

九十一學年度 原子科學 系(所) 丁 組碩士班研究生招生考試

科目 生物化學 科號 3502 共 7 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. Within chloroplasts, the Calvin Cycle ("dark reaction" pathway) function at maximal rate at night, when plants are in the dark.
- () 2. Avidin, a protein in egg white, tightly binds biotin.
- () 3. 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.
- () 4. Ion transport catalyzed by a carrier protein is typically faster than transport mediated by an ion channel.
- () 5. Insulin increases the capacity of the liver to synthesize glycogen
- () 6. During the actin/myosin reaction cycle, binding of ATP causes dissociation of myosin from actin
- () 7. Under competitive inhibition, V_{max} is unchanged compared to the uninhibited reaction.
- () 8. Under non-competitive inhibition, V_{max} is unchanged compared to the uninhibited reaction.
- () 9. β -tubulin is exposed at the minus end of a microtubule.
- () 10. Within a microtubule α -tubulin has bound GDP.
- () 11. Enzymes of proteasome are classified as serine proteases.
- () 12. The rate of hydrolysis of ATP depends on the magnitude of the free energy of phosphate hydrolysis.
- () 13. The formation of hydrogen bonds between amide carbonyls and amide hydrogens do not contribute much to the free energy change (ΔG°) for the folding of a polypeptide.
- () 14. 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).
- () 15. Most naturally occurring monosaccharides are the L stereoisomer.
- () 16. In membranes consisting of lipid mixtures, sphingomyelin may separate out into membrane microdomains called lipid rafts.
- () 17. High concentration of cholesterol in a phospholipid membrane would make the membrane more likely to undergo transition to the crystalline state.
- () 18. Cellulose forms a helical structure when dissolved in water.

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- () 19. When the sequence of a membrane proteins includes a continuous stretch of about 20 hydrophobic amino acids, the secondary structure of this part of the proteins is assumed to be α -helix.
- () 20. Two helical gramicidin molecules join together head to head to span the lipid bilayer.

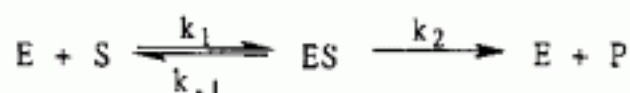
II. Multiple Choice (one answer). (45%)

- () 1. What are the main molecules that couple anabolism and catabolism?
- ATP
 - NADH
 - NADPH
 - a and b
 - a and c
- () 2. Which of the following is NOT a major energy storage molecule for animal tissues?
- protein
 - glycogen
 - triacylglycerols
 - cellulose
- () 3. Glycogen catabolism is initiated by the action of:
- phosphatase
 - hexokinase and maltase
 - α -amylase and α -(1 \rightarrow 6)-glucosidase (debranching enzyme)
 - phosphofructokinase
- () 4. What are the basic building blocks during biosynthesis of fatty acids?
- three-carbon units
 - two-carbon units
 - two-nitrogen units
 - glucose molecules
 - none of the above
- () 5. During fatty acid biosynthesis, the eukaryotic cell requires a lot of acetyl-CoA. Where does the cell get most of the required acetyl-CoA?
- from the endoplasmic reticulum
 - from mitochondria
 - from extracellular compartment
 - all of the above
 - none of the above

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- () 6. 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
- lysine
 - "neutral" amino acid
 - histidine
 - cysteine
- () 7. Protein often lose their specific biological properties on standing in solution at room temperature. The structural feature primarily involved is
- the overall three-dimensional structure
 - the polypeptide backbone
 - one or more of the side-chain R groups
 - disulfide bond
- () 8. During the purification of an enzyme, the purity of the enzyme recovered in the various fraction is determined from
- the specific activity in that fraction
 - the total activity in that fraction
 - the activity in that fraction
 - the protein concentration in that fraction
- () 9. The cross-linking which occurs in collagen
- is carried out by lysyl oxidase
 - involves the ϵ -amino group on lysine
 - is a non-enzymatic aldol condensation
 - is intermolecular between the tropocollagen molecules in the fibrial
- () 10. The enzyme which catalyzes the reaction below is classified as a
- $$\text{alcohol} + \text{NAD}^+ \rightarrow \text{aldehyde} + \text{NADH} + \text{H}^+$$
- lyase
 - oxidoreductase
 - isomerase
 - hydrolase
- () 11. The Michaelis-Menten combined rate constant, K_m , is defined for the following kinetic mechanism as



- $(k_1+k_2)/k_{-1}$
- $(k_{-1}+k_2)/k_1$
- $(k_1+k_{-1})/k_2$
- k_{-1}/k_1

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- () 12. For an enzyme which obeys Michaelis-Menten kinetics, what is the V_{max} value in $\mu\text{mole}/\text{min}$ if $v=35 \mu\text{mole}/\text{min}$ when $[S]=K_m$?
- 50
 - 70
 - 45
 - 95
- () 13. Which of the following statements is not a characteristic of k_{cat}/K_m ?
- It corresponds to a second order rate constant
 - It provides an excellent parameter for comparison of the catalytic efficiency of enzymes
 - It reflects the property of the enzyme when substrate concentration is at saturation
 - The upper limit for the k_{cat}/K_m value is fixed by the diffusion-controlled limit for the reaction, which is $10^9 \text{ M}^{-1}\text{s}^{-1}$
- () 14. The primary control in the clotting of blood is
- induction
 - post-translational modification
 - interaction of an allosteric effector with the enzyme
 - conformational change in the subunits in an allosteric interaction
- () 15. The highly charged 2,3-bisphosphoglycerate binds to hemoglobin
- on the exterior surface
 - on the heme group
 - at the Fe^{2+} ion
 - in the interior cavity
- () 16. the positive effector in the hemoglobin is
- oxygen molecule
 - BPG
 - CO_2
 - H^+
- () 17. Which of the following is incorrect about the oxygen saturation curves of normal hemoglobin (HbA), fetal hemoglobin (HbF), and myoglobin (Mb)?
- The P_{50} is smaller for HbF than for HbA
 - As the pH is decreased, the P_{50} for HbA is decreased
 - The P_{50} is greater for HbA than for Mb
 - The shape of the curve for HbA is sigmoidal

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- () 18. Enzymes have active sites which are complementary to
- the substrate
 - the product
 - the transition state
 - both the substrate and the product
- () 19. Self-assembly in the microtubules is based on the
- intermolecular interactions of the tubulins
 - the tertiary structure of the tubulins
 - the secondary structure of the tubulins
 - all of the above
- () 20. Of the four types of mammalian muscle cell, the only one which displays multiple nuclei is
- skeletal muscle cells
 - cardiac muscle cells
 - smooth muscle cells
 - myoepithelial cells
- () 21. The change in the oxidation state for nitrogen in the reduction of NO_2^- to NH_3 is
- 0
 - 3
 - 6
 - 8
- () 22. Which of the following has the highest standard free energy of phosphate hydrolysis?
- glycerol-3-phosphate
 - phosphoenolpyruvate
 - ATP
 - glucose-6-phosphate
- () 23. Which of the following is a constituent of cell surface proteoglycans?
- amylose
 - heparan sulfate
 - maltose
 - ribitol
- () 24. Which of the following compound that inhibits ATP synthesis by blocking respiration
- dinitrophenol
 - cyanide
 - oligomycin
 - dicyclohexylcarbodiimide (DCCD)

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- () 25. Which of the following is not a characteristics of the peptide bond:
- it is planar and rigid
 - the peptide plane has 6 atoms
 - atoms in plane have basic property
 - the atoms can be involved in H-bonding
- () 26. The biosynthesis of what amino acid involves reactions which are also part of the urea cycle?
- threonine
 - histidine
 - arginine
 - lysine
- () 27. The urea cycle is linked to the citric acid cycle by
- oxaloacetate
 - citrate
 - fumarate
 - aspartate
- () 28. Which of the following metabolic pathways is strictly anabolic
- gluconeogenesis
 - TCA cycle
 - β -oxidation of fatty acids
 - glycolysis
- () 29. During fasting or starvation, the brain
- converts endogenous fats and lipids to β -hydroxybutyrate
 - stimulates the degradation of brain protein
 - utilize its glycogen reserves to supply glucose
 - utilize β -hydroxybutyrate generated from fatty acids and lipids in the liver
- () 30. Which of the following has the highest standard free energy of phosphate hydrolysis?
- glycerol-3-phosphate
 - phosphoenolpyruvate
 - ATP
 - glucose-6-phosphate

III. What two properties make triacylglycerols more efficient than glycogen in the storage of metabolic energy? (5%)

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

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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