

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 clearly define or explain the following items:

- (a) Michaelis-Menten kinetics (6 pts)
- (b) Anabolism and Cometabolism (4pts)
- (c) Phytoremediation and Bioaugmentation (4pts)
- (d) Quorum sensing (6pts)
- (e) Glycolysis and Gluconeogenesis (5pts)

**(2) Evolution and phylogeny.** In 1977, Carl Woese and Fox George proposed a "Three Domains of Life" concept for grouping the living organisms on Earth based on the sequences of small subunit ribosomal RNA (SSU rRNA) gene. This revolutionary concept together with advance of molecular biological tools has brought about a paradigm shift in microbiology and microbial ecology.

- (a) What is "Three Domains of Life"? (3pts)
- (b) What are the SSU rRNA molecules in the procaryotic and eucaryotic cells, respectively? (2pts)
- (c) Please discuss why the SSU rRNA gene sequences are suitable for phylogenetic analysis (10pts)

**(3) Microbial Growth.** The growth of microorganisms reproducing by binary fission can be plotted as the logarithm of the cell numbers versus the incubation time.

- (a) In a closed system, the microbial growth usually has four distinct phases. Please draw a growth curve and briefly describe the four phases accordingly. (4pts)
- (b) Please explain what is "VBNC" (2 pts) and comment the significance of VBNC microorganisms regarding the safety of drinking water (4pts).
- (c) Please estimate the generation time based on the experimental data obtained in a batch culture. (10pts)

Time (hr)	Number of cell
0	$1 \times 10^2$
2	$1 \times 10^2$
4	$1 \times 10^2$
6	$1 \times 10^3$
8	$1 \times 10^4$
10	$1 \times 10^5$
12	$1 \times 10^6$
14	$1 \times 10^7$

(背面仍有題目,請繼續作答)

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- (4) **Metabolism** Fermentation and respiration are the two means by which chemoorganotrophs can conserve energy from the oxidation of organic compounds.
- Please indicate how the ATP is synthesized during the catabolic reactions? (5pts)
  - Which form of ATP synthesis requires cytoplasmic membrane participation? Why? (10pts)
- (5) **Microbial structure.** The inclusion bodies in the procaryotic cytoplasm are granules of organic or inorganic materials. They are usually used for storage of carbon compounds, inorganic substances and energy, or to reduce osmotic pressure. Please describe five kinds of inclusion bodies and the corresponding functions. (15 pts)
- (6) **Genetics** The genetic information stored in DNA is divided into units called genes. Genes are transcribed into the RNA molecules, followed by the translation process for synthesis of polypeptide. In addition to rRNA, please indicate another two types of RNA molecules and describe their roles in the protein synthesis. (10 pts)