

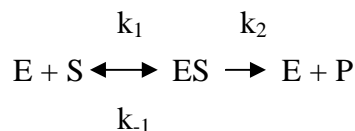
科目：生物化學  
考試時間：100 分鐘

系所：生命科學系  
本科原始成績：100 分

是否使用計算機：是

**I . Single-choice questions (60 points)**

1. Which of the listed amino acids is classified as a basic amino acid?  
(A) leucine (B) phenylalanine (C) aspartate (D) asparagines (E) lysine
2. Which of the peptides would absorb light at 280 nm?  
(A) ala-lys-his (B) ser-gly-asn (C) ala-ala-trp (D) val-pro-leu (E) ser-val-ile
3. Proteins with two different polypeptide chains are:  
(A) monomeric proteins (B) trimeric proteins (C) homodimeric proteins (D) heterodimeric proteins (E) none of the above
4. Membrane proteins differ from globular proteins in that:  
(A) membrane associated amino acids usually have polar side chains. (B) membrane proteins are much more soluble in detergents than water. (C) membrane proteins usually have more hydrophobic amino acids. (D) globular proteins are water insoluble. (E) All are true.
5. Secondary and higher orders of structure are determined by all EXCEPT:  
(A) hydrophobic interactions (B) ionic bonds (C) van der Waals forces (D) hydrogen bonds (E) peptide bonds
6. The plasma membrane is responsible for all EXCEPT  
(A) energy transduction (B) exclusion of certain toxic ions and molecules (C) signal transduction (D) accumulation of cell nutrients (E) all are true
7. All are distinctive features of enzymes EXCEPT  
(A) regulation (B) catalytic activity (C) ability to change (D) specificity (E) none is true
8. The specific site on the enzyme where \_\_\_\_\_ binds and catalysis occurs is called the \_\_\_\_\_ site.  
(A) coenzyme; substrate (B) substrate; active (C) coenzyme; regulatory (D) regulatory; active (E) none of the above
9. Which statement is correct about the Michaelis-Menten constant,  $K_m$ , for the kinetic mechanism below?



- (A) It is numerically equal to the substrate concentration required to achieve one half the maximum velocity. (B) Its defined as  $K_m = k_1/(k_{-1} + k_2)$ . (C) It is approximately equal to the dissociation constant for the enzyme-substrate complex to E + P. (D) The value of  $K_m$  is constant for an enzyme regardless of the specific substrate molecule used to determine it. (E) Its numeric value has the units of moles<sup>-1</sup>

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10. The mechanism of chymotrypsin involves which of the following elements?  
(A) deprotonation of an active site Asp residue by His to start the reaction. (B) formation of an acyl-enzyme intermediate that must be hydrolyzed to complete the reaction. (C) stabilization of the positively charged His by a Gln residue. (D) direct deprotonation of water by His to generate a hydroxide ion for initiation of the reaction. (E) both a and b occur.
11. All are properties of regulatory enzymes EXCEPT  
(A) pathway end-products may act as allosteric inhibitors. (B)  $v$  vs  $[S]$  plots are sigmoid- or S-shaped. (C) substrate binding is cooperative. (D) monomeric enzymes with a single regulated active site. (E) may be stimulated by allosteric activators.
12. Animals are totally dependent on plants and microorganisms for nitrogen fixation and nitrate assimilation because animals  
(A) do not have the reducing power (NADPH) to fix nitrogen (B) lack the enzyme aminotransferase (C) lack the enzymes to reduce  $N_2$  and  $NO_3^-$  to  $NH_4^+$  (D) lack carbamoyl-phosphate synthetase I (E) lack glutamate dehydrogenase
13. In the process of amino acid biosynthesis, how are glutamic acid, glutamine, proline, and arginine all related?  
(A) They are all derived from  $\alpha$ -KG. (B) They are all derivatives of acetyl CoA (C) They are all derivatives of pyruvate. (D) They are all derived from aspartate. (E) They are all derivatives of 3-phosphoglycerate.
14. Which of the following is a true statement regarding pyrimidine biosynthesis in animals?  
(A) PRPP and ATP are allosteric inhibitors (B) CTP is a feedback inhibitor (C) It is allosterically regulated at aspartate transcarbamoylase (D) UDP and UTP are feedback inhibitors of CPS-II (E) ACTase catalyzes the committed step in pyrimidine synthesis
15. Hydrogen bonds in ice are all EXCEPT  
(A) directional (B) straight (C) weak (D) responsible for the lower density of ice over liquid water (E) holding water molecules in ice apart
16. Which of the following sugars **does not** react with Feling's solution?  
(a) glucose, (b) mannitol, (c) lactose, (d) maltose, (e) sucrose, (f) trehalose.  
(A) a,c,e. (B) b,e,f. (C) a,d,f. (D) b,c,d. (E) c and f.
17. The residues of glycoproteins present on cell surface is recognized by the influenza virus is  
(A) calmodulin, (B) cerebroside, (C) hyaluronate, (D) lectin, (E) sialic acid.
18. The vitamin \_\_\_\_\_ is one of the components of coenzyme A, which is involved in \_\_\_\_\_.  
(A) pantothenic acid, carboxylation. (B) pantothenic acid, acyl transfer.  
(C) cobalamin, acyl transfer. (D) riboflavin, carboxylation. (E) niacin, electron transfer.

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19. Upon activation by the signal-receptor event, the GDP is exchanged with a GTP in the \_\_\_\_\_ subunit of heterotrimeric G protein. Activated G proteins transmit signals by binding \_\_\_\_\_ and produce cAMP. Then, the cAMP binds to the regulatory subunits of cAMP-dependent \_\_\_\_\_, is activated.
- (A)  $\alpha$ , tyrosine kinases, protein kinase A. (B)  $\alpha$ , adenylate cyclase, protein kinase A.  
(C)  $\alpha$ , tyrosine kinases, protein kinase C. (D)  $\beta$ , adenylate cyclase, protein kinase C.  
(E)  $\beta$ , tyrosine kinases, protein kinase C.
20. In liver, fructose 2,6-bisphosphate acts as a potent allosteric activator of \_\_\_\_\_ for the regulation of glycolysis; meanwhile, the increased formation of glucose 6-phosphate by \_\_\_\_\_ when blood-glucose levels are elevated.
- (A) hexokinase, glucokinase. (B) phosphofructokinase, hexokinase.  
(C) pyruvate kinase, hexokinase. (D) phosphofructokinase, glucokinase.  
(E) pyruvate kinase, glucokinase.
21. The descending order in the **standard reduction potentials** of the following compounds  
1. NADH, 2. FADH<sub>2</sub>, 3. Cytochrome a, 4. Cytochrome b, 5. Cytochrome c.
- (A) 1-2-3-4-5; (B) 1-2-4-5-3; (C) 1-2-5-4-3; (D) 2-1-5-4-3; (E) 2-1-4-5-3.
22. Which of the following statements about the citric acid cycle **is true**?
- (A) This cycle includes oxygen as a reactant. (B) In eukaryotes, the citric acid cycle takes place in cytoplasm. (C) The only reaction of the citric acid cycle that provides substrate-level phosphorylation is catalyzed by succinate dehydrogenase. (D) The determining rate of the citric acid cycle is the step of  $\alpha$ -ketoglutarate formation. (E) Succinyl-CoA synthetase is embedded in the inner mitochondrial membrane and directly associated with the electron-transport chain.
23. About oxidative phosphorylation, an electrochemical gradient is formed across the \_\_\_\_\_ mitochondrial membrane, \_\_\_\_\_ only electrons transfer, no protons transport, and \_\_\_\_\_ involves directly in O<sub>2</sub> consumption.
- (A) outer, Complexes I, Complex III. (B) outer, Complexes II, Complex IV..  
(C) inner, Complexes I, Complex III. (D) inner, Complexes II, Complex IV..  
(E) inner, Complexes III, Complex IV.
24. How amount of ATP yield when phosphoenolpyruvate is completely oxidized to CO<sub>2</sub> by a mammalian cell homogenate? Assume that glycolysis, the citric acid cycle, and oxidative phosphorylation are full active.
- (A) 12.5, (B) 13.0, (C) 13.5, (D) 14.0, (E) 14.5.

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25. Which of the following compounds is the common prosthetic group of transketolase,  $\alpha$ -ketoglutarate dehydrogenase and pyruvate dehydrogenase complex?  
(A) Thiamine, (B) riboflavin, (C) Biotin, (D) folate, (E) coenzyme A.
26. Pentose phosphate pathway (PPP) occurs in \_\_\_\_\_. The rate of PPP is controlled by the level of \_\_\_\_\_. There are \_\_\_\_\_ transketolase and \_\_\_\_\_ transaldolase involve in PPP.  
(A) cytoplasm,  $\text{NAD}^+$ , one, two. (B) cytoplasm,  $\text{NADP}^+$ , two, one.  
(C) mitochondria,  $\text{NAD}^+$ , two, one. (D) mitochondria,  $\text{NADP}^+$ , two, one.  
(E) mitochondria,  $\text{NAD}^+$ , one, two.
27. Which of the following statements about glycogen and its breakdown is **not true**?  
(a) Glycogen is a good source of energy for sudden, strenuous activity, even under anaerobic condition. (b) Glycogen is a polymer of glucose in  $\alpha(1\rightarrow6)$  linkages with  $\alpha(1\rightarrow4)$  linked branches every about 30 residues. (c) In glycogen breakdown, glucose residues are sequentially removed from the nonreducing ends. (d) UDP-glucose is produced from glycogen by the action of glycogen phosphorylase. (e) Pyridoxal phosphate participates in the phosphorolytic cleavage of glycogen.  
(A) a and c, (B) b and d, (C) c and e, (D) a and e, (E) b and c.
28. Which of the following enzymes play crucial roles in the metabolism of propionic acid (propionate) derived from odd-chain fatty acid degradation?  
(a) D-3-hydroxybutyrate dehydrogenase, (b) 3-hydroxy-3-methyl glutaryl CoA synthase, (c) 3-ketothiolase, (d) methylmalonyl CoA mutase, (e) propionyl CoA carboxylase.  
(A) a and c, (B) b and d, (C) c and e, (D) d and e, (E) only e.
29. Arrange the following steps in fatty acid synthesis in their proper order.  
(a) dehydration, (b) condensation, (c) reduction of a carbonyl group, (d) formation of malonyl ACP, (e) reduction of an enoyl group.  
(A) bcdae, (B) bdcae, (C) dbcae, (D) cdbae, (E) edcea.
30. How many moles of  $\text{H}_2\text{O}$  are formed when 1 mole of stearoyl CoA is completely oxidized to carbon dioxide?  
(A) 20, (B) 24, (C) 26, (D) 28, (E) 30.

**II. Please answer the following questions (40 points)**

1. Please describe five principal ways to regulate enzymatic activity? (10 points)

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2. Please explain the process of Western blotting analysis (10 points)
3. Please write the structure of glutathione and lecithin. (6 points)
4. Please distinguish the catalytic reactions of superoxide dismutase, catalase and peroxidase. (9 points)
5. Please describe the glyoxylate cycle. (5 points)