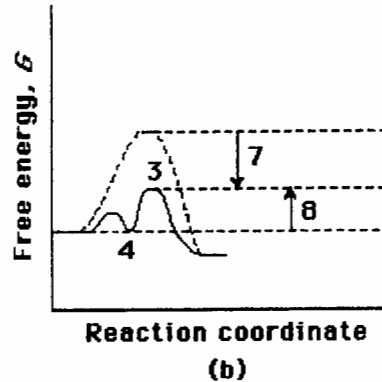
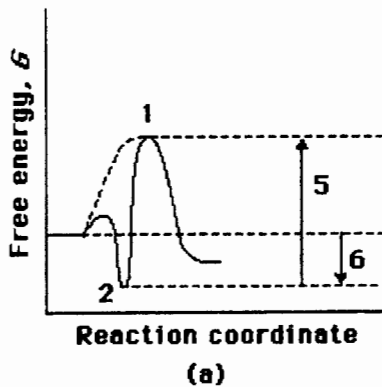


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(考題包含 **Part A, B, C**)

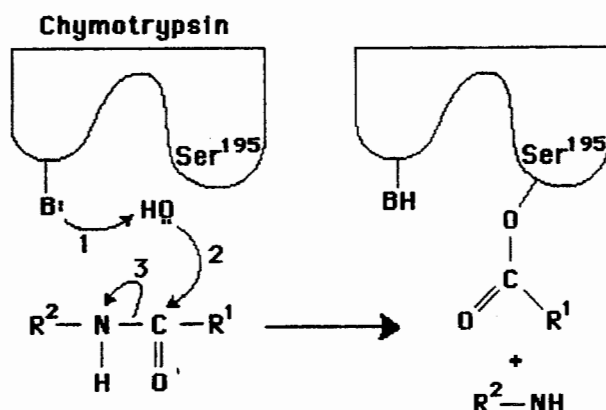
Part A. 35 points (Q1-10, 2 points each)

1. Compare the two reaction coordinate diagrams below and select the answer that correctly describes their relationship. In each case, the single intermediate is the ES complex.



- A) The activation energy for the *catalyzed* reaction is 5 in (a) and is 7 in (b).
- B) (a) describes a strict "lock and key" model, whereas (b) describes a transition-state complementarity model.
- C) The activation energy for the *uncatalyzed* reaction is given by 5+6 in (a) and by 7+4 in (b).
- D) The contribution of binding energy is given by 5 in (a) and by 7 in (b).
- E) The ES complex is given by 2 in (a) and 3 in (b).

2. In the following diagram of the first step in the reaction catalyzed by the protease chymotrypsin, the process of general base catalysis is illustrated by the number _____, and the process of covalent catalysis is illustrated by the number _____.



- A) 1; 2
- B) 1; 3
- C) 2; 3
- D) 2; 3
- E) 3; 2

(背面仍有題目，請繼續作答)

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3. Which of these statements about enzyme-catalyzed reactions is *false*?

- A) At saturating levels of substrate, the rate of an enzyme-catalyzed reaction is proportional to the enzyme concentration.
- B) If enough substrate is added, the normal V_{\max} of a reaction can be attained even in the presence of a competitive inhibitor.
- C) The rate of a reaction decreases steadily with time as substrate is depleted.
- D) The activation energy for the catalyzed reaction is the same as for the uncatalyzed reaction, but the equilibrium constant is more favorable in the enzyme-catalyzed reaction.
- E) The Michaelis-Menten constant K_m equals the $[S]$ at which $V = 1/2 V_{\max}$.

4. When oxygen binds to a heme-containing protein, the two open coordination bonds of Fe^{2+} are occupied by:

- A) one O atom and one amino acid atom.
- B) one O_2 molecule and one amino acid atom.
- C) one O_2 molecule and one heme atom.
- D) two O atoms.
- E) two O_2 molecules.

5. Myoglobin and the subunits of hemoglobin have:

- A) no obvious structural relationship.
- B) very different primary and tertiary structures.
- C) very similar primary and tertiary structures.
- D) very similar primary structures, but different tertiary structures.
- E) very similar tertiary structures, but different primary structures.

6. Carbon monoxide (CO) is toxic to humans because:

- A) it binds to myoglobin and causes it to denature.
- B) it is rapidly converted to toxic CO_2 .
- C) it binds to the globin portion of hemoglobin and prevents the binding of O_2 .
- D) it binds to the Fe in hemoglobin and prevents the binding of O_2 .
- E) it binds to the heme portion of hemoglobin and causes heme to unbind from hemoglobin.

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7. The most important contribution to the stability of a protein's conformation appears to be the:

- A) entropy increase from the decrease in ordered water molecules forming a solvent shell around it.
- B) maximum entropy increase from ionic interactions between the ionized amino acids in a protein.
- C) sum of free energies of formation of many weak interactions among the hundreds of amino acids in a protein.
- D) sum of free energies of formation of many weak interactions between its polar amino acids and surrounding water.
- E) stabilizing effect of hydrogen bonding between the carbonyl group of one peptide bond and the amino group of another.

8. In an α -helix, the R groups on the amino acid residues:

- A) alternate between the outside and the inside of the helix.
- B) are found on the outside of the helix spiral.
- C) cause only right-handed helices to form.
- D) generate the hydrogen bonds that form the helix.
- E) stack within the interior of the helix.

9. Two amino acids of the standard 20 contain sulfur atoms. They are:

- A) cysteine and serine.
- B) cysteine and threonine.
- C) methionine and cysteine
- D) methionine and serine
- E) threonine and serine.

10. The uncommon amino acid selenocysteine has an R group with the structure $-\text{CH}_2-\text{SeH}$ ($\text{p}K_a \approx 5$). In an aqueous solution, $\text{pH} = 7.0$, selenocysteine would:

- A) be a fully ionized zwitterion with no net charge.
- B) be found in proteins as D-selenocysteine.
- C) never be found in a protein.
- D) be nonionic.
- E) not be optically active.

(背面仍有題目，請繼續作答)

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11. How does the shape of a titration curve confirm the fact that the pH region of greatest buffering power for an amino acid solution is around its pK 's? (5 points)

12. What is the "β turn"? Why are glycine and proline often found within a β turn? (5 points)

13. Describe how immunoaffinity chromatography is performed. (5 points)

Part B. 35 points (5 points each)

1. What are the promoters? How are they recognized for initiation of transcription in prokaryotes and eukaryotes?
2. What is a chromatin? Describe the chromatin remodeling during transcription?
3. Describe the mechanisms by which ribosome recognizes the start codon in prokaryotes and eukaryotes.
4. What is an operon? How does lac repressor work? Describe the regulation of *lac* operon in the presence of 1) high lactose and high glucose, 2) high lactose and low glucose, 3) low lactose and high glucose, 4) low lactose and low glucose.
5. What are telomeres? How are they synthesized?
6. What is RNA interference (RNAi)?
7. Describe the function of HIV reverse transcriptase.

Part C. 30 points

1. Describe the function of insulin and glucagon in homeostatic regulation of *blood glucose* levels.
(10 points)
2. Answer the following questions :
 - (a) indicate key enzymes in fatty acid metabolism (4 points)
 - (b) indicate cellular compartment the fatty acid degradation takes place (2 points)
 - (c) illustrate beta fatty acid oxidative pathway (4 points)
 - (d) define ketogenesis (2 points)
3. Describe the two mechanisms underlying the regulation of the rate of urea cycle in mammalian cells. (8 points)