

八十四學年度 輻射生物研究所 組碩士班研究生入學考試

科目 遺傳學 科號 3405 共 三 頁第 1 頁 *請在試卷【答案卷】內作答

1. Please describe or explain the followings. (10%)
 - a. allelic exclusion
 - b. AP endonuclease
 - c. cladogenesis
 - d. penetrance
 - e. molecular imprinting

2. What is the function of each of the following sequences: (10%)
 - a. TATAAT
 - b. TTGACA
 - c. CCAAT
 - d. AATAAA
 - e. TACTAAC

3. Compare the function of a helicase with that of a topoisomerase. (5%)

4. What are the differences between continuous and discontinuous DNA replication? Why do both exist? (5%)

5. What is a signal peptide? What role does it play during protein synthesis in eukaryotes? (5%)

6. The following is the sequence of the anticoding strand of a DNA fragment

5' CAGCAGGGTCTAAAATCATA 3'

Assuming that transcription of this DNA begins with the first nucleotide and ends with the last:

Write down the sequence of the transcript in the 5' to 3', left to right format. How many amino acids can the transcript possibly code for? (5%)

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7. What is an oncogene, a proto-oncogene? Describe mechanisms that an oncogene can be activated/induced. (15%)

8. The DNA was isolated from a prototrophic strain of *E. coli* and used to transform an auxotroph deficient in the synthesis of purines ($purB^-$), pyrimidines ($pyrC^-$), and the amino acid tryptophan (trp^-). Tryptophan was used as the selective marker. The following data were obtained:

	number of colonies
$trp^+ pyrC^+ purB^+$	80
$trp^+ pyrC^+ purB^-$	5
$trp^+ pyrC^- purB^+$	70
$trp^+ pyrC^- purB^-$	15

a. What are the gene order? (5%)

b. What are the relative distances between loci? (5%)

9. In onions three bulb colors segregate: red, yellow, and white. A red parent is crossed to a white parent and all the offspring are red. When these are selfed, the following data are obtained:

red:	121
yellow:	31
white:	9

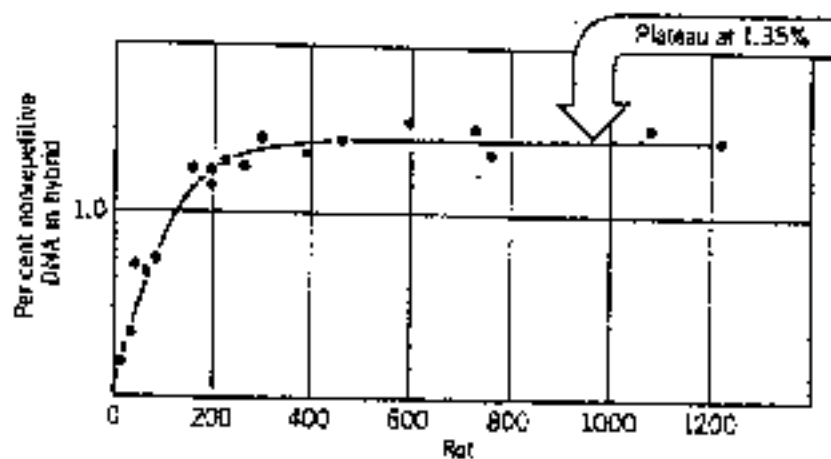
What is the mode of inheritance? Explain how is the ratio obtained? (10%)

10. Some Down syndrome cases are the result of a translocation of chromosome 21 to chromosome 14. Approximately one-third of the offspring of a translocation heterozygote are expected to have Down syndrome. Explain why. In fact, only about one-sixth of the offspring actually do have this syndrome. Explain why. (10%)

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11. The result of a Rot analysis is as follow.



Hybridizing an excess of mRNA with nonrepetitive DNA until saturation is reached

- Can you guess what is the purpose of this experiment? (3%)
- Briefly describe how this experiment was done. Why an excess of mRNA was used? (5%)
- The non-repetitive DNA in this sample has a complexity of 3.7×10^8 bp, and the average length of the gene in this DNA sample is 2 kb. Calculate the number of genes expressed. (7%)