編號：　436　系所：生物化學暨分子生物學研究所乙組　　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、是非題（第1題）

1. Indicate whether each of the following statements about eukaryotic cells is true (T) or false (F). (5%)

( ) 1-1. They have three distinct RNA polymerases.
( ) 1-2. Their mRNAs are generally synthesized by RNA polymerase I.
( ) 1-3. RNA polymerase III synthesizes only rRNAs.
( ) 1-4. The 5S rRNA is synthesized by RNA polymerase I
( ) 1-5. Their RNA polymerases initiate transcription at specific promoter sites on the DNA

二、配對題（第2題~第4題）；一律以英文字母作答。

2. The following reagents are often used in protein chemistry. Match the reagent with the purpose for which it is best suited. Some answers may be used more than once or not at all; more than one reagent may be suitable for a given purpose. (5%)

( ) 2-1. hydrolysis of peptide bonds on the carboxyl side of Lys and Arg
( ) 2-2. cleavage of peptide bonds on the carboxyl side of Met
( ) 2-3. breakage of disulfide (—S—S—) bonds
( ) 2-4. determination of the amino acid sequence of a peptide
( ) 2-5. determining the amino-terminal amino acid in a polypeptide

A. CNBr (cyanogen bromide)
B. Edman reagent (phenylisothiocyanate)
C. FDNB
D. dithiothreitol
E. performic acid
F. chymotrypsin
G. trypsin

3. Match these molecules in order with their biological roles. (8%)

( ) 3-1. viscosity, lubrication of extracellular secretions
( ) 3-2. carbohydrate storage in plants

（背面仍有題目，請繼續作答）

(　　) 3-3. transport/storage in insects
(　　) 3-4. exoskeleton of insects
(　　) 3-5. structural component of bacterial cell wall
(　　) 3-6. structural component of plant cell walls
(　　) 3-7. extracellular matrix of animal tissues
(　　) 3-8. carbohydrate storage in animal liver

A. glycogen
B. starch
C. trehalose
D. chitin
E. cellulose
F. peptidoglycan
G. hyaluronate
H. proteoglycan

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

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

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三、問答題與簡答題（第 5 題~第 12 題）

5. A chemist working in a pharmaceutical lab synthesized a new drug as a racemic mixture. Why is it important that she separate the two enantiomers and test each for its biological activity? (8%)

6. You have just made a solution by combining 50 mL of a 0.1 M sodium acetate solution with 150 mL of 1 M acetic acid ($pK_a = 4.7$). What is the pH of the resulting solution? (6%)

7. 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

7-1. protein X from protein A?

7-2. protein X from protein B?

7-3. protein X from protein C?

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: amp^R; tetracycline resistant: tet^R; ampicillin sensitive: amp^S; tetracycline sensitive: 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%)

(背面仍有題目,請繼續作答)

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 *erb*B 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%)

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%)