

國立嘉義大學九十六學年度  
食品科學系保健食品組碩士班招生考試試題

科目：生物化學

一、簡答題：(每格 2 分，共 30 分)

1. A weak acid with a  $pK = 6.5$ , the effective buffering range is \_\_\_\_\_.
2. Which DNA polymerase is most responsible for chain elongation in *E. coli*? \_\_\_\_\_
3. Give an amino acid with two chiral carbon atoms \_\_\_\_\_. How many stereoisomers can this amino acid form? \_\_\_\_\_
4. What is the net charge on the tripeptide Gly-Arg-Lys at pH 7? \_\_\_\_\_  
(The  $pK_a$ 's of Gly are 2.4 and 9.8. The  $pK_a$ 's of Arg are 1.8, 9.0, and 12.5. The  $pK_a$ 's of Lys are 2.2, 9.1, and 10.5.)
5. What is the purpose of treating a protein with 2-mercaptoethanol? \_\_\_\_\_
6. How many complete turns are there in an ideal  $\alpha$ -helix that contains 15 amino acids and has a pitch of 0.54 nm and a rise of 0.15 nm? \_\_\_\_\_
7. Which class of enzyme (one of six classes) for the following reaction: \_\_\_\_\_  
 $L\text{-Glutamate} + ATP + NH_4^+ \rightarrow L\text{-Glutamine} + ADP + Pi$
8. Which technique \_\_\_\_\_ is used to estimate the molecular weight of oligomeric proteins, while \_\_\_\_\_ is used to determine molecular weight of each chain.
9. An inhibitor binds to a site other than the active site of the enzyme. What kind of inhibition could the inhibitor be? \_\_\_\_\_
10. Phosphorylation that changes an enzyme's activity is an example of \_\_\_\_\_ regulation.
11. The aldose whose configuration at carbons 3, 4, and 5 matches that of D-fructose. \_\_\_\_\_
12. When a sugar polymer is analyzed and found to have equal portions of reducing and non-reducing sugar residues, it may be concluded that it is \_\_\_\_\_ (linear or branched)
13. A stretch of double-stranded DNA contains 1000 bp, and its base composition is 58% (G+C). How many thymine residues are in this region of DNA? \_\_\_\_\_

二、單選題：(每題 2 分，共 20 分)

1. Glycerol is converted to \_\_\_\_\_ when it is used for gluconeogenesis. (A) dihydroxyacetone phosphate (B) phosphoenolpyruvate (C) oxaloacetate (D) 3-phosphoglycerate
2. Which statement is false about allosteric regulation? (A) It is usually the mode of regulation for the last step in reaction pathways since this step produces the final product. (B) Cellular response is faster with allosteric control than by controlling enzyme concentration in the cell. (C) The regulation usually is important to the conservation of energy and materials in cells. (D) Allosteric modulators bind non-covalently at sites other than the active site and induce conformational changes in the enzyme.
3. A reducing sugar is one that (A) is an acetal (B) is a hemiacetal (C) can reduce  $Cu^{+2}$  but not  $Ag^{+1}$  (D) A and C.
4. Which is usually the slowest way to regulate a reaction in a metabolic pathway? (A) allosteric modulation (B) covalent modification (C) changing the enzyme concentration (D) feedback inhibition.
5. Phosphofructokinase I deficiency results in (A) an overproducing of fructose 6-phosphate (B) an overproducing of fructose 1,6-bisphosphate (C) fructose 1,6-bisphosphate deficiency (D) A and C.
6. Which of the following is not regulated in glycolysis? (A) pyruvate kinase (B) phosphoglycerate kinase (C) hexokinase (D) PFK-1.

7. Which carbon atom(s) of pyruvate is(are) first converted to carbon dioxide by pyruvate dehydrogenase complex? (A) the carboxylate carbon (# 1) (B) the carbonyl carbon (#2) (C) the methyl carbon (#3) (D) both carbons #1 and #3 in equal amounts
8. More ATP is formed from glucose in glycogen than free glucose, even free glucose released from glycogen because (A) Limit dextrin contains additional molecules (B) The debranching enzyme releases from glucose (C) The glucose is already phosphorylated after glucogen phosphorylase action (D) The glucose bypasses glycolysis.
9. The major regulatory step of the pentose phosphate pathway is catalyzed by which enzyme? (A) transaldolase (B) phosphofructokinase-1 (C) glucose 6-phosphate dehydrogenase (D) ribose 5-phosphate isomerase.
10. The non-oxidative stage of the pentose phosphate pathway \_\_\_\_\_ (A) produces NADPH and releases  $CO_2$  (B) consists entirely of near-equilibrium reactions (C) contains two reactions whose enzymes are allosterically inhibited by NADPH (D) consumes four ATP molecules.

三、問答題：(50 分)

- 1.(a) 何謂 reactive oxygen species (ROS)? (3 分); (b) Glutathione 是由哪些 amino acids 所組成(3 分); (c) 請寫出 Glutathione peroxidase 所參與的反應(3 分); (d) 請寫出 Glutathione reductase 所參與的反應(3 分)。
- 2.請簡述下列 lipoprotein 及 apolipoprotein 的主要功能及重要性。  
(a) chylomicron (3 分) (b) high density lipoprotein (HDL) (3 分)  
(c) apolipoprotein C-II (3 分) (d) apolipoprotein E (3 分)
- 3.(a) 請寫出在生化代謝中會產生 NADPH(亦即：nicotinamide adenine dinucleotide phosphate (NADP)還原形式(reduced form))的反應(4 分); (b) 請舉一例說明 NADPH 所參與的生化代謝反應(2 分); (c) NAD 及 NADP 是那個 vitamin 的輔酶形式(coenzyme form, 請寫出該 vitamin 的全名)(2 分); (d) flavin adenine dinucleotide (FAD)及 flavin mononucleotide (FMN) 是那個 vitamin 的輔酶形式(coenzyme form, 請寫出該 vitamin 的全名)(2 分)。
- 4.(a) 請說明為何醣類可轉變成脂肪，但脂肪酸卻無法參與糖質新生反應(gluconeogenesis)而轉變成葡萄糖(glucose)(3 分); (b) 請比較 fatty acid synthesis 和 fatty acid  $\beta$ -oxidation 這兩個與脂肪代謝相關的反應(請針對反應發生的時機、場所、及參與反應的反應物、產物、輔助因子做說明)(6 分); (c) 哪些 amino acids 是屬於 branched chain amino acids (BCAA, 請務必寫出 amino acid 的英文名稱)(3 分); (d) 請以 glutamate 說明何謂 transamination 以及何謂 deamination(4 分)。