

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Please define the terminology below and their possible relationships.
  - (a) De-nitrification and Anammox (6 %)
  - (b) Dehalorespiration and *Dehalococcoides* (6 %)
  - (c) Polymerase Chain Reaction and Agarose Gel Electrophoresis (6 %)
  - (d) Syntrophy and Methanogenesis (6 %)
  - (e) NADH and Electron transport chain (6 %)
  
2. A microbial ecologist wants to know the distribution of complete nitrifying bacteria, *Nitrospira* in the wastewater treatment plant. This question can be addressed by using several molecular tools, such as FISH, DGGE, and quantitative PCR.
  - (a) What is FISH? How does it work? (3%+5%)
  - (b) What is DGGE? How does it work? (3%+5%)
  - (c) Please suggest the microbial ecologist how to use these methods to address the question? (10%).
  
3. Please compare the size of ribosomes present in *Bacteria*, *Archaea*, *Eucarya*, Chloroplast and Mitochondria. (10%)
  
4. You have been hired for a bioremediation project. In this project, you are asked to apply in-situ bioremediation method to a site where groundwater is contaminated with the chlorinated pollutants such as trichloroethene.
  - (a) It is suggested that use of reductive dechlorination and bioaugmentation methods to the site may be feasible. Please describe what are the “reductive dechlorination” and “bioaugmentation” methods. (8%)
  - (b) What environmental factors will you consider to stimulate the microbial degradation of trichloroethene anaerobically in this case? Please describe the corresponding rationales of microbiology (16%).
  
5. When the surrounding environment is no longer suitable for the growth, many microorganisms will change the physiological state to the VBNC conditions.
  - (a) What does VBNC stand for? (2%)
  - (b) Please elucidate the significance of VBNC microorganisms in the drinking water system.(8%)