

所別：生物物理研究所碩士班 科目：普通生物

1. (共 30 分) For *Drosophila* (fruit fly), normal veins and long bristles are the wild type characteristics controlled by dominant alleles. The following table shows experimental results of the F₁ progeny by crossing a male of fused veins and bobbed bristle with a female of normal veins and long bristles.

Phenotype	Number of flies
Normal veins & long bristles	19
Normal veins & bobbed bristles	228
fused veins & long bristles	232
fused veins & bobbed bristles	18

- (a) (5 分) State Mendel's first and second laws.
- (b) (5 分) What precaution should be taken in selecting the parents for the crossing ?
Explain your reasons.
- (c) (5 分) What is the genotype of the female parent ? Explain your answer.
- (d) (8 分) Do the above results agree with Mendel's second laws ? Use genetic diagram to explain your answer.
- (e) (7 分) Suggest a genetic explanation for the observed results in the table. Use genetic diagram to explain your answer.
2. (共 15 分) Describe in details the cell cycle of a eukaryotic cell. Describe each phase in the cell cycle in detail, with suitable drawings.
3. (共 20 分)
- (a) (10 分) Name 4 enzymes that are essential in DNA replication. Describe in detail their functions in DNA replication.
- (b) (10 分) What is Okazaki fragments ? Explain why Okazaki fragment is essential in DNA replication. Make a drawing to show how it works.
4. (共 15 分)
- (a) (9 分) What are the three kinds of RNA that are present in cells ? Explain in details their functions in a cell, especially in terms of protein synthesis.
- (b) (6 分) The following is the sequence of a piece of single stranded nucleic acid:
AUG CGA AGG CCU ACA CGU ACC UUC GCU. Draw the secondary structure that this RNA can fold into with lowest energy.
5. (共 20 分) What is the most important problem that you think that need to be solved or understood in biology ? Write a short essay (more than 400 words) to convince me.