

- Explain why are fermentations so useful to many microorganisms? Can ATP be produced during fermentation? Please describe alcoholic, lactic acid, and formic acid fermentations. (10%)
- 二 What is a two-component phosphorelay system? Describe the mechanism of chemotaxis in *Escherichia coli*. (10%)
- 三 Define the following terms: (14%)
1. cosmids, 2. bacterial artificial chromosome, 3. proteomics, 4. conjugation, 5. major groove, 6. reversible covalent modification of enzymes, 7. ATP-binding cassette transporters
- 四 Describe “metabolic pathway engineering” and how it is used in biotechnology, please give one example. (10%)
- 五 Microbial products often are classified as primary and secondary metabolites. Please define both of them. (6%).
- 六 What is the T_m ? Draw a DNA melting curve and explain the curve. (3%)
Explain the nucleic acid hybridization in term of southern and northern hybridization. (3 %) Explain the western blot and also explain why it can be utilized to define the phylogenetic tree as well? (4%)
- 七 What is the pseudomurein? Compare it to the murein and which kind of microorganisms that contain each component? (4%) What is the nitrogen fixation? Why does the nitrogen fixation as an oxygen-sensitive process in the cyanobacteria, and how does the nature of microorganism have for preventing the O_2 into the cell? And by what kind mechanism that it can do the photosynthesis? (4%) What is the parasporal body? (2%)
- 八 What does the lymphocyte stem cell develop, if matured in thymus, what will it develop? What kinds of cells there would be? Please also describe functions for these matured cells. (3%) What kinds of cell there would be if matured in bone marrow? Please also describe the functions of these matured cells. (2%) What does the complement do? (3%) What is the cytokine and how do you name it specifically and usually what is its activity? (2%)
- 九 Imagine that human being need a diversity of immunoglobulins about 10 trillion (10^{13}); How is this diversity generated? (3%) When an individual is exposed to an antigen, it would be an initial lag phase, or latent period of several days to weeks before an antibody response is mounted; so what kind of immunoglobulin appears first; give a description of its characteristics and what kind of immunoglobulin appears second; also describe its characteristics? (2%) What is the Natural killer (NK) cell? Explain it. (2%) (Multiple choice, please select one) 1. The five class of Immunoglobulin belongs to (a) Isotypes (b) Idiotypes (c) Allotypes (1%), 2. If the mutations that occur during B cell development; specific immunoglobulin molecules that differ in the hypervariable region of the Fab portion; thus they belong to (a) Isotypes (b) Idiotypes (c) Allotypes (1%), 3. If they are the allelic forms of antibody and not exist in all individual one; then they belong to (a) Isotypes (b) Idiotypes (c) Allotypes. (1%)
- 十 What is the 1. paralog, 2. ortholog, 3. probiotics, 4. prebiotics, 5. type I hypersensitivity and give an example for this phenomena. (10%)