

## 1. Questions of "Single choice". (15%)

- (1) Name two mutagens which would be classified as base analogues.  
(A) acridine orange and proflavin. (B) ethylmethane sulfonate and ethylmethylketone peroxide. (C) ultraviolet light and cosmic radiation.  
(D) 5-bromouracil and 2-aminopurine. (E) hydroxyurea and peroxidase.
- (2) A bacterium makes the amino acid glycine or absorb it from its surroundings. A biochemist found that glycine binds to a repressor protein and cause the repressor to bind to the bacterial chromosome, "turning off" an operon. If this is like other operons, the genes of this operon probably code for enzyme that  
(A) control bacterial cell division. (B) break down glycine. (C) produce glycine. (D) cause the bacterium to differentiate. (E) manufacture the repressor protein.
- (3) If an incorrect base is incorporated during DNA synthesis and is not corrected by DNA polymerase, it can be corrected by postreplication repair. This involves  
(A) detection of the mismatch. (B) a recognition of the methylation status of the DNA strands. (C) a process similar to excision repair. (D) all the above. (E) none of the above.
- (4) A new *Neurospora* mutant was tested for auxotrophy. The mutant grows on minimal medium (M) + arginine (A) + histidine (H), M + proline (P) + H, and M + A + H + P, but not on M, or on M + A + P. The mutant requires  
(A) arginine. (B) histidine. (C) proline. (D) histidine and proline. (E) arginine and proline.
- (5) A bacterial histidine mutant was plated on minimal medium. A single colony grew. This colony must have arisen from a  
(A) forward mutation. (B) auxotrophic mutation. (C) back mutation.  
(D) suppressor mutation. (E) back mutation OR suppressor mutation.

(背面仍有題目,請繼續作答)

2. As in all eukaryotes, gene expression in plants is regulated by transcription factors – often in association with signaling hormones – that modulate the recruitment of RNA polymerase to a given gene by binding to its promoter and enhancer regions. (12%)
- (1) What are the five main classes of plant hormones?
  - (2) How might a gene encoding a gibberellic acid biosynthesizing enzyme be related to the Mendelian trait of plant height (TT, Tt = tall, tt = dwarf) in *Pisum sativum* (garden pea)?
3. A mutation in the  $\beta$ -globin gene, a component of hemoglobin, results in a shortened polypeptide even though the immature (unspliced) mRNA transcript was the correct length. Propose two different causes for the short polypeptide. (6%)
4. Imagine you have three test tube containing identical solutions of purified, double-stranded human DNA. You expose the DNA in tube 1 to an agent that break the sugar-phosphate (phosphodiester) bonds. You expose the DNA in tube 2 to an agent that breaks the bonds that attach the bases to the sugars. You expose the DNA in tube 3 to an agent that breaks the hydrogen bonds. After treatment, how would the structure of the molecules in three tube differ? (6%)
5. (1) With new information from the Human Genome Project, many new genes will be identified for which the function is not known. What features of the DNA sequence might help you determine the function of a newly identified gene? (3%)
- (2) How does RNA editing contribute to protein diversity in eukaryotes? (3%)
  - (3) Other *polA* mutants of *E. coli* lack the 3'  $\rightarrow$  5' exonuclease activity of DNA polymerase I. Will the rate of DNA synthesis be altered in these mutants? What effect(s) will these *polA* mutations have on the phenotype of the organism? (5%)

6. All DNA molecules move in the same direction when electrophoresed. Is this generally true of protein also? Explain. (5%)
7. Why does salt concentration affect the melting temperature of DNA? (10%)
8. Which of the molecules, polyalanine and polyaspartic acid, will have its three-dimensional shape altered by a change in pH, and what changes will occur? (10%)
9. Which histone is found in chromatin but not in the nucleosome unit? (5%)
10. What is the advantage of using a plasmid with two antibiotic-resistance genes as a cloning vehicle? (10%)
11. Which of these is *not* one of the procedures used in Southern blotting? (5%)
  - (A) electrophoresis
  - (B) hybridization
  - (C) autoradiography
  - (D) restriction fragment preparation
  - (E) DNA microarray assay
12. Proteomics presents a particular challenge because (5%)
  - (A) the number of proteins in humans probably exceeds the number of genes.
  - (B) a cell's proteins differ with cell type.
  - (C) proteins are extremely varied in structure and chemical properties.
  - (D) A and B are true.
  - (E) A, B, and C are true.