

編號： 432 系所：生物化學暨分子生物學研究所甲組 科目：生物化學

本試題是否可以使用計算機：可使用，不可使用（請命題老師勾選）

※請依題號順序於答案卷上作答，未依題號順序作答者不予計分。

一、配對題（第1題~第2題）；一律以英文字母作答。

1. (5%)

A B C D E

Tyr-Lys-Met Gly-Pro-Arg Asp-Trp-Tyr Asp-His-Glu Leu-Val-Phe

Which one of the above tripeptides:

- ( ) 1-1. is most negatively charged at pH 7?
- ( ) 1-2. will yield DNP-tyrosine when reacted with 1-fluoro-2,4-dinitrobenzene and hydrolyzed in acid?
- ( ) 1-3. contains the largest number of nonpolar R groups?
- ( ) 1-4. contains sulfur?
- ( ) 1-5. will have the greatest light absorbance at 280 nm?

2. Match the protein or structural feature on the upper part with one appropriate description on the lower part. (5%)

- ( ) 2-1. activator
- ( ) 2-2. helix-turn-helix
- ( ) 2-3. leucine zipper
- ( ) 2-4. repressor
- ( ) 2-5. zinc finger

- A. a positive regulator
- B. a negative regulator
- C. facilitates transcription only when bound to a signal molecule
- D. a DNA-binding structural motif found in many prokaryotic regulatory proteins
- E. a structural feature involved in protein-protein interactions between some regulatory protein monomers
- F. a protein that dissociates from DNA when bound to a signal molecule
- G. a DNA-binding structural motif found in many eukaryotic proteins

(背面仍有題目,請繼續作答)

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## 二、問答題與簡答題（第3題~第12題）

3. Yeast can metabolize D-mannose to ethanol and  $\text{CO}_2$ . In addition to the glycolytic enzymes, the only other enzyme needed is phosphomannose isomerase, which converts mannose 6-phosphate to fructose 6-phosphate. If mannose is converted to ethanol and  $\text{CO}_2$  by the most direct pathway, which of the compounds and cofactors in this list are involved? (5%)

- A. Lactate
- B. Acetaldehyde
- C. Acetyl-CoA
- D. FAD
- E. Glucose 6-phosphate
- F. Fructose 1-phosphate
- G. Pyruvate
- H. Lipoic acid
- I. Thiamine pyrophosphate
- J. Dihydroxyacetone phosphate

4. Please differentiate between configuration and conformation of a protein? (7%)

5. A biochemist is attempting to separate a DNA-binding protein (protein X) from other proteins in a solution. Only three other proteins (A, B, and C) are present. The proteins have the following properties: (9%)

	pI (isoelectric point)	Size $M_r$	Bind to DNA?
protein A	7.4	82,000	yes
protein B	3.8	21,500	yes
protein C	7.9	23,000	no
protein X	7.8	22,000	yes

What type of protein separation techniques might she use to separate

- 5-1. protein X from protein A?
- 5-2. protein X from protein B?
- 5-3. protein X from protein C?

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6. You are trying to determine the sequence of a protein that you know is pure. Give the most likely explanation for each of the following experimental observations. (9%)
- 6-1. The Sanger reagent (FDNB, fluorodinitrobenzene) identifies Ala and Leu as amino-terminal residues, in roughly equal amounts.
- 6-2. Your protein has an apparent  $M_r$  of 80,000, as determined by SDS-polyacrylamide gel electrophoresis. After treatment of the protein with performic acid, the same technique reveals two proteins of  $M_r$  35,000 and 45,000.
- 6-3. Size-exclusion chromatography (gel filtration) experiments indicate the native protein has an apparent  $M_r$  of 160,000.
7. An enzyme catalyzes a reaction at a velocity of 20  $\mu\text{mol}/\text{min}$  when the concentration of substrate (S) is 0.01 M. The  $K_m$  for this substrate is  $1 \times 10^{-5}$  M. Assuming that Michaelis-Menten kinetics are followed, what will the reaction velocity be when the concentration of S is (a)  $1 \times 10^{-5}$  M and (b)  $1 \times 10^{-6}$  M? (6%)
8. A plasmid that encodes resistance to ampicillin and tetracycline is digested with the restriction enzyme *Pst*I, which cuts the plasmid at a single site in the ampicillin-resistance gene. The DNA is then annealed with a *Pst*I digest of human DNA, ligated, and used to transform *E. coli* cells. [ampicillin resistant:  $\text{amp}^R$ ; tetracycline resistant:  $\text{tet}^R$ ; ampicillin sensitive:  $\text{amp}^S$ ; tetracycline sensitive:  $\text{tet}^S$ ] (a) What antibiotic would you put in an agar plate to ensure that the cells of a bacterial colony contain the plasmid? (b) What antibiotic-resistance phenotypes will be found on the plate? (c) Which phenotype will indicate the presence of plasmids that contain human DNA fragments? (12%)
9. If beeswax, cholesterol, and phosphatidylglycerol were dissolved in chloroform, then subjected to thin-layer chromatography on silica gel using a mixture of chloroform/methanol/water as the developing solvent, which would move fastest and which slowest? Why? (10%)
10. The product of the *erbB* oncogene closely resembles the cellular receptor for epidermal growth factor (EGF). How do the two proteins differ, and how does this difference account for the oncogenic action of the ErbB protein? (10%)
11. Describe the pathway by which GMP is converted into GTP; show coenzymes that are involved and name the enzymes. (10%)

(背面仍有題目,請繼續作答)

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12. Please elucidate how an injured cell uses a specialized cell junction to prevent the damage from spreading to its neighbors. Also, please briefly design an experiment to prove the existence of this type of cell junction regulation. (12%)