九十一學年度 微机电系统工程 系（所） 組碩士班研究生招生考試

科目 生物化學 科號 2202 共 5 頁第 1 頁 *請在試卷【答案卷】內作答

I. TRUE or FALSE. (A statement is regarded here as false if any part of it is false). If you believe a statement to be true, write **T** in answer sheet; if false, write **F**. A positive grade will be given for a correct answer, an equal negative grade for an incorrect answer, and a zero grade for no answer. **(30%)**

( ) 1. Most naturally occuring monosaccharides are the L stereoisomer.

( ) 2. In membranes consisting of lipid mixtures, sphingomyelin may separate out into membrane microdomains called lipid rafts.

( ) 3. High concentration of cholesterol in a phospholipid membrane would make the membrane more likely to undergo transition to the crystalline state.

( ) 4. Cellulose forms a helical structure when dissolved in water.

( ) 5. When the sequence of a membrance proteins includes a continous stretch of about 20 hydrophobic amino acids, the secondary structure of this part of the proteins is assumed to be α-helix.

( ) 6. Two helical gramicidin molecules join together head to head to span the lipid bilayer.

( ) 7. Within chloroplasts, the Calvin Cycle ("dark reaction" pathway) function at maximal rate at night, when plants are in the dark.

( ) 8. Avidin, a protein in egg white, tightly binds biotin.

( ) 9. The entropy of activation for an enzyme-catalyzed reaction is always negative because the number of degree of freedom of a substrate are reduced upon binding to the enzyme.

( ) 10. Ion transport catalyzed by a carrier protein is typically faster than transport mediated by an ion channel.

( ) 11. Insulin increases the capacity of the liver to synthesize glycogen

( ) 12. During the actin/myosin reaction cycle, binding of ATP causes dissociation of myosin from actin

( ) 13. Under competitive inhibition, V_{max} is unchanged compared to the uninhibited reaction.

( ) 14. Under non-competitive inhibition, V_{max} is unchanged compared to the uninhibited reaction.

( ) 15. β-tubulin is exposed at the minus end of a microtubule.

( ) 16. Within a microtubule α-tubulin has bound GDP.

( ) 17. Enzymes of proteosome are classified as serine proteases.

( ) 18. The rate of hydrolysis of ATP depends on the magnitude of the free energy of phosphate hydrolysis.

( ) 19. The formation of hydrogen bonds between amide carbonyls and amide hydrogens do not contribute much to the free energy change ($\Delta G^{o'}$) for the folding of a polypeptide.

( ) 20. For most globular proteins, the aliphatic and aromatic amino acids are found on the surface of a folded protein and the polar and ion forming amino acids are found in the core (inner regions).

II. Multiple Choice (one answer). (40%)

( ) 1. The buffering action of proteins over the pH range of 6-8 depends for the most part on the presence in the protein structure of
a. lysine
b. "neutral" amino acid
c. histidine
d. cysteine

( ) 2. Protein often lose their specific biological properties on standing in solution at room temperature. The structural feature primarily involved is
a. the overall three-dimensional structure
b. the polypeptide backbone
c. one or more of the side-chain R groups
d. disulfide bond

( ) 3. During the purification of an enzyme, the purity of the enzyme recovered in the various fraction is determined from
a. the specific activity in that fraction
b. the total activity in that fraction
c. the activity in that fraction
d. the protein concentration in that fraction

( ) 4. The cross-linking which occurs in collagen
a. is carried out by lysyl oxidase
b. involves the ε-amino group on lysine
c. is a non-enzymatic aldol condensation
d. is intermolecular between the tropocollagen molecules in the fibrial

( ) 5. The enzyme which catalyzes the reaction below is classified as a

alcohol + NAD^+ --> aldehyde + NADH + H^+

a. lyase
b. oxidoreductase
c. isomerase
d. hydrolase

( ) 6. The Michaelis-Menten combined rate constant, K_m, is defined for the following kinetic mechanism as

$$E + S \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} ES \xrightarrow{k_2} E + P$$

a. $(k_1+k_2)/k_{-1}$
b. $(k_{-1}+k_2)/k_1$
c. $(k_1+k_{-1})/k_2$
d. k_{-1}/k_1

( ) 7. For an enzyme which obeys Michaelis-Menten kinetics, what is the V_{max} value in umole/min if v=35 umole/min when [S]=K_m?
a 50
b 70
c 45
d 95

( ) 8. Which of the following statements is not a characteristic of k_{cat}/K_m?
a. It corresponds to a second order rate constant
b. It provides an excellent parameter for comparison of the catalytic efficiency of enzymes
c. It reflects the property of the enzyme when substrate concentration is at saturation
d. The upper limit for the kcat/Km value is fixed by the diffusion-controlled limit for the reaction, which is 10^9 $M^{-1}s^{-1}$

( ) 9. The primary control in the clotting of blood is
a. induction
b. post-translational modification
c. interaction of an allosteric effector with the enzyme
d. conformational change in the subunits in an allosteric interaction

( ) 10. The highly charged 2,3-bisphosphoglycerate binds to hemoglobin
a on the exterior surface
b on the heme group
c at the Fe^{2+} ion
d in the interior cavity

( ) 11. the positive effector in the hemoglobin is
a. oxygen molecule
b. BPG
c. CO_2
d. H^+

( ) 12. Which of the following is incorrect about the oxygen saturation curves of normal hemoglobin (HbA), fetal hemoglobin (HbF), and myoglobin (Mb)?
a. The P_{50} is smaller for HbF than for HbA
b. As the pH is decreased, the P_{50} for HbA is decreased
c. The P_{50} is greater for HbA than for Mb
d. The shape of the curve for HbA is sigmoidal

( ) 13. Enzymes have active sites which are complementary to
a the substrate
b the product
c the transition state
d both the substrate and the product

( ) 14. Self-assembly in the microtubules is based on the
a. intermolecular interactions of the tubulins
b. the tertiary structure of the tubulins
c. the secondary structure of the tubulins
d. all of the above

( ) 15. Of the four types of mammalian muscle cell, the only one which displays multiple nuclei is
a. skeletal muscle cells
b. cardic muscle cells
c. smooth muscle cells
d. myoepithelial cells

( ) 16. The change in the oxidation state for nitrogen in the reduction of NO_2^- to NH_3 is
a 0
b 3
c 6
d 8

( ) 17. Which of the following has the highest standard free energy of phosphate hydrolysis?
a. glycerol-3-phosphate
b. phosphoenolpyruvate
c. ATP
d. glucose-6-phosphate

( ) 18. Which of the following is a constituent of cell surface proteoglycans?
a. amylose
b. heparan sulfate
c. maltose
d. ribitol

( ) 19. Which of the following compound that inhibits ATP synthesis by blocking respiration
a. dinitrophenol
b. cyanide
c. oligomycin
d. dicyclohexylcarbodiimide (DCCD)

( ) 20. Which of the following is not a characteristics of the peptide bond:
a. it is planar and rigid
b. the peptide plane has 6 atoms
c. atoms in plane have basic property
d. the atoms can be involved in H-bonding

III. Fill in the blank. (10%)

1. A simple pathway has two steps: A ⟷ B ⟷ C
$\Delta G^{o'}$ for A ⟷ B = +11.4 kJ/mol and K_{eq} is 10^{-2}
$\Delta G^{o'}$ for B ⟷ C = -22.8 kJ/mol and K_{eq} is 10^{4}
What is the standard free energy change for conversion of A to C? a
At equilibrium what is the concentration ratio C/A? b

2. What FAD initials stand for? c
FAD is derived from what vitamin? d

3. Which of the following F_1 subunits contains a catalytic site that binds ADP & P_i to form ATP: α, β, γ, δ, or ε? e

4. Is uptake of phosphate by mitochodria dependent on ΔpH or ΔΨ? f

5. By what mechanism is glucose taken up from blood by muscle cells? g

7. α-helices are stabilized by hydrogen bonding. The carbonyl on amino acid "n" is hydrogen bonded to the N-H on amino acid "h"

8. Give the structure characteristics of an alpha helix: i angstroms/turn, j amino acids/turn.

IV. What is a monoclonal antibody and how is it prepared in the laboratory? (10%)

V. For each of these molecules, describe where on Hb molecule that molecule is thought to bind? (10%)
a. oxygen
b. carbon monoxide
c. carbon dioxide