

系所組別：環境工程學系丙組

考試科目：微生物學

考試日期：0307 · 節次：2

※ 考生請注意：本試題 可 不可 使用計算機

(1)[Terminology] Please briefly explain or describe the terminology below

- (a) VBNC (4%)
- (b) Proton motive force (4%)
- (c) β -oxidation pathway (4%)
- (d) Tyndallization (4%)
- (e) Endosymbiotic hypothesis (4%)

(2)[Microbial structure] Cell membranes are absolutely required for the living microorganisms. In nature, the membrane structures are slightly different among microorganisms. Please compare and contrast the cell membrane of *Bacteria* and *Archaea*. Include labeled drawing in your discussion. (16%)

(3)[Microbial growth] Please define the generation time of microbial growth (2%) and calculate the generation time of a broth culture in which the cell density increases in the log phase from 5×10^2 to 1×10^8 in 12 hours. (8%) Please describe how will you monitor the cell density (6%).

(4)[Metabolism] Fermentation and respiration are the two fueling processes by which microorganisms can conserve energy from the oxidation of organic or inorganic compounds.

- (a) Microbial respiration can occur at aerobic and anaerobic conditions. Please describe the process of anaerobic respiration using glucose catabolism as an example (6%). Does fermentation or anaerobic respiration yield as much ATP as aerobic respiration? Please explain your answer (4%).
- (b) Denitrification is an anaerobic respiration process. What is denitrification? Please describe it based on the chemical reaction, energy and electron sources used by microbes (8%). If you were the farmer, will you like this microbial process? Why or why not (2%)?
- (c) How does the fermentation process generate ATP (5%)? Why is the fermentation process important to many microorganisms (5%)?

(5)[Microbial Genetics] In all life forms, the functional unit of genetic information is the gene. Physically, the genes are located on chromosomes or other large molecules known as genetic elements. The information stored in DNA is transferred to RNA molecules, and finally, information carried by RNA is used to synthesize proteins. This genetic flow is called central dogma of molecular biology.

- (a) Three major types of RNA molecules are usually produced in the genetic flow. Please discuss their functions in the protein synthesis? (6%)
- (b) In *Bacteria*, how is the transcription process (DNA \rightarrow RNA) initiated? (8%)
- (c) If an RNA can be translated, it must contain an open reading frame. How would you find the open reading frame if you were given a nucleotide sequence? (4%)