

**I. 簡答題 (請標明題號，於非選擇題作答區內作答)**

1. The plasma membrane of the animal cell is composed of a number of structures. List these structures and correlate with their functions. (8 分)
2. Which organelle is responsible for storing calcium in skeletal muscle cell? What events can trigger the release of calcium into the cytoplasm? How the elevated calcium concentration in cytoplasm contributes to the muscle contraction? (8 分)
3. Briefly describe how three different processes that occur during sexual reproduction increase the genetic diversity of offspring. Is the increased genetic diversity beneficial to reproductive success or survival of offspring? Why? (8 分)
4. A dividing cell from a rodent has 19 chromosomes, each consisting of two sister chromatids. During which stages of cell division could this cell be? Explain your answer. (6 分)
5. When crossing an organism that is homozygous recessive for a single trait with a heterozygote, what is the chance of producing an offspring with the homozygous recessive phenotype? Explain your answer. (4 分)
6. Cytosine makes up 42% of the nucleotides in a sample of DNA from an organism. Approximately what percentage of the nucleotides in this sample will be thymine? Explain your answer. (4 分)
7. *E. coli* cells grown on <sup>15</sup>N medium are transferred to <sup>14</sup>N medium and allowed to grow for two more generations (two rounds of DNA replication). DNA extracted from these cells is centrifuged. What density distribution of DNA would you expect in this experiment? Explain your answer. (4 分)
8. What cause DNA molecules to move to the positive pole during electrophoresis? Why do large molecules move more slowly than smaller ones? (5 分)
9. If every protein is encoded by a gene, how can humans have many more proteins than genes? (5 分)
10. What are microRNAs (miRNAs)? If a gene has the sequence AATTCGCG, what would be the sequence of a miRNA that turns off expression of the gene? (8 分)
11. Explain how a severe protein deficiency in the diet that decreases the concentration of blood plasma proteins can cause edema, the accumulation of fluid in body tissues. (5 分)
12. How does the structure of a gill match its function? (6 分)
13. What is the main difference between innate immunity and adaptive immunity? (5 分)
14. Acetylcholine stimulates skeletal muscle contraction but inhibits or slows cardiac muscle contraction. How can this neurotransmitter have such opposite effects? (5 分)
15. In logistic growth ( $G=rN(K-N)/N$ ), at what population size (in terms of K) is the population increasing most rapidly? Explain why. (G: growth rate of the population; K: carrying capacity; N: the population size; r: per capital rate of increase) (6 分)
16. List the four major threats to biodiversity. (4 分)

**II. 配合題 (每題 1 分，共 9 分) (請標明題號，於非選擇題作答區內作答)**

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| _____ 1. Earthworms                            | A. sponges     |
| _____ 2. Pseudocoelom                          | B. cnidarians  |
| _____ 3. Largest phylum                        | C. flatworms   |
| _____ 4. No true tissues                       | D. molluscs    |
| _____ 5. Sea star                              | E. annelids    |
| _____ 6. Have a muscular foot and a mantle     | F. nematodes   |
| _____ 7. Turtles                               | G. arthropods  |
| _____ 8. The simplest bilateral animals        | H. echinoderms |
| _____ 9. Two body forms are polyps and medusae | I. chordates   |