

※ 考生請注意：本試題 可 不可 使用計算機

1. A new virus has been discovered, and the genome has been determined to be 22% A, 30% T, 40% C, and 25%G. What does this tell you about the genome of this virus? (6%)
2. What is the purpose of replication? At what stage in the cell cycle does it occur? (6%)
3. What are some reasons that translation cannot be coupled to transcription in eukaryotes? (6%)
4. How does the binding of the *lac* repressor to the *lac* operator prevent transcription? (7%)
5. Please explain what are the **orthologs** and **paralogs**. (6%)
6. In what way might one use heat-shock genes in *Drosophila* to facilitate the use of **RNAi** as a research tool? (6%)
7. Please explain the *P* element (transposon) mediated **hybrid dysgenesis** in *Drosophila*. (7%)
8. Please briefly describe a DNA microarray and its use. (6%)
9. Which evolutionary forces will result in excessive heterozygosity in a population? (5%)
10. Please explain how genetists used fruitfly chromosomes as a tool to illustrate inbreeding depression. (5%)
11. Please explain the "three-stage approach" to sequencing an entire genome. (5%)
12. Please define "balanced polymorphisms" and the determining evolutionary force. (5%)
13. What is a 'molecular clock'? (5%)

(背面仍有題目,請繼續作答)

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14. Suppose that red flower color (RR or Rr) is dominant to white flower color (rr) in rose. A friend has a rose plant with red flowers and wants to determine whether the plant is RR or Rr. In order to determine the genotype, you cross it with a white-flowered rose. (5%)

(A) What is the name of the cross that you performed?

(B) How will this cross help you determine the genotype of the red flowered rose?

That is, how will the results from this cross differ if the red-flowered rose is RR vs Rr?

15. You construct a genetic linkage map by following allele combinations of three genes, X, Y and Z. You determine that X and Y are 3 cM apart, X and Z are 3 cM apart, and that Y and Z are 6 cM apart. (6%)

(A) What are these cM numbers most likely based on?

(B) Referring to the cM numbers in this question, what is the relative gene order of these three genes?

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16-22. Choose the correct answer (only one answer) from each of the question (14%)

16. Some organisms have abnormal sex chromosomes such as XO or XXY. The most likely cause of the abnormal sex chromosome is:

- A. Error occurred in mitosis of fertilized egg
- B. Gene mutation
- C. Error occurred in meiosis in gamete formation
- D. Sex chromosomes in gametes are either lost or doubled in fertilization
- E. Sex chromosome translocation

17. When an allotetraploid is backcrossed to one of its progenitor species, a sterile progeny is produced. This individual can be best represented by:

- A.  $n_1 + n_2$
- B.  $2n_1 + n_2$
- C.  $2n_1$
- D.  $2n_2$
- E.  $2n_1 + 2n_2$

18. The proteinaceous complex mediating synapsis is called the

- A. zygonemal complex
- B. pachynemal complex
- C. leptonemal complex
- D. synaptonemal complex
- E. diplonemal complex

19. Methods for determining the linkage group and genetic map in humans involve which of the following?

- A. syntenic testing and lod score determination
- B. twin spots and tetrad analysis
- C. tetrad analysis and bromodeoxyuridine
- D. zygotene and pachytene DNA synthesis
- E. chiasmotype and classical analyses

(背面仍有題目,請繼續作答)

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20. Given the parents AABBCc multiply AabbCc, assume simple dominance and independent assortment. What proportion of the progeny will be expected to phenotypically resemble the first parent?

- A. 1/8
- B. 1/4
- C. 3/4
- D. 7/8
- E. 9/16

21. If two independently derived recessive mutant alleles producing similar recessive phenotypes fail to complement, what can you conclude?

- A. The alleles must be on different genes
- B. They are both mutations of the same allele
- C. The alleles must be on the same gene
- D. The alleles are epistatic
- E. The alleles are both homozygous

22. A likely explanation for abnormal human phenotypes associated with trisomies is:

- A. The presence of multigene families in the extra chromosomal copy
- B. The extra chromosome has typically undergone significant rearrangements
- C. Meiotic recombination
- D. Altered gene dosage
- E. All of the above