

國立屏東教育大學 101 學年度研究所碩士班入學考試

生物化學 試題

(化學生物系碩士班)

※請注意：1.本試題共三頁。

2.答案須寫在答案卷上，否則不予計分。

一、選擇題 (每題 3 分，共 30 分)

1. The basic structure of a proteoglycan consists of a core protein and a:
 - (A) glycolipid.
 - (B) glycosaminoglycan.
 - (C) lectin.
 - (D) lipopolysaccharide.
 - (E) peptidoglycan.
2. Which of the following does not involve cyclic AMP?
 - (A) Regulation of glycogen synthesis and breakdown
 - (B) Regulation of glycolysis
 - (C) Signaling by acetylcholine
 - (D) Signaling by epinephrine
 - (E) Signaling by glucagon
3. Cellular isozymes of pyruvate kinase are allosterically inhibited by:
 - (A) high concentrations of AMP.
 - (B) high concentrations of ATP.
 - (C) high concentrations of citrate.
 - (D) low concentrations of acetyl-CoA.
 - (E) low concentrations of ATP.
4. Which substance is not involved in the production of urea from NH_4^+ via the urea cycle?
 - (A) Aspartate
 - (B) ATP
 - (C) Carbamoyl phosphate
 - (D) Malate
 - (E) Ornithine
5. The synthesis of both glycerophospholipids and triacylglycerols involves:
 - (A) CDP-choline.
 - (B) CDP-diacylglycerol.
 - (C) phosphatidate phosphatase.
 - (D) phosphatidic acid.
 - (E) phosphoethanolamine.

6. Topoisomerases:
- (A) always change the linking number in increments of 1.
 - (B) can act on single-stranded DNA circles.
 - (C) change the degree of supercoiling of a DNA molecule but not its linking number of DNA.
 - (D) occur in bacteria, but not in eukaryotes.
 - (E) require energy from ATP.
7. Glycosylation of proteins inside the endoplasmic reticulum does not involve:
- (A) a His residue on the protein.
 - (B) an Asn residue on the protein.
 - (C) dolichol phosphate.
 - (D) glucose.
 - (E) N-acetylglucosamine.
8. Which one of the following statements is true of enzyme catalysts?
- (A) Their catalytic activity is independent of pH.
 - (B) They are generally equally active on D and L isomers of a given substrate.
 - (C) They can increase the equilibrium constant for a given reaction by a thousand-fold or more.
 - (D) They can increase the reaction rate for a given reaction by a thousand-fold or more.
 - (E) To be effective, they must be present at the same concentration as their substrate.
9. Which of the following statements about sterols is true?
- (A) All sterols share a fused-ring structure with four rings.
 - (B) Sterols are found in the membranes of all living cells.
 - (C) Sterols are soluble in water, but less so in organic solvents such as chloroform.
 - (D) Stigmasterol is the principal sterol in fungi.
 - (E) The principal sterol of animal cells is ergosterol.
10. Saturated fatty acids are degraded by the stepwise reactions of beta-oxidation, producing acetyl-CoA. Under aerobic conditions, how many ATP molecules would be produced as a consequence of removal of each acetyl-CoA?
- (A) 2
 - (B) 3
 - (C) 4
 - (D) 5
 - (E) 6

二、問答題（每題10分，共70分）

1. Distinguish between simple diffusion (SD), facilitated diffusion (FD), and active transport (AT) across a membrane for the following questions (more than one may be true):
- (A) Which processes are energy dependent?
 - (B) Which processes need some kind of carrier protein(s)?
 - (C) Which processes can be saturated by substrate?
 - (D) Which processes can establish a concentration gradient?
 - (E) How much energy does it take to transport an uncharged substrate in, if its starting inside concentration is ten-fold greater than outside?

2. The citric acid cycle is frequently described as the major pathway of aerobic catabolism, which means that it is an oxygen-dependent degradative process. However, none of the reactions of the cycle directly involves oxygen as a reactant. Why is the pathway oxygen-dependent?
3. For each of these methods of separating proteins, describe the principle of the method, and tell what property of proteins allows their separation by this technique.
 - (a) ion-exchange chromatography
 - (b) size-exclusion (gel filtration) chromatography
 - (c) affinity chromatography
4. Each of the following reagents or conditions will denature a protein. For each, describe in one or two sentences what the reagent/condition does to destroy native protein structure.
 - (a) urea
 - (b) high temperature
 - (c) detergent
 - (d) low pH
5. The turnover number for an enzyme is known to be $5,000 \text{ min}^{-1}$. From the following set of data, calculate the K_m and the total amount of enzyme present in these experiments.

Substrate concentration (mM)	Initial velocity ($\mu\text{mol/min}$)
1	167
2	250
4	334
6	376
100	498
1,000	499

(a) $K_m =$ _____. (b) Total enzyme = _____ μmol .

6. A solution of DNA is heated slowly until the t_m is reached. What is the likely structure of the DNA molecules at this temperature?
7. What are the regulatory implications for the cell with regard to ATP and AMP, given that the former are generally high, and the latter are low?