

1. Once heart beat and breathing stop, an organism is dead. Please describe the criteria to define that **(I)** cell is alive, **(II)** cell is aged, and **(III)** cell is death. (25%)
2. Genetic information is transferred from DNA to messenger RNA (mRNA) and then the information of mRNA is used to synthesize protein. **(I)** Please describe what is microRNA (miRNA)? **(II)** Diagram the biogenesis pathway of miRNA. **(III)** Discuss the physiological functions and possible role of miRNA in human diseases. (25%)
3. Please design **three** experiments to test the hypothesis that there is sexual difference in brains. The experimental designs should include “research rationale” and “methods” and “expected results”. (25%)
4. Please explain the following bio-techniques and the purposes to use those techniques (merely translate into Chinese is discouraged): (25%)
 - a. chromatin immunoprecipitation assay
 - b. real-time polymerase chain reaction (PCR)
 - c. in situ hybridization
 - d. two-dimensional array
 - e. gene therapy