

系所組別：環境工程學系甲組

考試科目：環境化學及環境微生物學

考試日期：0222，節次：2

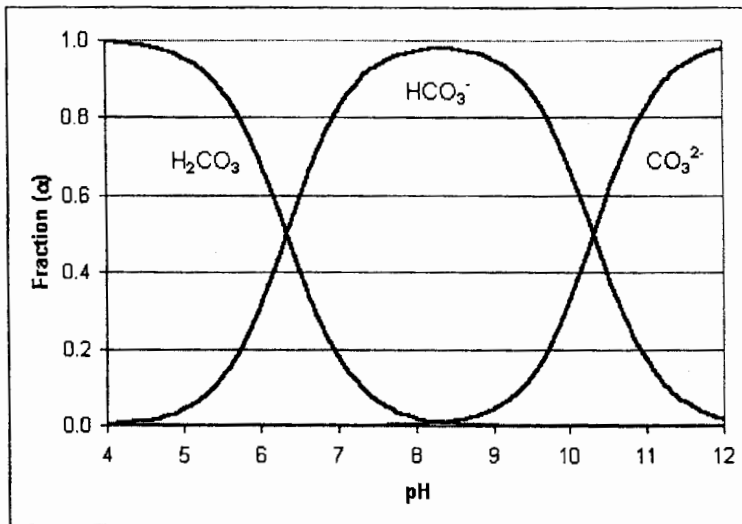
※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1.

(a) Please use the following figure and information to calculate the pH of unpolluted rain. (10pt.)

Carbon dioxide partial pressure in the air = 3.55×10^{-4} atm = $10^{-3.45}$ atm

Henry's Law constant of carbon dioxide = $10^{-1.47}$ mol L⁻¹ atm⁻¹



(b) Please define the criteria of acid rain and discuss how acid rain forms. (10pt.)

2.

Due to the limitation of land, more and more researchers focus on treating contaminated land in order to rehabilitate it for future use. Please discuss the factors that affect contaminated land remediation. (10pt.)

3.

Sub-surface mining often progresses below the water table, so water must be constantly pumped out of the mine in order to prevent flooding. When a mine is abandoned, the pumping ceases, and water floods the mine. This introduction of water is the initial step in most acid rock drainage situations. For example, large amounts of pyrite (FeS₂) are exposed to weathering after the mining processes. What kind of environmental problems will be generated in this case? Please use the chemical reaction to illustrate your reasons. (20pt.)

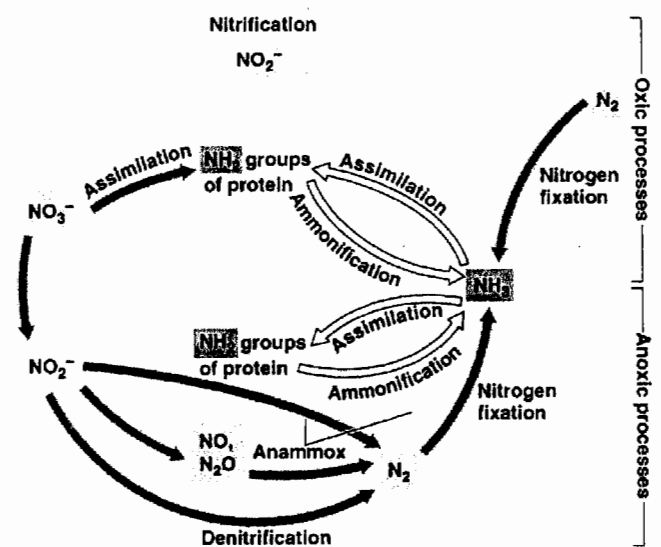
(背面仍有題目,請繼續作答)

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4. You have been hired to implement a bioremediation project to clean up a site in which the soil is contaminated with the diesel fuel. Your initial investigation shows that the aliphatic hydrocarbon is the major pollutant.
- On your knowledge of Environmental Microbiology, please briefly define the "bioremediation" technology. (4pts)
 - What microbiological strategy or approach will you apply to remedy the aliphatic hydrocarbons in soil? Why will you plan to do so? Please briefly describe your plan (10 pts).
 - What environmental factors should you consider or control during the operation of your bioremediation work (5 pts).

5. The figure at the right shows the redox cycle for nitrogen in the ecosystem.

- Please list out the reaction equations for Nitrification, Denitrification, and Anammox, respectively. (9pts)
- Please describe the electron and carbon sources for the microbial growth associated with the Nitrification, Denitrification, and Anammox, respectively. (12pts)



6. When the living environment is no longer suitable for the microbial growth, many microorganisms will change the physiological state to the VBNC conditions.
- What does VBNC stand for? (2pts)
 - Please elucidate the significance of VBNC microorganisms in the drinking water system. (8pts)