

※ 注意：全部題目均請作答於試卷內之「非選擇題作答區」，請標明題號依序作答。

填充題：

1. (5分) 兩林中發現新蛙種 FRn，皮色只有藍色與黃色兩種。今欲研究皮色之顯性或隱性遺傳，先假設 FRn 的皮色為單一基因 A 決定，A 具有不同基因型：A(顯性)，a(隱性)。Exp1: 藍色雄蛙(M) 與藍色雌蛙(F) 交配，所得子代全為藍色；Exp2: 黃色雄蛙(M) 與黃色雌蛙(F) 交配，所得子代有藍色及黃色兩種。

可推知 FRn 蛙的皮色顯性表現為 [1a] 色

兩次實驗中 M 與 F 蛙的基因型 (請回答 AA, Aa, or aa)

EXP1: M- [1b], F-[1c]

EXP2: M- [1d], F-[1e]

2. (4分) About the DNA structure:

Most of the DNAs in physiological status are in [2a] form (fill in A, B, or Z). The double-stranded DNA is held in right-handed helix; whereas the covalently closed circular DNA molecules are usually in [2b] form (topology). The melting temperature of a DNA molecule is a characteristic largely determined by [2c] and [2d].

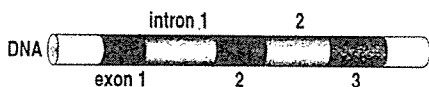
3. (5分) Please tell the difference between mitosis and meiosis of the the eukaryocytes

	mitosis	meiosis
Number of chromosome duplication (1 or 2 times)	[3a]	
Number of cell division (1 or 2 times)		[3b]
pairing and recombination between chromosome homolog (Yes or No)	[3c]	
Final ploidy (diploid/2N or haploid/N)	[3d]	[3e]

問答題：

4. 請舉出 DNA, RNA 的分子組成及構造上的差異。(5分)
5. 請列出原核生物與真核生物細胞間 細胞核構造及內含遺傳物質組成級及結構 的差異 (6分)
6. a. DNA helicase 在 DNA replication 時有什麼的功能?  
 b. 經過 DNA helicase 的作用，在核酸複製時又需要 DNA topoisomerase 的作用，請問 DNA topoisomerase 如何協助讓 DNA helicase 的作用更具效率?  
 c. 核酸聚合酶鏈反應(PCR)也是一種核酸複製，但進行 PCR 反應時並不需要添加 DNA helicase, 請問為何不需要? (9分)
7. DNA double-strand break (DSB) 對細胞而言是嚴重危機，可利用 homologous recombination 或是 non-homologous end joining 方式進行修復，請說明這兩種方式的修復機制，修復時機，以及修復後有什麼差異。(10分)
8. 人類基因體約 45% 為 transposon-related sequence，但在一般細胞不會因為 transposon 在基因體跳躍而造成遺傳的不穩定，請提出解釋。(6分)

9. Please describe the role of  $\sigma^{70}$  factor in transcription. (5分)
10. Single genes can produce multiple products by alternative splicing. Please use the genomic DNA shown below to describe at least 5 different pathways to splice an RNA. (5分)



11. Please explain why most regulation of gene expression occurs at the transcription initiation stage. (5分)
12. *E. coli lac Z* is often used as a reporter gene in *S. cerevisiae*. Can it be used as a reporter gene in *E. coli*? Why? (5分)
13. Please provide three mechanisms to explain how short RNAs in eukaryotes (siRNAs, miRNAs, and piRNAs) can silence expression. (5分)
14. In each of the following cases stating how a certain protein is treated, indicate what level(s) of protein structure (primary, secondary, tertiary, and/or quaternary) would change as the result of the treatment, and explain your answer: (9分)
- (1) Egg white (albumin) is boiled.
  - (2) Meat in your stomach is digested (gastric juices contain proteolytic enzymes).
  - (3) Hemoglobin consists of two  $\alpha$ -globin and two  $\beta$ -globin polypeptides. The amino acid valine replaces glutamic acid at the number-six position in the  $\beta$ -polypeptide chain.
15. Eukaryotic mRNAs are post-transcriptionally modified at their 5' and 3' ends. What roles does each of these modifications play in translation? (7分)
16. Male sexual behavior in one particular organism is under the control of several regulatory genes, including a gene called *yfg* which encodes a potential DNA-binding protein. One means to understand more fully the function of *yfg* in male sexual behavior is to identify genes/DNA sequences that interact with its protein product. Describe 3 different possible assays you would take to accomplish this goal. (9分)

試題隨卷繳回