



考試科目：生物化學

系所名稱：生物科技研究所碩士班甲組

1.答案以橫式由左至右書寫。2.請依題號順序作答。

第一部份. 共 25 分

選擇題(每題 2 分)

1. All of the following are characteristic of replication of the *E. coli* circular chromosome EXCEPT:
 - a. replication is bi-directional.
 - b. it initiates at a unique position called *oriC*.
 - c. torsional stress introduced in the duplex DNA is relieved by DNA gyrase.
 - d. the unwinding of the duplex DNA is driven by the translocation of the DNA polymerase.
 - e. replication forks move in opposite directions.

2. DNA polymerases share all of the following characteristics EXCEPT:
 - a. incoming bases are paired with corresponding bases on the template strand within the polymerase active site
 - b. polymerization proceeds in a 5'→3' direction
 - c. polymerization is antiparallel to template strand
 - d. strong processivity
 - e. polymerization is dependent upon the presence of an oligonucleotide primer

3. The degree to which the enzyme remains associated with the template through successive cycles of nucleotide addition is referred to as:
 - a. processivity.
 - b. turn-over number.
 - c. progression.
 - d. semidiscontinuousness
 - e. dissociativity.

4. The enzyme that seals nicks in dsDNA where a 3'-OH and 5'-phosphate are juxtapositioned is:
 - a. DNA polymerase I.
 - b. DNA gyrase.
 - c. DNA polymerase III.
 - d. DNA ligase.
 - e. primerase.

5. Progression through the cell cycle for eukaryotic cells is regulated through a series of _____ that depend on _____, produced at one phase and degraded at another, that bind _____ which regulate specific proteins by phosphorylation.

- a. checkpoints; cyclins; cyclin dependent protein kinases (CDKs)
- b. cyclins; phosphorylation; protein kinases
- c. phosphorylations; cyclins; protein kinases
- d. CDKs; cyclins; protein kinases
- e. none are true

6. The principal DNA polymerase in eukaryotic leading strand DNA replication is:

- a. DNA polymerase α (alpha).
- b. DNA polymerase β (beta).
- c. DNA polymerase γ (gamma).
- d. DNA polymerase δ (delta).
- e. DNA polymerase ϵ (epsilon).

7. All are stages in transcription EXCEPT:

- a. binding of RNA polymerase holoenzyme at the promoter sites.
- b. chain elongation.
- c. DNase I activity on RNA polymerase/DNA complex.
- d. initiation of polymerization.
- e. chain termination.

8. When the cellular level of tryptophan decreases in *E. coli*:

- a. tryptophan-bound Trp repressor associates with *trp* operator.
- b. Trp aporepressor has lowered affinity for *trp* promoter allowing RNA. polymerase binding and transcription of the *trp* operon.
- c. tryptophan binds *trp* inducer to promote positive control of *trp* promoter.
- d. *trp* repressor has a greater affinity for *trp* operator.
- e. none of the above.

9. The genetic code is said to be degenerate, which means that:

- a. Each codon codes for more than one amino acid.
- b. An anticodon can interact with more than one codon in the mRNA in which the codon may differ in any or all of the three nucleotides.
- c. Most amino acids are coded for by more than one codon.
- d. The code is universally used by virtually all species.
- e. None are true.

10. The appropriate order for the basic steps of protein synthesis are:

- A. The elongation reaction transfers the peptide chain from the peptidyl-tRNA in the P site to the aminoacyl-tRNA in the A site.
- B. The P site is occupied by peptidyl-tRNA carrying the growing polypeptide chain.
- C. Binding of mRNA by the small subunit followed by association of a particular initiator aminoacyl-tRNA that recognizes the first codon.
- D. The large ribosomal subunit joins the initiation complex, preparing it for the elongation stage.
- E. The new, longer peptidyl-tRNA moves from the A site into the P site as the ribosome moves one codon further along the mRNA.

- a. A, C, E, B, D
- b. B, E, C, D, A
- c. C, D, A, B, E
- d. D, C, E, B, A
- e. C, D, B, A, E

11. What do eukaryotic transcriptional factors do? (5 分)

第二部份. 共 25 分

(一) : 選擇題(每題 2 分)

1. If the rate constant for the enzyme catalyzed reaction is $2 \times 10^5/\text{sec}$ and the rate constant for the uncatalyzed reaction is $2 \times 10^{-6}/\text{sec}$, the catalytic power of the enzyme is: (a) 10^{11} (b) 2×10^{-11} (c) 10^{-11} (d) 10^{-1} (e) 2×10^{-1}
2. When every enzyme molecule in the reaction mixture has its substrate-binding site occupied by substrate, the kinetics become _____-order, and the velocity is _____.: (a) zero; V_{max} (b) first; V_{max} (c) second; $V_{\text{max}}/2$ (d) zero; $V_{\text{max}}/2$ (e) first; $V_{\text{max}}/2$.
3. For an enzyme-catalyzed reaction, the initial velocity was determined at two different concentrations of the substrate. Which of the following would be closest to the value of K_m ? (a) 0.17 mM (b) 5.7 mM (c) 2.7 mM (d) 0.60 mM (e) 1.7 mM.

[S] (mM)	V_o (mM/min)
1.0	2.0
4.0	2.8

4. Enzymes have active sites which have the greatest complementarity to the: (a) substrate (b) transition state (c) product (d) both substrate and product (e) none of the above.
5. Usually the quickest method of influencing an enzymatic activity is by: (a)

allosteric regulation (b) covalent modification (c) enzyme induction (d) activation of zymogen (e) enzyme destruction.

6. The correct sequence for the hormone-activated enzymatic cascade that leads to activation of glycogen phosphorylase is: (a) A, B, C, D, E (b) B, C, E, A, D (c) C, B, A, D, E (d) B, D, E, A, C (e) E, A, D, C, B
- A. Phosphorylation to active phosphorylase kinase
 - B. Activation of G-protein
 - C. Activation of adenylyl cyclase to produce cAMP
 - D. Phosphorylation of glycogen phosphorylase
 - E. cAMP activation of protein kinase A (PKA)

(二)：簡答題 (total 13 分)

1. In metabolic reactions, many coenzymes which play roles as electron carriers. (a) Please indicates 2 coenzymes which are "two-electron carriers". (4 分) (b) Name 2 coenzymes which are "one-electron carriers". (4 分) (c) Name three "mobile electron carriers" (5 分)

第三部份. 共 25 分

(一)：選擇題(每題 2 分)

1. The fluidity of the lipid side chains in the interior of a bilayer is generally increased by:
- A) a decrease in temperature.
 - B) an increase in fatty acyl chain length.
 - C) an increase in the number of double bonds in fatty acids.
 - D) an increase in the percentage of phosphatidyl ethanolamine
 - E) the binding of water to the fatty acyl side chains.
2. If the plasma membrane of animal cells was made entirely permeable to Na^+ , the Na^+/K^+ pump would:
- A) Be completely inhibited.
 - B) Begin to pump Na^+ in both directions.
 - C) Begin synthesizing ATP.
 - D) Continue to pump ions and hydrolyse ATP, but not build a Na^+ gradient.
 - E) Continue to pump ions but not hydrolyze ATP.
3. The nucleic acid bases:
- A) absorb ultraviolet light maximally at 280 nm.
 - B) are all about the same size.
 - C) are relatively hydrophilic.
 - D) are roughly planar.
 - E) can all stably base-pair with one another.
4. Which of the following proteins does not "footprint" the *lac* operon control region?
- A) lac repressor

- B) β -galactosidase
- C) RNA polymerase
- D) cAMP-CAP

5. Which of the following is false regarding the denaturation of DNA?

- A) DNA can be denatured with high heat.
- B) DNA can be denatured by high pH.
- C) denaturation of DNA can be detected by measuring the UV absorbency at 260 nm.
- D) denaturation disrupts the hydrogen bonds holding the strands together.
- E) DNA can be denatured by low salt conditions.

(二)：簡答

1. Why can cardiac glycosides be used in treating heart failure(心臟衰竭)?(4分) Whether it can work or not, we directly microinject these drugs into cell. Please explain why?(3分)
2. Describe CAP how to regulate lac operon. (4分)
3. Describe lipoproteins (4分)

第四部份. 共 25 分

(一)：選擇題(每題 2 分)

1. A gene can be defined as:
 - a. the unique function that some cells have but other cells do not have.
 - b. a specific segment of nucleotide bases in DNA that encode for the synthesis of a particular protein.
 - c. a single strand of DNA that is designated as the sense strand.
 - d. a functional segment of a unique protein.
 - e. the segment of DNA that is changed in a mutation.
2. Where C_{α} is the α -carbon, N represents the amide nitrogen and C_o is the carbonyl carbon of amino acids in a peptide, the peptide backbone of a protein consists of the repeated sequence:
 - a. $-C_{\alpha}-N-C_o-$
 - b. $-N-C_o-C_{\alpha}-$
 - c. $-N-C_{\alpha}-C_o-$
 - d. $-C_o-C_{\alpha}-N-$
 - e. none of the above
3. The peptide bond has partial _____ character.
 - a. hydrogen bond
 - b. double bond
 - c. triple bond
 - d. van der Waals bond
 - e. all of the above

4. Amino acid side chains capable of forming hydrogen bonds are usually located on the protein _____ and form hydrogen bonds primarily with the _____.
- surface, water solvent
 - interior, water solvent
 - surface, other amino acid side chains
 - interior, other amino acid side chains
 - all are true
5. _____ amino acids are almost never found in the interior of a protein, but the protein surface may consist of _____ amino acids.
- Nonpolar, both polar and nonpolar
 - Nonpolar, mostly nonpolar
 - Polar, both polar and nonpolar
 - Polar, only polar
 - Polar, only nonpolar
6. Electrostatic interactions among amino acid residues on proteins may be damped out by high concentrations of:
- water.
 - organic solvents.
 - salts.
 - heat.
 - all of the above.

(二)：填充題(每個空格 1 分)

Amino acid 縮寫與全稱

e.g. A → Ala → Alanine

- H → _____ → Histidine
- C → _____ → Cysteine
- D → _____ → Aspartic Acid
- E → _____ → Glutamic Acid
- F → _____ → Phenylalanine
- G → _____ → Glycine
- I → Ile → _____
- K → Lys → _____
- R → Arg → _____
- L → Leu → _____
- M → Met → _____
- N → Asn → _____
- P → _____ → Proline