

注意：考試開始鈴響前，不得翻閱試題，
並不得書寫、畫記、作答。

國立清華大學 115 學年度碩士班考試入學試題

系所班組別：分析與環境科學研究所

科目代碼：3004

考試科目：環境微生物

—作答注意事項—

1. 請核對答案卷（卡）上之准考證號、科目名稱是否正確。
2. 考試開始後，請於作答前先翻閱整份試題，是否有污損或試題印刷不清，得舉手請監試人員處理，但不得要求解釋題意。
3. 考生限在答案卷上標記「由此開始作答」區內作答，且不可書寫姓名、准考證號或與作答無關之其他文字或符號。
4. 答案卷用盡不得要求加頁。
5. 答案卷可用任何書寫工具作答，惟為方便閱卷辨識，請儘量使用藍色或黑色書寫；答案卡限用 2B 鉛筆畫記；如畫記不清（含未依範例畫記）致光學閱讀機無法辨識答案者，其後果一律由考生自行負責。
6. 提早交卷者不可攜出試題，請將試題連同答案卷(卡)交予監考人員，攜出將以違規論處。當節考試結束後試題將置於講台，可自行取回，本試場不負保管責任。
7. 其他應考規則、違規處理及扣分方式，請自行詳閱准考證明上「國立清華大學試場規則及違規處理辦法」，無法因本試題封面作答注意事項中未列明而稱未知悉。

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*請在【答案卡】作答

I. 單選題(每題 2 分，共 40 分，答錯不倒扣)

1. Carbon dioxide can be used as a sole carbon source by
(A) Chemotroph (B) Auxotroph
(C) Autotroph (D) Heterotroph
2. Which one of the following microorganisms would use inorganic substrates as a source of energy and electron donors to drive energy acquisition?
(A) Chemolithotroph (B) Chemoorganotroph
(C) Photolithotroph (D) Photoorganotroph
3. In microbial metabolism, which one of following pathways for glucose catabolism produces the most ATP via electron transfer chain?
(A) Embden-Meyerhof pathway
(B) Pentose phosphate pathway
(C) Transition of pyruvate to acetyl CoA
(D) Tricarboxylic acid cycle
4. Which one of the following macromolecules would NOT normally be used for microbial energy metabolism?
(A) Polysaccharides (B) Polypeptides
(C) Polynucleotide (D) Triacyl glyceride
5. For bactericidal activity, which one of the following has the ability to cause thymine dimer formation?
(A) Microwave (B) Ultraviolet light
(C) X rays (D) Gamma rays
6. The control for elimination of pathogens in milk is commonly used by
(A) Incineration (B) Sterilization
(C) Chlorination (D) Pasteurization
7. The end product of denitrification step in the nitrogen cycle is
(A) N_2 (B) NH_4^+
(C) NO_3^- (D) NO_2^-

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8. Anammox bacteria involved in nitrogen cycle is

- (A) Aerobic
- (B) Facultative anarobic
- (C) Microaerobic
- (D) Anaerobic

9. Which one of the following catabolic conversion involved by Anammox bacteria is

- (A) $\text{N}_2 + 8\text{H}^+ \rightarrow 2\text{NH}_3 + \text{H}_2$
- (B) $\text{NH}_4^+ + \text{O}_2 \rightarrow \text{NO}_2^- + 2\text{H}^+ + \text{H}_2\text{O}$
- (C) $\text{NH}_4^+ + \text{NO}_2^- \rightarrow \text{N}_2 + 2\text{H}_2\text{O}$
- (D) $\text{NO}_3^- \rightarrow \text{NO}_2^- \rightarrow \text{NO} \rightarrow \text{N}_2\text{O} \rightarrow \text{N}_2$

10. Which one of the following is a major constituent of microbial cell membranes, nucleic acids, and cellular energy transfer systems?

- (A) Potassium
- (B) Phosphorous
- (C) Sulfur
- (D) Magnesium

11. Respiration and photosynthesis are central to this process

- (A) Carbon cycle
- (B) Nitrogen cycle
- (C) Sulfur cycle
- (D) Phosphorous cycle

12. In the pulp industry, which of the following is NOT formed by the polymerization of monosaccharides and is difficult to be hydrolyzed by microorganisms, thus causing water pollution?

- (A) Starch
- (B) Cellulose
- (C) Lignin
- (D) Chitin

13. The conversion of sulfur would be converted to sulfates by

- (A) *Desulfotomaculum* sp.
- (B) *Thiobacillus* sp.
- (C) *Thermodesulfobium* sp.
- (D) *Caldivirga* sp.

14. The sulfite reducing bacteria is

- (A) Aerobic
- (B) oxygen tolerant anarobic
- (C) Microaerobic
- (D) Anaerobic

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15. In the process of microbial remediation, glutathione (GSH) frequently participates in the hydrolysis of contaminated organic compounds. What are the components of GSH?

- (A) vitamin
- (B) protein
- (C) short peptide
- (D) carbohydrate

16. Which of following is NOT used to remove heavy metal contamination in water?

- (A) Bacteria
- (B) Fungi
- (C) Algae
- (D) Lichen

17. Bioleaching is frequently done by

- (A) Protozoa
- (B) Bacteria
- (C) Algae
- (D) Fungi

18. The following bacterial species could be applied in uranium bioleaching

- (A) *Thiobacillus ferrooxidans*
- (B) *Escherichia coli*
- (C) *Streptococcus pyogenes*
- (D) *Staphylococcus aureus*

19. The commonly used method for monitoring the total count of bacteria in water is

- (A) Plat counting
- (B) Most probable number (MPN)
- (C) Microscopic examination
- (D) Optical density determination

20. The taxonomy, oxygen requirement, and cell wall component of most of methogens are

- (A) Archaea, Aerobic and peptidoglycan
- (B) Archaea, Anerobic and pseudomurein
- (C) Bacteria, Anaerobic and peptidoglycan
- (D) Bacteria, Aerobic and pseudomurein

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II. 問答題(每題 15 分，共 60 分)

1. (1) Define “coliform” and list possible bacterial genus included in this group. (2) Describe the experimental process. (3) What is the importance to monitor the number of coliform?
2. (1) Explain metagenomics and metabarcoding and briefly describe the methods. (2) How can these methods be applied to investigate microbial communities in environments.
3. Describe antibiotic resistance and its development process, as well as its impact on the environment and human health.
4. (1) Define ectomycorrhizae and endomycorrhizae. (2) What is the important role of these mycorrhizae in bioremediation of environmental pollutants