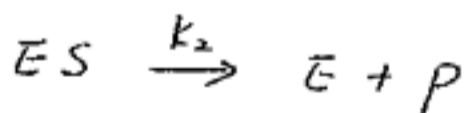
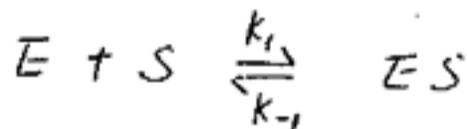
13. 試述導致「溫室效應」的主要氣體包括哪些？各氣體的主要排放源為何？以抑制 CO₂ 排放量為例，列舉可能的防治策略 (Control Mitigations) 及適應策略 (adaptive measures). (20%)
14. 目前都會區的車輛成長快速，為主要的空氣污染源，試就 (1) 法規管理 (2) 防污技術，(3) 經濟誘因手段，(4) 教育宣導等四層面闡述如何改善都會區的空氣品質。

(物理化學)

15. Ten grams of H₂ at 25°C are allowed to expand isothermally against a constant external pressure of 0.5 atm from a volume of 20 L to a volume of 100 L. Calculate ΔS_g , $\Delta S_{surr.}$ and $\Delta S_{univ.}$ for this process. (assume ideal gas)

$$\begin{aligned} \text{Gas constant } R &= 8.315 \text{ J K}^{-1} \text{ mol}^{-1} \\ &= 0.08206 \text{ atm} \cdot \text{L} \cdot \text{K}^{-1} \text{ mol}^{-1} \end{aligned} \quad (20\%)$$

16. Based on enzyme kinetics,



Try to derive the following equation by Michaelis-Menten mechanism,

$$V = \frac{V_{max} [S]}{K_m + [S]}$$

and explain the meaning of V_{max} and K_m (20%)