

1. Microorganisms in ecosystems act as primary producers, decomposers, and primary consumers. Please use an example to describe the roles of microorganisms in **bioremediation**. (10%)
2. Please explain the technology of **DNA-DNA hybridization** and its application in studying the relatedness of bacteria. (10%)
3. Please describe the major characteristics of the family *Enterobacteriaceae* and their roles in natural environments. (10%)
4. Please explain how **proton motive force** (PMF) is created and its involvements in bacterial growth, metabolism, and motility. (10%)
5. Please use an example to describe the **beneficial effects** of microorganisms on eukaryotes. (10%)
6. Please describe the biological characteristics of the following microorganisms (each question is 4%, total 28%).
  - (1) Influenza virus H1N1
  - (2) *Caenorhabditis elegans*
  - (3) *Staphylococcus aureus*
  - (4) *Penicillium notatum*
  - (5) viroid
  - (6) tobacco mosaic virus
  - (7) *Phytophthora infestans*
7. Please describe the following terms and their functions in microbial growth or survival. (22%)
  - (1) Bacteriocin (4%)
  - (2) Porin (3%)
  - (3) Beta-hydroxybutyrate (PHB) (2%)
  - (4) Flagellum (3%)
  - (5) Z ring (3%)
  - (6) Peptidoglycan (3%)
  - (7) Hopanoid (2%)
  - (8) Endospore (2%)