

國立成功大學

110學年度碩士班招生考試試題

編 號： 140

系 所： 環境工程學系

科 目： 環境化學及環境微生物學

日 期： 0202

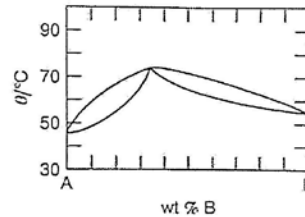
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備 註： 可使用計算機

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

Problem 1 (20 points)

Please answer the following questions, using the accompanying figure.



- (1) A waste liquid mixture consists of 33 g of component A and 99 g of compound B. At what temperature would the mixture begin to boil?
- (2) Under the conditions in (a), what is the composition of the vapor when boiling first occurs?
- (3) If the distillation is continued until the boiling point is raised by 5.0 °C, what would be the composition of the liquid left in the still?
- (4) Under the conditions in (3), what are the composition and mass of the two components collected over the initial 5.0 °C interval?

Problem 2 (15 points)

A solution contains 10^{-3} M dissolved inorganic carbon and has a pH of 8.23. Assume this water sample is sealed and do not open to the atmosphere.

- (a) How much strong acid (H_2SO_4 in mole per liter of solution) would be required to titrate this solution to a pH of 6.3?
- (b) How much strong acid (H_2SO_4 in mole per liter of solution) would be required to titrate this solution to its equivalence point?

Problem 3 (15 points)

What is the pH of a rainwater sample if it is left to equilibrate with 2.0 ppmv of SO_2 ($K_H=1.2 \text{ mol L}^{-1}\text{atm}^{-1}$)? Assume SO_2 is the only acidic gas present.

The acid dissociation constants of sulfuric acids are $\text{p}K_{a1} = -3.2$ $\text{p}K_{a2} = 1.92$

The acid dissociation constants of sulfurous acids are $\text{p}K_{a1} = 1.81$ $\text{p}K_{a2} = 6.91$

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■ 環境微生物學試題

4. 氨氮是廢水中常見的污染物，可以藉由微生物代謝作用轉換成穩定無害的氮氣。
- (a) 請以化學平衡方程式說明如何利用硝化菌與厭氧銨氧化菌將氨氮轉化為氮氣，處理僅含氨氮不含有機物的廢水(8 pts)
 - (b) 請各列舉硝化菌與厭氧銨氧化菌的兩個細菌屬名(genus name) (8 pts)。這些菌群的生長碳源、能量來源、以及電子接受者(6 pts)
 - (c) 相對於傳統的硝化脫硝代謝反應，以硝化菌與厭氧銨氧化菌代謝作用應用於處理含氨氮廢水被認為是比較環境永續的綠色生物技術，為什麼？(8 pts)
 - (d) 最大可能數(Most Probable Number, MPN)法可用於計數生物處理反應槽氨氧化菌的數量，請試說明如何進行相關實驗 (10 pts)
 - (e) 分子生物技術，例如定量聚合酶鏈鎖反應(Quantitative Polymerase Chain Reaction, qPCR)，亦可用於氨氧化菌群的定量分析。以定量氨氧化菌為例，請試說明 qPCR 的操作與定量原理 (10 pts)