

國立嘉義大學九十三學年度

生物科技研究所碩士班招生考試試題

科目：生物化學

一、選擇題：50% (單選題，每題 2 分)

1. In a conjugated protein, a prosthetic group is:
 - A) a part of the protein that is not composed of amino acids.
 - B) a fibrous region of a globular protein.
 - C) a subunit of an oligomeric protein.
 - D) synonymous with "protomer."
 - E) a nonidentical subunit of a protein with many identical subunits.
2. In the binding of oxygen to myoglobin, the relationship between the concentration of oxygen and the fraction of binding sites occupied can best be described as:
 - A) hyperbolic.
 - B) sigmoidal.
 - C) linear with a positive slope.
 - D) linear with a negative slope.
 - E) random.
3. Enzymes are potent catalysts. They:
 - A) drive reactions to completion while other catalysts drive reactions to equilibrium.
 - B) are consumed in the reactions they catalyze.
 - C) are very specific and can prevent the conversion of products back to substrates.
 - D) increase the equilibrium constants for the reactions they catalyze.
 - E) lower the activation energy for the reactions they catalyze.
4. Which of the following amino acid residues is not a point of oligosaccharide attachment in glycoproteins?
 - A) Thr.
 - B) Gly.
 - C) Ser.
 - D) Asn.
5. A lipid derived from isoprenoid precursors is:
 - A) palmitate.
 - B) cholesterol.
 - C) arachidonate.
 - D) prostaglandin G₂.
 - E) sphingosine.
6. The reaction of the citric acid cycle that produces an ATP equivalent (in the form of GTP) by substrate level phosphorylation is the conversion of:
 - A) citrate to isocitrate.
 - B) succinyl-CoA to succinate.
 - C) succinate to fumarate.
 - D) fumarate to malate.
 - E) malate to oxaloacetate.
7. The role of hormone-sensitive triacylglycerol lipase is to:
 - A) hydrolyze lipids stored in the liver.
 - B) hydrolyze triacylglycerols stored in adipose tissue.
 - C) hydrolyze membrane phospholipids in hormone-producing cells.
 - D) synthesize triacylglycerols in the liver.
 - E) synthesize lipids in adipose tissue.
8. Almost all of the oxygen (O₂) one consumes in breathing is converted to:
 - A) carbon dioxide (CO₂).
 - B) carbon monoxide and then to carbon dioxide.
 - C) water.
 - D) acetyl-CoA.
 - E) none of the above.
9. All of the following are considered "weak" interactions in proteins except:
 - A) van der Waals forces.
 - B) hydrogen bonds.
 - C) ionic bonds.
 - D) peptide bonds.
 - E) hydrophobic interactions.
10. In hemoglobin, the transition from T state to R state (low to high affinity) is triggered by:
 - A) subunit association.
 - B) subunit dissociation.
 - C) Fe²⁺ binding.
 - D) heme binding.
 - E) oxygen binding.
11. In competitive inhibition, an inhibitor:
 - A) binds at several different sites on an enzyme.
 - B) binds reversibly at the active site.
 - C) binds only to the ES complex.
 - D) binds covalently to the enzyme.
 - E) lowers the characteristic V_{max} of the enzyme.
12. When the linear form of glucose cyclizes, the product is a(n):
 - A) glycoside.
 - B) hemiacetal.
 - C) anhydride.
 - D) lactone.
 - E) oligosaccharide.
13. The hydrolysis of ATP has a large negative ΔG°; nevertheless the molecule is stable in solution. This stability is due to:
 - A) resonance stabilization.
 - B) entropy stabilization.
 - C) the hydrolysis reaction having a large activation energy.
 - D) ionization of the phosphates.
 - E) the hydrolysis reaction being endergonic.

14. The anaerobic conversion of 1 mol of glucose to 2 mol of lactate by fermentation is accompanied by a net gain of:
 A) 1 mol of ATP.
 B) 2 mol of ATP.
 C) 1 mol of NADH.
 D) 2 mol of NADH.
 E) none of the above.
15. Which of the following is not an intermediate of the citric acid cycle?
 A) oxaloacetate.
 B) citrate.
 C) α -ketoglutarate.
 D) succinyl-CoA.
 E) acetyl-CoA.
16. Which of these is able to cross the inner mitochondrial membrane?
 A) fatty acyl-CoA.
 B) malonyl-CoA.
 C) acetyl-CoA.
 D) fatty acyl-carnitine.
 E) None of the above can cross.
17. Uncoupling of mitochondrial oxidative phosphorylation:
 A) halts all mitochondrial metabolism.
 B) slows down the citric acid cycle.
 C) allows continued mitochondrial ATP formation, but halts O₂ consumption.
 D) halts mitochondrial ATP formation, but allows continued O₂ consumption.
18. Which of the following substrates cannot contribute to net gluconeogenesis in mammalian liver?
 A) alanine.
 B) palmitate.
 C) α -ketoglutarate.
 D) glutamate.
 E) pyruvate.
19. Amino acid residues commonly found at the end of β turn are:
 A) Ala and Gly.
 B) Pro and Gly.
 C) two Cys.
 D) hydrophobic.
 E) those with ionized R groups.
20. In a plot of l/V against 1/[S] for an enzyme-catalyzed reaction, the presence of a competitive inhibitor will alter the:
 A) V_{max}.
 B) intercept on the l/V axis.
 C) intercept on the l/[S] axis.
 D) curvature of the plot.
 E) pK of the plot.
21. V_{max} for an enzyme-catalyzed reaction:
 A) generally increases when pH increases.
 B) increases in the presence of a competitive inhibitor.
 C) is unchanged in the presence of a uncompetitive inhibitor.
 D) is twice the rate observed when the concentration of substrate is equal to the K_m.
- E) is limited only by the amount of substrate supplied.
22. A lipid derived from isoprenoid precursors is:
 A) palmitate.
 B) cholesterol.
 C) arachidonate.
 D) prostaglandin G₂.
 E) sphingosine.
23. The precursors of DNA and RNA synthesis in the cell all contain:
 A) ribose.
 B) deoxyribose.
 C) adenine.
 D) 3 phosphates.
 E) 3 sugars.
24. The main function of the pentose phosphate pathway is to:
 A) supply energy.
 B) give the cell an alternative pathway should glycolysis fail.
 C) supply NADH.
 D) provide a mechanism for the utilization of the carbon skeletons of excess amino acids.
 E) supply pentoses and NADPH.
25. The glyoxylate cycle is:
 A) an alternative path of glucose metabolism in cells that do not have enough O₂.
 B) the most direct way of providing the precursors for synthesis of nucleic acids (e.g., ribose).
 C) defective in people with phenylketonuria.
 D) a means of using acetate for both energy and biosynthetic precursors.
- 二、簡答題 : (10%)**
- Photosynthesis in plant could be presented as a simple reaction as follow:
- $$\text{H}_2\text{O} + \text{CO}_2 \longrightarrow \text{CH}_2\text{O} + \text{O}_2$$
- (1) Which product will be labeled with radioactive O¹⁸, if the reaction is performed using H₂O¹⁸.
 (2) Why ?
- 三、申論題 : (40%)**
- Dehydrogenase usually binds NAD⁺ as a cofactor, what is the chemical structure of NAD⁺? Could you describe the function of two main parts of NAD⁺ structure? (15%)
 - Give three reasons to explain the complexity of the polysaccharide structure of glycoprotein is much higher than those of proteins and DNA biopolymers. (10%)
 - Glutathione (γ -glutamyl-L-cysteinylglycine; GSH) is a tripeptide biomolecules. It participates in many cellular reactions. Besides some cellular redox reactions, antioxidation and detoxication are two among the important activities of GSH. Please describe these reactions. (15%)