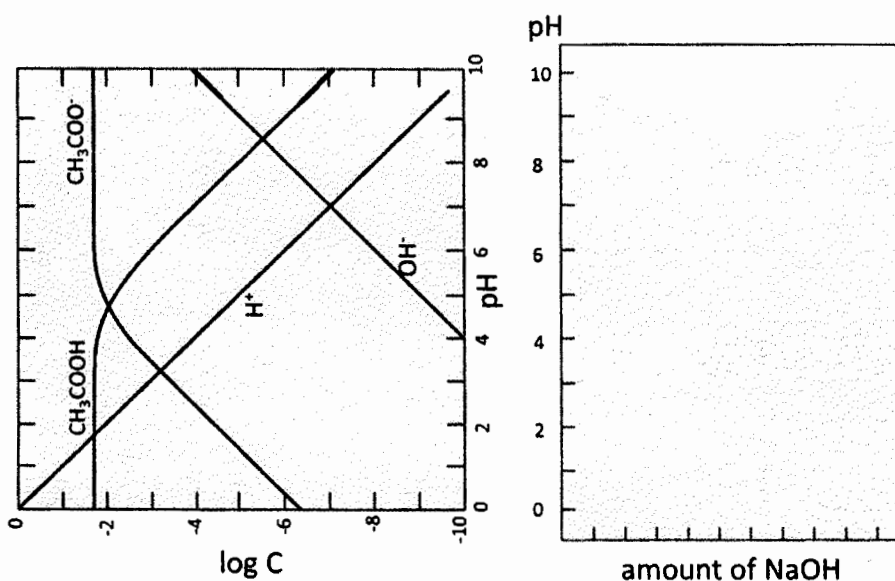


※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. (1) Please describe what a titration curve is. (5pt)

(2) **Please sketch the figures exactly the same as the following ones on your answer sheet.** Please use the logC-pH diagram given to schematically draw a titration curve for a clean water with 0.03 M acetic acid. Please draw on the empty figure on the right and show the beginning, midpoint and equivalence point of the titration curve clearly. (15pt)



2. In the aqueous environment, molecules distribute themselves between water and solids. A reasonable description of this partitioning is given by a modified Freundlich relation:

$$C_s = K_d C_{aq}$$

where K_d is the distribution coefficient

(1) Please give 3 example pollutants that could have the above behaviour. (5pt)

(2) Please list the factors that may affect K_d value. (5pt)

3. In routine operation of an anaerobic waste treatment system, the volatile-acids analysis is used mainly for control to determine whether or not the system is in balance.

(1) Please define what the volatile acid is. (5pt)

(2) Indicate what the most prevalent volatile acids are formed during anaerobic treatment. (5pt)

(3) What is the principle involved in the determination of volatile acids by column-partition chromatography? What is the purpose of acidification of samples for the volatile-acid analysis? (5pt)

(4) The direct-distillation method is commonly used for the routine determination of volatile acids. What is the principle involved in the distillation procedure for volatile acids? (5pt)

※ 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。

環境微生物學

4. Anaerobic digestion process is now increasingly used for treatment of complex substance in waste/wastewater and recovery of renewable energy. **(a)** Please describe the principle of anaerobic digestion, for example, how starch (澱粉), a kind of polysaccharide is degraded and renewable energy produced (15 pts). The anaerobic microorganisms have to work closely in the degradation of the compounds. This microbial interaction is called syntrophy or syntrophic association. **(b)** Please explain the microbial syntrophy based on the underlying thermodynamics (5pts).
5. Biofilm is a type of microbial consortia in the environment. Within biofilm, many activities of microbial cells are regulated by quorum sensing. **(a)** Please explain what is quorum sensing (5pts), and **(b)** briefly discuss its importance to microorganisms (5 pts).
6. Monod equation is commonly used to account for the relationship of microbial growth rate and substrate concentration. Please describe the equation and discuss the meanings of each constant in the Monod equation (10pts).
7. Please describe how you distinguish gram-positive and gram-negative bacteria (10pts).