

國 立 清 華 大 學 命 題 紙

98 學年度__工學院生物工程學程__碩士班入學考試

科目__生物化學__ 科目代碼__0801__共__2__頁第__1__頁 *請在【答案卷卡】內作答

1. In biological systems, there are three main classes of biopolymers— proteins/polypeptides, polynucleotides, and polysaccharides. Please describe the basic chemical structure and the primary roles of each class of these biopolymers (15%).
2. Explain the following terminology: (10%)
 - a. Denaturation (or shrinkage) temperature (e.g., collagen)
 - b. Salt out (e.g., for protein separation)
 - c. Osmotic pressure
 - d. Micelle
3. Outline the procedures (steps) of creating a recombinant vector for recombinant protein expression? (8%) What types of tools will be used in these procedures (6%)?
4. To achieve high level, controllable expression of proteins that can be easily purified, what features are generally incorporated in the expression vectors? (5%) Please also schematically illustrate all other features of an expression vector (6%).
5. State briefly the principle and procedure of SDS-PAGE (SDS-polyacrylamide gel electrophoresis) for protein characterization. (15%)
6. Enzyme A follows Michaelis-Menten kinetics.
 - a. The K_m of enzyme A for substrate S is (K_m^S) 1 mM, for substrate T (K_m^T) is 10 mM. Which one between S and T is the preferred substrate for enzyme A? (5%)
 - b. The rate constant (k) of enzyme A for S is $2 \times 10^4 \text{ sec}^{-1}$. The rate constant for T is $4 \times 10^5 \text{ sec}^{-1}$. When S and T are present at 1 mM, which one reacts faster via Enzyme A? (5%)

國 立 清 華 大 學 命 題 紙

98 學年度__工學院生物工程學程__碩士班入學考試

科目__生物化學__ 科目代碼__0801__共__2__頁第__2__頁 *請在【答案卷卡】內作答

7. (1) For each of the following sentences, fill in the blanks with the best word or phrase selected from the list below. Not all words or phrases will be used; each word or phrase should be used only once. (17%)

(a) Proteins are transported out of a cell via the _____ or _____ pathway.

Fluids and macromolecules are transported into the cell via the _____ pathway. All proteins being transported out of the cell pass through the _____ and the _____. Transport vesicles link organelles of the _____ system. The formation of _____ in the endoplasmic reticulum stabilizes protein structure.

(b) Cells can signal to each other in various ways. A signal that must be relayed to the entire body is most efficiently sent by _____ cells, which produce hormones that are carried throughout the body through the bloodstream. On the other hand, _____ methods of cell signaling do not require the release of a secreted molecule and are used for very localized signaling events. During _____ signaling, the signal remains in the neighborhood of the secreting cell and thus acts as a local mediator on nearby cells. Finally, _____ signaling involves the conversion of electrical impulses into a chemical signal. Cells receive signals through a _____, which can be an integral membrane protein or can reside inside the cell.

(c) _____ join the intermediate filaments in one cell to those in the neighboring cell.

_____ anchor intermediate filaments in a cell to the extracellular matrix.

_____ involve cadherin connections between neighboring cells and are anchorage sites for actin filaments. _____ allow for the exchange of small molecules from one cell to its adjacent cell. _____ prevent the leakage of molecules between adjacent cells.

adherens junctions	gap junctions	highway junctions
desmosomes	hemidesmosomes	tight junctions
amplification	G-protein	phosphorylation
contact-dependent	K ⁺ channel	receptor
endocrine	neuronal	target
epithelial	paracrine	carbohydrate
Golgi apparatus	disulfide bonds	hydrogen bonds
endocytic	ionic bonds	endomembrane
lysosome	endoplasmic reticulum	protein
endosome	secretory	exocytic

(2) What are the main structures providing tensile strength in

A) animal connective tissue? B) animal epithelium? (4%)

(3) Briefly describe the mechanism of p53 helping the DNA-damaged cell arrest the cell cycle in G1. (4%)