

(請依序作答於答案卷上)

Part A (50 %)

- I. (10 %) Many important events occurred during the development of Microbiology, and we cannot understand microorganisms so well without the efforts of the following great scientists. Please describe the contribution each scientist put on studying microorganisms.
1. Louis Pasteur 2. Antony van Leeuwenhoek 3. Robert Koch 4. David Bergey 5. Fred Griffith
- II. (8 %) A culture medium is a solid or liquid preparation used to grow, transport, and store microorganisms. Culture media can be classified into supportive, enriched, selective and differential media based on their functions. Please define and give an example for each type of medium mentioned above.
- III. (10 %) Definition
1. Riboswitch 2. Quorum sensing 3. Photolithoautotrophs 4. stringent response 5. horizontal gene transfer
- IV. (12%) When *E. coli* grows in a medium containing both glucose and lactose, it exhibits "diauxic growth" due to the way it utilizes both sugars. 1. Please draw a diauxic growth curve and explain how the growth curve is different from the one when *E. coli* grows in a medium containing only glucose. 2. Catabolite repression is part of the reason why diauxic growth occurs. In the case of *lac* operon, which encodes proteins required for lactose metabolism, catabolite repression is accomplished by catabolic activator protein (CAP) and *lac* repressor. Please explain how these two regulators coordinately control the expression of *lac* operon through the CAP binding site and *lac* operator during the diauxic growth.
- V. (10 %) Recombinant DNA technology requires suitable cloning vectors to bring a DNA fragment of interest into the host cells. Most of the cloning vectors are derived from plasmids, and they usually share common features including origin of replication, selectable markers and multiple cloning sites. 1. What is the purpose for each feature mentioned above in a cloning vector? 2. Many enzymes are used in creating recombinant DNA. What are the purposes to use the following enzymes in a cloning process? (A) T4 DNA ligase (B) restriction endonuclease (C) Pfu DNA polymerase (D) reverse transcriptase

Part B (50%)

- I. Define the following terms: (10%)
1. Microbial species, 2. Morphovar, 3. Serovar, 4. Type strain,
5. Operational taxonomic unit
- II. Describe the major characteristics of the following microorganism and discuss their important positive/negative impacts on human and the environment. (10%)
1. Proteobacteria, 2. Mycoplasma, 3. Actinomycetes, 4. Cyanobacteria, 5. Streptococci
- III. Describe five microbial virulence factors involved in bacterial pathogen invasion and dissemination. The answer should include the microorganism involved and the mechanism of action of each virulence factor. (10%)
- IV. Describe and discuss the following techniques often used in the diagnosis of microbial and immunological disease. (10%)
1. Flow cytometry, 2. Immunoprecipitation, 3. Enzyme-linked immunosorbent assay, 4. Complement fixation,
5. Viral hemagglutination
- V. Matching: (10%)
1. Chemotherapeutic drugs that kill or damage bacterial pathogens:
1-1. Cell wall synthesis inhibition ①
1-2. Cell membrane disruption ②
1-3. Antimetabolites ③
2. Antifungal agents ④
3. Antiviral drugs ⑤
- Keys:** (A) cephalosporins (B) vancomycin (C) quinolones (D) polymyxin (E) trimethoprim (F) Isoniazid (G) tetracycline (H) chloramphenicol (I) miconazole (J) griseofulvin (K) amantadine (L) rimantadine (M) chloroquine