※ 注意：請於試卷內之「非選擇題作答區」作答，並應註明作答之題號。

A Part

I. **(10%)** 1. What is the periplasmic space, and what is its function? 2. Explain why penicillin can be an effective drug to treat gram-positive bacterial infections but is ineffective against most gram-negative bacteria.

II. **(10%)** Metabolism is made possible by enzymes. Define and explain the following term: 1. apoenzyme, 2. allosteric inhibition, 3. ATP synthase, 4. constitutive enzyme, 5. enzyme repression.

III. **(10%)** Compare and explain the differences among conjugation, transformation, general transduction, specialized transduction, and transposition on the basis of general method, donor, and recipient.

IV. **(10%)** Genomics is a growing field that has enabled scientists to study the cellular physiology. 1. What is the difference between paralogue and orthologue? 2. What is the role of mass spectrometry in proteomics? 3. Protein-DNA interactions can be identified through the use of chromatin immunoprecipitation (ChIP). Describe a ChIP-chip experiment.

V. **(10%)** 1. Explain the opportunistic disease and give some examples of opportunistic disease. 2. Compare the gastroenteritis caused by *Vibrio cholera* with that of *Campylobacter jejuni*. How are they similar and different, and how to do laboratory diagnosis?

B Part

I. **(10%)** Definition

1. endosymbiotic hypothesis　2. Multilocus sequence typing (MLST)　3. metagenomics
4. bioaugmentation (in bioremediation)　5. pathogenicity island

II. **(10%)** A bacterial strain, which can degrade cellulose, was isolated from a toppled tree trunk in the forest. 1. In order to identify which bacterial species it is, what kind of economical approach you will use? Please briefly describe the procedures on how you can get the answer. 2. Please design an experiment to identify the gene responsible for cellulose- degradation ability in this bacterium.

III. **(12%)** Microorganisms can be harmful or beneficial to human life. Please explain whether the following microorganisms are good or bad to human beings and why.

1. *Saccharomyces cerevisiae*　2. Lactic acid bacteria
3. *Bacillus thuringiensis*　4. *Rhizopus oryzae*
5. *Escherichia coli* O157:H7　6. *Agrobacterium tumefaciens*

IV. **(8%)** Some individuals are allergic to fungal spores, and exposure to such allergens may cause localized anaphylactic responses such as itchy and tearing eyes, congested nasal passages, coughing, and sneezing. Antihistamine can alleviate these symptoms and a desensitization program, gradually activating IgG, can be used to treat allergy caused by such environmental allergens. Based on the mechanism for allergy, please explain why antihistamine and desensitization can work for allergy treatment/therapy.

V. **(10%)** Based on the characteristics, please design a proper procedure to isolate each microorganism described below in an environmental sample.

1. *Halobacterium* sp., an extreme halophilic archaeon
2. *Azotobacter* sp., a free-living nitrogen fixing bacterium
3. *E. coli*, belonging to coliform bacterial group
4. Chitin-degrading fungi
5. Coliphage

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