

## A. 填充題 (答案第一字母已寫出) (12%)

1. The odor of moist earth is largely the result of streptomycete production of volatile substances such as g\_\_\_\_\_.
2. A most distinctive feature of the archaebacteria is the nature of their membrane lipids. They differ from both eubacteria and eucaryotes in having branched chain hydrocarbons attached to glycerol by e\_\_\_\_\_ links rather than fatty acids connected by ester links.
3. In nutrient-rich warm ponds and lakes, surface cyanobacteria can reproduce rapidly to form blooms. The release of large amount of organic matter upon the death of the bloom microorganisms stimulates the growth of chemoheterotrophic bacteria that subsequently depletes the available o\_\_\_\_\_. This kills fish and other organisms.
4. The results of numerical taxonomic analysis are often summarized with a tree-like diagram called a d\_\_\_\_\_.
5. One strain of a species is designated as the t\_\_\_\_\_ strain. It is usually one of the first strains studied and often is more fully characterized than other strains.
6. In chemolithotrophy a reduced i\_\_\_\_\_ molecule donates electrons for energy production.
7. According to the c\_\_\_\_\_ hypothesis, first formulated in 1961 by the British biochemist Peter Mitchell, the electron transport chain is organized so that, during its operation, protons move outward from the mitochondrial matrix and electrons are transported inward.
8. Many enzymes consists of a protein, the apoenzyme, and also a nonprotein component, a cofactor, required for catalytic activity. If the cofactor is firmly attached to the apoenzyme it is a p\_\_\_\_\_ group.
9. S\_\_\_\_\_ is the process by which all living cells, viable spores, viruses, and viroids are either destroyed or removed from an object or habitat.
10. Many microorganisms possess enzymes that afford protection against toxic  $O_2$  products. Obligate aerobes and facultative anaerobes usually contain the enzymes superoxide d\_\_\_\_\_ and catalase, which catalyze the destruction of superoxide radical and hydrogen peroxide, respectively.
11. A mutated microorganism that lacks the ability to synthesize an essential nutrient and therefore must obtain it or a precursor from the surroundings is an a\_\_\_\_\_.
12. A c\_\_\_\_\_ mutant bacterium produces the enzyme in question whether or not they are needed.

**B. 配對簡答題 (38%)**

答題說明：對應於左邊 15 個微生物學字辭或片語的每一個，試由右邊 (a~z) 選擇一個(每一個至多只能被選用一次)有重要關連的字辭或片語與之配對，並扼要(勿超過三句；中、英文皆可)說明「二者之關連性」及「此關連性在微生物學上的意義或重要性」。

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|--------------------------------------|--------------------------------------|
| 1. Cell wall                         | a) 1 M NaCl                          |
| 2. 16S ribosomal RNA                 | b) 50S Ribosome                      |
| 3. Chemotaxis                        | c) Endospore                         |
| 4. Extreme halophile                 | d) Sewage treatment                  |
| 5. Pentose phosphate pathway         | e) Nicotinamide adenine dinucleotide |
| 6. Lyophilization                    | f) Antibiotics                       |
| 7. MacConkey's agar                  | g) Gram stain                        |
| 8. Chloramphenicol                   | h) Catabolite repression             |
| 9. Reducing power                    | i) O <sub>2</sub>                    |
| 10. PEP-dependent phosphotransferase | j) 3 M NaCl                          |
| 11. Reductive TCA cycle              | k) Nucleic acid synthesis            |
| 12. Coenzyme A                       | l) Iron                              |
| 13. Nitrogenase                      | m) Motility                          |
| 14. Siderophore                      | n) FtsZ protein                      |
| 15. Diauxic growth                   | o) Culture preservation              |
|                                      | p) Koch's postulates                 |
|                                      | q) Acetyl group                      |
|                                      | r) Polymerase chain reaction         |
|                                      | s) Enterobacteriaceae                |
|                                      | t) Glucose                           |
|                                      | u) Carcinogen                        |
|                                      | v) Plasmid                           |
|                                      | w) CO <sub>2</sub> fixation          |
|                                      | x) $\beta$ -galactosidase            |
|                                      | y) Phyletic classification           |
|                                      | z) Differential medium               |

C. 問答題 (50%)

1. *Vibrio fischeri* is a marine bacterium that is capable of emitting fluorescence. Interestingly, under the same culture conditions, the only factor that affects the intensity of the bioluminescence is cell density. It is, the bacterium yields light only when the cell density reaches a certain level. (6%)
  - A) What is your hypothesis to explain this phenomenon?
  - B) What is your strategy to identify the structural genes responsible for the production of fluorescence?
  - C) How are you going to clone the regulatory gene responsible for the cell density dependent light emission?
2. Write an outline of a research proposal about microbial diversity. The proposal should include: A) Title of your project; B) The significance of microbial diversity; C) One specific aim of your research; D) Your experimental designs. (8%)
3.
  - A) Explain how a laminar flow works.
  - B) What kind of facilities must be equipped in a laboratory working on highly infectious microorganisms (for example, Ebola virus)?
  - C) What should you do if you have accidentally spilled a 100-ml culture of dengue virus on floor of the laboratory? (6%)
4. Briefly describe the significance of the following microorganisms (10%)
  - a) *Helicobacter pylori*
  - b) *Escherichia coli* O157
  - c) *Cryptococcus neoformis*
  - d) Epstein-Barr virus
  - e) *Mycobacterium tuberculosis*
5. Briefly explain the following terms (10%)
  - a) DNA vaccines
  - b) Superantigens
  - c) Neutralizing antibodies
  - d) Minimal Inhibitory Concentrations
  - e) Adhesins
6. The entire genome of the baking yeast, *Saccharomyces cerevisiae*, has been sequenced. What impact to biotechnology do you expect would bring from these data? (4%)
7. It is well established that the virus causing varicella (chickenpox) may become latent in nerves after the primary infection. The virus may be reactivated in older adults or in patients with impaired cellular immunity. The reactivation results in a vesicular rash on skin and is known as herpes zoster.
  - A) How did scientists know that varicella and herpes zoster are caused by the same virus?
  - B) How did scientists know that the virus is latent in nerve?
  - C) Is there any way to eradicate the virus in the persistently infected neurons? (6%)