

國立高雄大學 103 學年度研究所碩士班招生考試試題

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

A: Choose the one best response to each following questions. (60 points)

1. Which of the following atoms could interact through a hydrogen bond?
(A) the oxygen of a ketone and the hydrogen of an aldehyde. (B) the oxygen of methanol and a hydrogen on the methyl carbon of methanol. (C) the hydrogen of an amine and the oxygen of an alcohol. (D) the hydrogen on an aromatic ring and the oxygen of carbon dioxide. (E) none of the above.
2. Which of the following pairs of amino acids contains both an aliphatic and an aromatic amino acid?
(A) Thr and Tyr. (B) Val and Gln. (C) Phe and Ile. (D) Ser and Cys. (E) none of the above.
3. The peptide hormone insulin is composed of two peptide held together primarily by what mechanism?
(A) disulfide bonds between cysteine residues. (B) charge-charge interactions between acidic and basic amino acids. (C) extensive hydrogen bonding due to the relatively high serine and glutamine content. (D) hydrophobic interactions. (E) an amide bond formed from the R-groups of a glutamic acid residue and a lysine residue.
4. When oxygen is bound to myoglobin, the amino acid _____ is complexed to the iron ion of the heme group while _____ forms a hydrogen bound to the oxygen.
(A) cysteine; serine. (B) cysteine; histidine. (C) serine; cysteine. (D) histidine; histidine. (E) histidine; cysteine.
5. During the conversion of IMP to GMP and AMP, _____ serves as the nitrogen source for GMP, while _____ serves as the nitrogen source for AMP.
(A) glutamate, asparagines. (B) glutamate, aspartate. (C) glutamine, asparagines. (D) glutamine, aspartate. (E) none of the above.
6. Which of the following interactions causes a change from the R state (oxy form) to the T state (deoxy form) of hemoglobin?
(A) interactions between heme groups. (B) protonation of the R-group of His146 on the β subunit to allow formation of a salt bridge with Lys40 on the α subunit. (C) salt bridge formed by α 1-Arg141 to the carboxylate of α 2Asp126. (D) protonation of the α 1 subunit terminal carboxyl group disrupts a salt bridge with α 2Lys 127. (E) none of the above.
7. Which of the following explains why enzymes are extremely effective catalysts?
(A) an enzyme stabilizes the transition state. (B) enzymes bind very tightly to substrates. (C) enzymes release products very rapidly. (D) an enzyme can convert a normally endergonic reaction into an exergonic reaction. (E) an enzyme lowers the energy of activation only for the forward reaction.

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8. In the mechanism of chymotrypsin, which of the following amino acids found in the active site is correctly defined in terms of its role in the reaction?
(A) serine: hydrogen bonds with carbonyl oxygen to withdraw electron density from the substrate. (B) histidine: deprotonates aspartic acid to allow a nucleophilic attack to occur. (C) aspartic acid: electrostatic stabilization of histidine to make a stronger base. (D) cysteine: performs a nucleophilic attack on the carbonyl carbon of the substrate. (E) none of the above.
9. Which of the following is an irreversible form of inhibition?
(A) competitive inhibitor. (B) suicide inhibitor. (C) noncompetitive inhibitor. (D) uncompetitive inhibitor. (E) none of the above.
10. Amino acid synthesis is generally regulated by
(A) turnover. (B) diet. (C) feedback and allosteric enzyme regulation. (D) A and B. (E) A, B, and C.
11. Hydroxylation of cholesterol by cytochrome P450 requires
(A) NADPH. (B) activated O₂. (C) PLP. (D) A and B. (E) A and C.
12. Name three amino acids that are positively charged at a neutral pH
(A) lys, arg, and his. (B) his, arg, and cys. (C) cys, arg, and met. (D) lys, arg, and pro. (E) arg, glu, and his.
13. Which of the following compounds is used to reducing disulfide bonds?
(A) β-Mercaptoethanol. (B) Guanidinium chloride. (C) SDS. (D) Urea. (E) None of above.
14. Which of the following protein purification methods is depending in protein size?
(A) DEAE chromatography. (B) Salting out. (C) Affinity chromatography. (D) IEF. (E) Gel-filtration chromatography.
15. In preparation for attachment to the tRNA, amino acids are activated by
(A) methylation. (B) adenylation. (C) dimethylation. (D) all of the above. (E) none of the above.
16. Which of the following statements **is not true**? (A) Glycosaminoglycans are the major fraction of proteoglycans. (B) Glycosaminoglycans present repeating disaccharide units and exhibit many β-1,3 glycosidic linkage. (C) Glycosaminoglycans present on the animal cell surface and in the extracellular matrix. (D) The major skeleton of cartilage components is chondroitin sulfate. (E) Monitoring changes in the amount of glycosylated hemoglobin is a useful means of assessing the effectiveness of treatments for diabetes mellitus.
17. The biochemical property of lectins that is the basis for most of their biological effects is their ability to bind to: (A) amphipathic molecules. (B) hydrophobic molecules. (C) specific lipids. (D) specific oligosaccharides. (E) specific peptides.

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18. Which of the following statements **is not true**?
- (A) Arachidonate is the major precursor of eicosanoid hormones. (B) The 90% spermaceti oil is a mixture of triacylglycerols and waxes containing an abundance of unsaturated fatty acids. (C) Lipid raft is a modification of the original fluid mosaic model. (D) Cholesterol-sphingolipid microdomains in the outer monolayer of the plasma membrane, slightly thinner, and less ordered (more fluid) than neighboring phospholipid microdomains. (E) Liposomes are spherical structures of lipid bilayers. They can be used to contain or transport molecules such as drugs for therapy, DNA for gene therapy.
19. The blood groups of human is determined by (A) triacylglycerol. (B) phospholipids. (C) ether lipids. (D) cholesterol. (E) glycosphingolipids.
20. Which of the following statements about signal transduction and cancer is **incorrect**?
- (A) Protein kinases are central in different signal transduction pathways. (B) Protein kinase inhibitors can be effective anticancer drugs. (C) Viral sarcoma gene is an oncogene. (D) The C-terminal amino acids of viral sarcoma are rich tyrosine residues, resulting in always active and promote unregulated cell growth. (E) Tumor-suppressor genes code for proteins whose normal function is to turn off cell growth.
21. A right order of energy source during exercise is?
- (1) ATP (2) aerobic metabolism (3) anaerobic metabolism (4) creatine phosphate
(A) 4123. (B) 1234. (C) 1243. (D) 1432. (E) 1423.
22. A potent allosteric **activator** of liver phosphofructokinase is
- (A) citrate. (B) ATP. (C) glucose 6-phosphate. (D) fructose 1,6-bisphosphate. (E) fructose 2,6-bisphosphate.
23. Which of the following statements about glycolysis is **incorrect**?
- (A) Conversion glucose 6-phosphate to fructose 6-phosphate is an isomerization reaction. (B) Conversion fructose 1,6-bisphosphate to dihydroxyacetone phosphate and glyceraldehyde 3-phosphate is a lyase reaction. (C) Phosphorylation is coupled to the oxidation of glyceraldehyde 3-phosphate by a thioester intermediate. (D) High energy compounds are formed by the catalysis of glyceraldehydes 3-phosphate dehydrogenase and enolase. (E) Water is formed by the catalysis of aldolase.
24. How many nucleoside triphosphate and water molecules are spent in synthesizing glucose from two molecules pyruvate, respectively? (A) 2, 2. (B) 4, 4. (C) 6, 6. (D) 6, 4. (E) 4, 2.

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25. The two moles of CO₂ produced in the first turn of the citric acid cycle have their origin in the:
(A) carboxyl and methylene carbons of oxaloacetate. (B) carboxyl group of acetate and a carboxyl group of oxaloacetate. (C) carboxyl group of acetate and the keto group of oxaloacetate. (D) two carbon atoms of acetate. (E) two carboxyl groups derived from oxaloacetate.
26. What is the chemical effect of CO on aerobic metabolism? (A) The flow of electrons from NADH to coenzyme Q is blocked. (B) The flow of electrons from Cyt a-a₃ to oxygen is blocked. (C) The proton transfer through Fo of ATP synthase is blocked. (D) The transport of ATP out of and ADP into the mitochondria is blocked. (E) Oxidative phosphorylation is uncoupled from electron transport and all the energy is lost as heat.
27. Which of the following statements of glycogen phosphorylase in muscle is **true**?
(A) It catalyzes phosphorolysis of the (α 1 \rightarrow 6) bonds at the branch points of glycogen.
(B) It catalyzes the degradation of glycogen by hydrolysis of glycosidic bonds.
(C) It degrades glycogen to form glucose 6-phosphate.
(D) It removes glucose residues from the reducing ends of the glycogen chains.
(E) It exists in an active (a) form R state, and an inactive (b) form T state that is allosterically regulated by AMP.
28. Insulin stimulates glycogen synthesis by
(A) activating glycogen synthase kinase. (B) inactivating glycogen synthase kinase.
(C) activating phosphorylase kinase. (D) activating glycogen phosphorylase.
(E) inactivating protein phosphatase 1.
29. For fatty acid synthesis, the activated donor of two-carbon units in the elongation step is _____, and the elongation reaction is driven by _____. In contrast, the product of two-carbon units is _____, and the degradation is driven by _____ in fatty acid oxidation.
(A) acetyl CoA, carboxylation, malonyl CoA, dephosphorylation.
(B) acetyl acyl carrier protein (ACP), decarboxylation, malonyl ACP, phosphorylation.
(C) malonyl ACP, decarboxylation, acetyl CoA, inorganic pyrophosphate hydrolysis.
(D) malonyl ACP, carboxylation, acetyl ACP, phosphorylation.
(E) malonyl CoA, decarboxylation, acetyl ACP, inorganic pyrophosphate hydrolysis.
30. Acetyl CoA carboxylase plays an essential role in regulating fatty acid metabolism. Which of the following regulators to act as **activator** of acetyl CoA carboxylase:
(1) epinephrine (2) glucagons (3) insulin (4) citrate (5) AMP (6) palmitoyl CoA.
(A) 1,2,5. (B) 1,2,4,6. (C) only 3. (D) 3 and 4. (E) 4 and 6.

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B. Please draw the amino acid structures (1~2) and simply explain the following terms (3~8)

(40 points)

1. Met (4 points)
2. Trp (4 points)
3. Two-dimensional electrophoresis (4 points)
4. Michaelis constant (K_M) (4 points)
5. Zymogen (4 points)
6. The Cori cycle (6 points)
7. Photorespiration (7 points)
8. Aerobic glycolysis (7 points)