

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

A. Choose the best one answer from each of the question. (30%)

1. What is the probability that two parents who are heterozygous for the recessive trait of albinism will have two albino offspring?

- A) 1/2 B) 1/4 C) 1/8 D) 1/16 E) 1/32

2. There is good evidence for linkage when

- A) a gene is associated with a specific phenotype
B) two genes occur together in the same gamete
C) two genes work together to control a specific characteristic
D) two characteristics are caused by a single gene
E) genes do not segregate independently during meiosis

3. Which of these is a way that the sexual life cycle increases genetic variation in a species?

- A) by allowing crossing over
B) by allowing an increase in cell number
C) by increasing gene stability
D) by conserving chromosomal gene order
E) by decreasing mutation frequency

4. Which of the following is true of a species that has a chromosome number of $2n = 16$?

- A) The species is diploid with 32 chromosomes per cell.
B) The species has 16 sets of chromosomes per cell.
C) Each cell has eight homologous pairs.
D) During the S phase of the cell cycle there will be 32 separate chromosomes.
E) A gamete from this species has four chromosomes.

5. Assume that a cross is made between AaBb and aabb plants and that all the offspring are either AaBb or aabb. These results are consistent with _____.

- A) complete linkage
B) alternation of generations
C) codominance
D) incomplete dominance
E) hemizyosity

6. Diana was told that her baby has Down syndrome because it had two copies of the same chromosome from its dad. Which of the following would be most likely to have caused the Down syndrome?
- A) XYY father
 - B) deletion
 - C) amniocentesis
 - D) karyotyping
 - E) nondisjunction
7. A genomic condition which may be responsible for some forms of fragile-X syndrome as well as Huntington disease involves
- A) F plasmids inserted into the FMR-1 gene
 - B) various lengths of trinucleotide repeats
 - C) multiple breakpoints fairly evenly dispersed along the X chromosome
 - D) multiple inversions in the X chromosome
 - E) single translocations in the X chromosome
8. In a mammal how many inactivated X chromosomes (Barr bodies) would be present in cells of individuals who were XXXY?
- A) 0
 - B) 1
 - C) 2
 - D) 3
 - E) 4
9. When a wild-type fly is crossed to a fly homozygous for an autosomal recessive gene, all of the progeny express the recessive phenotype, what type of chromosomal change probably accounts for this result?
- A) inversion
 - B) deletion
 - C) duplication
 - D) translocation
 - E) trisomy
10. Of the following human aneuploidies, which is the one that generally has the most severe impact

on the health of the individual?

- A) 47,+21
- B) 47,XXY
- C) 47,XXX
- D) 47,XYY
- E) 45,X

11. In a nucleosome, the DNA is wrapped around

- A) polymerase molecules.
- B) ribosomes.
- C) histones.
- D) a thymine dimer.
- E) nucleases

12. Mendel's second law of independent assortment has its basis in which of the following events of meiosis I?

- A) synapsis of homologous chromosomes
- B) crossing over
- C) alignment of synapsed pairs of homologous chromosomes on the metaphase plate
- D) separation of homologs at anaphase
- E) separation of cells at telophase

13. Which of the following statements describes one difference between DNA replication in prokaryotes and DNA replication in eukaryotes?

- A) Prokaryotic chromosomes have histones, whereas eukaryotic chromosomes do not.
- B) Prokaryotic chromosomes have a single origin of replication, whereas eukaryotic chromosomes have many.
- C) The rate of elongation during DNA replication is slower in prokaryotes than in eukaryotes.
- D) Prokaryotes produce Okazaki fragments during DNA replication, but eukaryotes do not.
- E) Prokaryotes have telomeres, and eukaryotes do not.

14. What is the role of DNA ligase in the elongation of the lagging strand during DNA replication?

- A) It synthesizes RNA nucleotides to make a primer.
- B) It catalyzes the lengthening of telomeres.

- C) It joins Okazaki fragments together.
- D) It unwinds the parental double helix.
- E) It stabilizes the unwound parental DNA.

15. Which of the following sets of materials is required by both eukaryotes and prokaryotes for DNA replication?

- A) double-stranded DNA, four kinds of DNA nucleotides, primers, origins of replication
- B) topoisomerases, telomerases, polymerases
- C) G-C rich regions, polymerases, chromosome nicks
- D) nucleosome loosening, four kinds of DNA nucleotides, four kinds of RNA nucleotides
- E) ligase, primers, nucleases

B. Answer the following questions. (70%)

1. Determine the sequence of genes along a chromosome based on the following recombination frequencies: A—B, 8 map units; A—C, 28 map units; A—D, 25 map units; B—C, 20 map units; B—D, 33 map units. (5%)

2. Suppose that purple flower color (WW or Ww) is dominant to white flower color (ww) in sweet pea plant. A friend has a sweet pea plant with purple flowers and wants to determine whether the plant is WW or Ww. In order to determine the genotype, you cross it with a white-flowered sweet pea plant. (5%)

- (a) What is the name of the cross that you performed?
- (b) How will this cross help you determine the genotype of the purple flowered sweet pea? (That is, how will the results from this cross differ if the sweet pea flower color is WW vs Ww?)

3. Describe the following terms.(4% each term, 40%)

- (a) Telomere
- (b) Epistasis
- (c) Genetic Model Organisms
- (d) Missense mutation
- (e) Plasmid
- (f) RNA editing
- (g) Repressor
- (h) Imprinting
- (i) Fitness cost
- (j) Allele frequency

編號： 65

國立成功大學 106 學年度碩士班招生考試試題

系 所：生命科學系

考試科目：遺傳學

考試日期：0214，節次：3

第 5 頁，共 5 頁

4. What is Polymerase Chain Reaction (PCR)? When or how can it be used? Please provide at least one experimental example that PCR can be used. (10%)

5. Please compare the prokaryotic and eukaryotic transcription. What are there in common and what are the differences? (10%)