

注意事項：答案一律寫在試卷上，否則不予計分。
請依序作答，並標明題號，但不必抄題。

Answer the following questions.

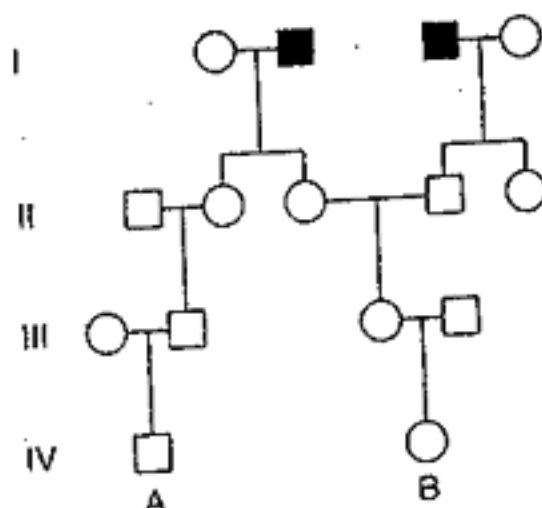
1. (16%)

(1) A researcher wanted to find out the map distance between two loci in soybean, which we will indicate as A and B. She crossed inbred lines that were AABB and aabb (Cross 1) and then backcrossed the progeny of this cross to inbred line aabb and scored the progeny as recombinant or nonrecombinant. In another cross between inbred lines AAbb and aaBB (Cross 2), she also crossed the progeny back to aabb line and scored the progeny. Given the data below from these crosses, what is the estimated rate of recombination between these two loci. (6%)

Progeny type	Numbers	
	Cross 1	Cross 2
AaBb	43	12
Aabb	8	59
aaBb	11	62
aabb	51	15

(2) A family where both parents have normal pigmentation, but they have an albino child. If they have three children, what is the probability that two will be normal and one will have albinism? (4%)

(3) Consider the following pedigree of a rare autosomal recessive disease, PKU. (6%)



- (a) If individuals A and B marry, what is the probability their first child will have PKU?
 (b) If their first child has the disease, what is the probability their second child will be unaffected?

(背面仍有題目,請繼續作答)

2. (16%)

(1) Actinomycin D is an antibiotic that blocks DNA-dependent RNA synthesis, but not RNA-dependent replicases. Suppose you isolate a new virus and find that its growth is not inhibited by actinomycin D.

(a) Is the genome of this virus composed of DNA or RNA? (3%)

(b) What would your answer have been if it was found that actinomycin D does inhibit viral growth? (3%)

(2) At least three modifications occur during the process of hnRNA into mRNA. List them and described each one. (6%)

(3) Suppose that the *Tetrahymena* rRNA gene, which contains an intron, is isolated and introduced into *E. coli*. The bacterial RNA polymerase recognizes the promoter and transcribed the gene. Would you expect to find mature rRNA species within the bacterial cell? Why? (4%)

3. (20%)

(1) Starting with pig cells and a probe that is the human β -globin gene, describe how you would clone the β -globin gene from pigs. You may assume that you have available all the materials needed in a cloning experiment. (8%)

(2) What is a molecular marker? Give two examples. Discuss why it is easier to locate and map many molecular markers rather than functional genes. (6%)

(3) (6%)

(a) Describe the term "Genomics".

(b) Discuss the goals of the Human Genome Project.

4. (22%)

(1) What is the DNA fingerprinting? How can it be used in human identification and relationship testing? (6%)

(2) What roles do PCR and Southern blotting play in the analysis DNA fingerprinting. (6%)

3) What is the polygenic inheritance? Discuss the issues that make polygenic inheritance difficult to study. (5%)

4) Scientists are now using DNA sequences to show phylogenetic relationships between or among species. In many cases, cDNA is made from isolated mRNA and then sequenced. Is the method a reasonable approach to show evolutionary relationships? (5%)

5. (26%)

(1) There are mutant tRNAs that act as nonsense and missense suppressors. At the molecular level, explain how you think these suppressors work. (6%)

(2) During the Amest test, why is the potential mutagen mixed with a rat liver extract? (5%)

(3) In Müller's experiment with CIB chromosomes, is the experiment measuring the mutation rate within a single gene? Explain. If we divide 91 by 783, we obtain a mutation rate of 11.6%. In your own words, explain what this value means. (5%)

(4) Spontaneous mutations can occur by the conversion of cytosine to uracil, but this kind of deamination does not usually lead to a mutation. Why? (5%)

(5) The DNA of some organisms contains a small number of modified bases in addition to the usual four. The most common of these is 5-methylcytosine, which base-pairs with guanine exactly as ordinary cytosine does. Why is deamination of 5-methylcytosine so likely to cause mutations? (5%)