

※ 注意：請於試卷內之「選擇題作答區」依序作答。

一、 選擇題：(每題 2 分)

- The cross of an uncertain genotype with a homozygous recessive genotype at the same locus is a
 - pure-breeding cross
 - monohybrid cross
 - testcross
 - dihybrid cross
- Why was the one-gene-one-enzyme hypothesis recast as the one-gene-one-polypeptide hypothesis?
 - Genes can encode proteins that are not enzymes.
 - Some enzymes are not polypeptides.
 - Some enzymes have more than one polypeptide subunit.
 - Some polypeptides are not enzymes.
- Which one of the following is **incorrect**?
 - DNA polymerases can proofread but RNA polymerases cannot.
 - Some RNA polymerases, but no DNA polymerases, are sensitive to α -amanitin.
 - Only RNA polymerases can initiate the formation of a polynucleotide.
 - RNA polymerases synthesize in a $3' \rightarrow 5'$ direction while DNA polymerases synthesize in a $5' \rightarrow 3'$ direction.
- Single bacterial cells sensitive to the infection of a phage are inoculated into a large number of separate culture dishes and allowed to grow in parallel. After many generations, a sample is taken from each culture, inoculated with the phage, and separately plated. Which result is expected?
 - All plates will have similar numbers of bacterial colonies.
 - No bacterial colonies will be seen on any of the plates.
 - Only one plate in 10^6 will have bacterial colonies.
 - Some plates will have no bacterial colonies, some will have a few, and some will have many.
- Which one of the following statements is true about mitosis?
 - The nucleolus disappears during metaphase.
 - Nuclear membranes reform at the end of telophase.
 - Centromeres are aligned on the metaphase plate at prophase.
 - The nucleolus reforms at the end of anaphase.
- How many different genotypes are obtainable from the cross $Aa Bb \times Aa Bb$?
 - 3
 - 4
 - 9
 - 16
- Proof that genes lie on chromosomes was obtained by
 - Correlating aneuploids resulting from nondisjunction with inheritance patterns
 - Showing that some genes appear to be sex linked
 - Showing that males have an X and a Y, while females have two X's
 - Showing that in *Drosophila*, males are the heterogametic sex
- Two alleles at the *white* locus in *Drosophila melanogaster* are $w^{apricot}$, which has orange-colored eye, and w^{coral} , which has pink-colored eyes. This is an example of
 - codominance.
 - a multiple allelic series.
 - penetrance.
 - epistasis.

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9. The genotypic ratio of the progeny of a monohybrid cross is typically
 - a. 1:2:1
 - b. 9:3:3:1
 - c. 27:9:9:9:3:3:3:1
 - d. 3:1
10. Which of the following is NOT a DNA marker?
 - a. RFLP
 - b. STS
 - c. ECE
 - d. EST
11. Which of the following statements is NOT true about sex determination in mammals?
 - a. It is equivalent to testis determination.
 - b. In males, it results from the action of the testis-determining factor.
 - c. Sex reversal occurs when the *SRY* gene is present in males.
 - d. The *SRY* gene encodes the testis-determining factor.
12. The effector molecule that induces the lac protein-coding genes is
 - a. lactose
 - b. allolactose
 - c. glucose
 - d. β -galactosidase
13. Bacterial operons containing protein-coding genes for the synthesis of amino acids, such as the tryptophan operon, are customarily classified as
 - a. negatively controlled
 - b. positively controlled
 - c. repressible operons
 - d. inducible operons
14. The receptors for steroid hormones
 - a. lie on the cell surface and act via second messengers
 - b. lie on the cell surface and when bound by hormone are transported into the nucleus and bind response elements to activate transcription
 - c. lie in the cytoplasm and act via second messengers
 - d. lie in the cytoplasm and when bound by hormone are transported into the nucleus and bind response elements to activate transcription
15. Which one of the following statements is NOT the role RISC has in RNAi?
 - a. RISC cleaves double-stranded RNA into 21-23-bp fragments having 3' overhangs.
 - b. RISC binds short double-stranded RNA, unwinds it, pairs one strand with a complementary mRNA.
 - c. RISC binds short double-stranded RNA, unwinds it, pairs one strand with a complementary mRNA, and, in doing so, blocks transcription.
 - d. RISC amplifies the interference signal.

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※ 注意：請於試卷內之「非選擇題作答區」依序作答，並應註明作答之大題及小題題號。

二、 簡答題：

1. In tomatoes, red fruit color is dominant to yellow. Suppose a tomato plant homozygous for red is crossed with one homozygous for yellow. Determine the appearance of
 - a. the F1 tomatoes
 - b. the F2 tomatoes
 - c. the offspring of a cross of the F1 tomatoes back to the red parent
 - d. the offspring of a cross of the F1 tomatoes back to the yellow parent (10 分，每小題 2.5 分)

2. Bean plants may have different symptoms when infected with a virus. Some show local lesions that do not seriously harm the plant; others show general systemic infection. The following genetic analysis was made:

P: local lesions x systemic infection

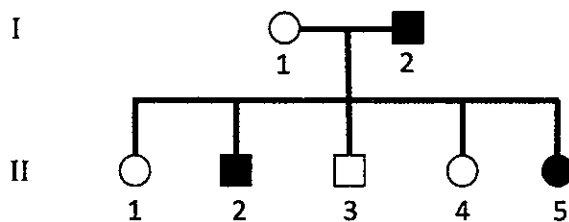
F1: all local lesions

F2: 785 local lesions : 269 systemic infection

What is the likely genetic basis of this difference in beans (5 分)? Assign gene symbols to all the genotypes occurring in the genetic analysis. Design a testcross to verify your assumptions (5 分).

3. Consider the following pedigree, in which the allele responsible for the trait (a) is recessive to the normal allele (A):

Generation



- a. What is the genotype of the mother?
 - b. What is the genotype of the father?
 - c. What are the genotypes of the children?
 - d. Given the mechanism of inheritance involved, does the ratio of children with the trait to children without the trait match what would be expected? (10 分，每小題 2.5 分)
4. In peaches, fussy skin (F) is completely dominant to smooth (nectarine) skin (f), and the heterozygous condition of oval glands at the base of leaves (G^O) and no glands (G^N) gives round glands. A homozygous fussy, no-gland peach variety is bred to a smooth, oval-gland variety.
 - a. What will be the appearance of the F1 peaches? (3 分)
 - b. What will be the appearance of the F2 peaches? (3 分)
 - c. What will be the appearance of the offspring of a cross of the F1 peaches back to that smooth, oval-glanded parent? (4 分)

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5. In *Drosophila*, the recessive allele *bw* causes a brown eye, and the (unlinked) recessive allele *st* causes a scarlet eye. Flies homozygous for both recessives have white eyes. The genotypes and corresponding phenotypes, then, are as follows:

$bw^{+}/-$	$st^{+}/-$	red eye
bw/bw	$st^{+}/-$	brown
$bw^{+}/-$	st/st	scarlet
bw/bw	st/st	white

Outline a hypothetical biochemical pathway that would produce this type of gene interaction (10 分). Demonstrate why each genotype shows its specific phenotype (5 分).

6. The cross $a^{+}a^{+}b^{+}b^{+} \times aabb$ produces an F1 that is phenotypically $a^{+}b^{+}$. Its F2 phenotypes appear in the following numbers:

$a^{+}b^{+}$	110
$a^{+}b$	16
ab^{+}	19
ab	15
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Total.	160

What F2 numbers would be expected if the a and b loci assorted independently (5 分)? Use a chi-square test to evaluate whether they are linked or assorted independently (10 分).

試題隨卷繳回