

以下為選擇題，每題三分，請作答於試卷內之「選擇題作答區」

1. Which of the following organism is commonly found in conventional activated sludge? (A) Zooglea (B) Influenza virus (C) Earthworms (D) Zebra mussel
2. Chemolithotrophs use which of the following compound as energy source? (A) organic (B) inorganic (C) both inorganic and organic (D) neither organic or inorganic compounds
3. Which of the following statement about energy or redox tower is NOT true? (A) The reduced substance in the redox pair at the top of the redox tower has the greatest tendency to donate electrons (B) oxidation is a process involve losing electrons and releasing energy (C) The higher the reduction potential (more positive) for one redox pair, the higher the tendency to gain electrons in redox reactions (D) In most biological process, nitrate is the most common electron carriers.
4. The growth of one bacterial cell continues until the cell divides into two new cells. This process is called (A) binary fusion (B) binary fission (C) binary division (D) bindery fusion
5. A typical bacterial growth curve can be divided into 4 different phases: 1. stationary phase 2. death phase 3. lag phase 4. exponential phase. Which of the following is the correct order for a batch culture? (A) 1234 (B) 2413 (C) 3412 (D) 1324
6. In a chemostat bioreactor, the population density and growth rate are controlled by ___ and ___, respectively. (A) limiting nutrient / flow rate (B) flow rate / limiting nutrient (C) dilution rate / flow rate (D) cell decay rate / doubling time
7. Which of the following is NOT major factor affecting water disinfection efficiency? (A) type of organisms, eg. *Bacillus* and *Escherichia* (B) disinfectant contact time (C) water organic contents (D) volume of the tank
8. Which of the following statement regarding drinking water is TRUE? (A) Both physical and chemical methods are used to treat and purify water (B) potable water is not safe for human consumption (C) Cholera can be transmitted by water or air (D) Viruses are not easily inactivated by water disinfection agents such as chlorine
9. Which of the following statement regarding wastewater treatment is NOT true? (A) Most wastewater treatment facilities employ methods designed to detect each pathogenic organism that may be present in a given sample (B) Secondary treatment may be aerobic or anoxic (C) Wastewater plants are usually constructed to handle both domestic and industrial wastes (D) Biological process is the most common method used in domestic wastewater treatment plants
10. Which of the following statement about sludge bulking is NOT true? (A) Wastewater high in glucose, maltose and lactose can potentially trigger the sludge bulking (B) The most prevalent cause of filamentous bulking is low substrate concentration (C) *Thiothrix* is a common bulking microorganism (D) Increase dissolve oxygen can enhance the growth filamentous bulking bacteria.

以下為簡答及計算題，計分比重標於題尾，請作答於試卷內之「非選擇題作答區」

11. List some indicator microorganisms for water quality monitoring other than fecal

見背面

colifoms and what are the criteria for an ideal microbial indicator? (10%)

12. What is Sharon-Anammox process? What are the microbes involved? (10%)
13. 台大環工所去年用電 840000 度 (kW·hr)。假設電力全部來自燃煤發電，而 1 公克無煙煤 (含碳 85%) 的熱值約為 14000 Btu/lb (1 Btu/lb = 2.326 kJ/kg)。假如燃煤發電效率是 35%，請問去年環工所排放多少噸的二氧化碳？地球接受之太陽輻射大約 1400 W/m²，如果利用光合作用來產生生質能 (光合作用效率是 1%)，生質能之發電效率是 20%，需要多大面積的地面才夠提供環工所需要之能源？(1 W·hr = 3600 J) (15%)
14. 在 1 L 水中加入氯化鈣 BaCl₂ (純度 99%) 0.35 × 10⁻³ g，氯化鈉 NaCl (純度 98%) 15.53 g，硫酸鉀 K₂SO₄ (純度 99%) 16.2 × 10⁻³ g，

(一) 請計算各離子之濃度(M)

(二) 請計算離子強度，I

(三) 請利用 Davies relationship 計算 Ba²⁺ 及 SO₄²⁻ 之離子活性係數(ion activity coefficient)，γ

$$\log \gamma = -0.5 Z^2 \left(I^{0.5} / (1 + I^{0.5}) - 0.2I \right)$$

(四) 如果硫酸鉀之溶解度積為 10^{-9.96} M²，請問此溶液中及離子強度的影響下，有無硫酸鉀沈澱？(合計 15%)

(原子量：Ba: 137.3, Cl: 35.45, Na: 23.0, K: 39.1, S: 32.1, O: 16.0)

15. 將二氧化碳(CO₂)儲存在深海海底，是一個正在研究中的碳儲存方法。如果在台灣附近找一處可以儲存 CO₂ 的海域，請問至少要多深的水深才夠。下表為 CO₂ 之蒸汽壓與溫度的關係。如果海水的溫度都是 2°C，比重為 1.025。

飽和蒸汽(atm)	1	2	5	10	20	40	60
溫度(°C)	-78.2 (固體)	-69.1 (固體)	-56.7	-39.5	-18.9	5.9	22.4

(一) 請利用表中之資料，建立飽和蒸汽壓力與溫度之關係

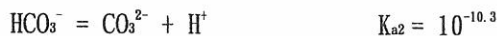
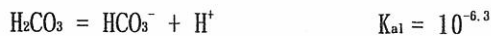
(二) 計算在 2°C 下，將 CO₂ 固化的最低壓力

(三) 估計每單位深度之壓力(1 atm = 1.033 Kg-force/cm²)

計算達到將 CO₂ 固化的最小深度。(10%)

16. 某工廠製造的超純水，僅含有 0.12 mg/L 之總無機碳，pH 值為 6.00。今為了製程上之需要，以氮氣吹曝並以真空除氣，將所有無機碳去除，其最終之 pH 值竟然超過 8。請你解釋此現象，並計算出其最終之 pH 值。(10%)

相關之反應及平衡常數如下：



參考資料：指數及對數運算表

運算	數值	運算	數值	運算	數值
10 ^{0.1}	1.26	log 1	0	ln 2	0.69
10 ^{0.2}	1.58	log 2	0.30	ln 3	1.10

$10^{0.3}$	2.00	$\log 3$	0.48	$\ln 4$	1.39
$10^{0.4}$	2.51	$\log 4$	0.60	$\ln 5$	1.61
$10^{0.5}$	3.16	$\log 5$	0.70	$\ln 6$	1.79
$10^{0.6}$	3.98	$\log 6$	0.78	$\ln 7$	1.95
$10^{0.7}$	5.01	$\log 7$	0.85	$\ln 8$	2.08
$10^{0.8}$	6.31	$\log 8$	0.90	$\ln 9$	2.20
$10^{0.9}$	7.94	$\log 9$	0.95	$\ln 10$	2.30

$\ln(a) = \log(a)/\log(e)$, $e = 2.718$, $\log(e) = 0.4343$



試題隨卷繳回