

國 立 宜 蘭 大 學

1 0 4 學 年 度 研 究 所 碩 士 班 考 試 入 學

生物化學試題

(生 物 技 術 與 動 物 科 學 系 生 物 技 術 碩 士 班)

准考證號碼：

《作答注意事項》

- 1.請先檢查准考證號碼、座位號碼及答案卷號碼是否相符。
- 2.考試時間：100 分鐘。
- 3.本試卷共有單選題 50 題，一題 2 分，共計 100 分。
- 4.請將答案寫在答案卷上。
- 5.考試中禁止使用大哥大或其他通信設備。
- 6.考試後，請將試題卷及答案卷一併繳交。
- 7.本試卷採雙面影印，請勿漏答。
- 8.應試時不得使用電子計算機。

單選題 (共 50 題，每題 2 分)

- () 1. The pH of a sample of blood is 7.4, while gastric juice is pH 1.4. The blood sample has:
- (A) 0.189 times the $[H^+]$ as the gastric juice.
 - (B) 5.29 times lower $[H^+]$ than the gastric juice.
 - (C) 6 times lower $[H^+]$ than the gastric juice.
 - (D) 6,000 times lower $[H^+]$ than the gastric juice.
 - (E) a million times lower $[H^+]$ than the gastric juice.
- () 2. Which of the following is *not* considered a noncovalent interaction ?
- (A) Electrostatic interaction
 - (B) Hydrophobic interaction
 - (C) Disulfide bond
 - (D) Hydrogen bond
 - (E) van der Waals interaction
- () 3. In glycoproteins, the carbohydrate moiety is always attached through the amino acid residues :
- (A) asparagine, serine, or threonine
 - (B) aspartate or glutamate
 - (C) glutamine or arginine
 - (D) glycine, alanine, or aspartate
 - (E) tryptophan or tyrosine
- () 4. Which of the following peptides exhibits the highest UV absorbance at the wavelength of 280 nm?
- (A) Thr-Trp-Tyr
 - (B) Asp-Thr-Arg
 - (C) His-Pro-Gly
 - (D) Asn-Phe-Gln
 - (E) Glu-Lys-Ile
- () 5. Edman degradation will:
- (A) determine the C-terminal amino acid by using a carboxypeptidase.
 - (B) cleave the protein into a multitude of smaller peptides.
 - (C) compare overlapping sets of peptide fragments.
 - (D) determine the N-terminal amino acid.
- () 6. The uncommon amino acid selenocysteine has an R group with the structure $-CH_2-SeH$ ($pK_a \sim 5$). In an aqueous solution, $pH=7.0$, selenocysteine would:

- (A) be a fully ionized zwitterions with no net charge.
 - (B) be found in proteins as D-selenocysteine.
 - (C) never be found in a protein.
 - (D) be nonionic.
 - (E) not be optically active.
- () 7. By adding SDS during the electrophoresis of proteins, it is possible to:
- (A) determine a protein's isoelectric point.
 - (B) determine an enzyme's specific activity.
 - (C) determine the amino acid composition of the protein.
 - (D) preserve a protein's native structure and biological activity.
 - (E) separate proteins exclusively on the basis of molecular weight.
- () 8. Which of the following proteins would show up as the band at the bottom of an SDS polyacrylamide gel after electrophoresis?
- (A) Ribonuclease A, 14 kDa
 - (B) Myoglobin, 17 kDa
 - (C) DNase I, 31 kDa
 - (D) Haptoglobin, 45 kDa
 - (E) Serum albumin, 67 kDa
- () 9. Which of the following is *not* commonly used to assist protein folding?
- (A) Chaperones
 - (B) Disulfide isomerase
 - (C) Heat shock proteins
 - (D) Ubiquitin
 - (E) Peptidyl-prolyl cis-trans isomerase
- () 10. The Protein Data Bank (PDB) is a database that primarily contains information about:
- (A) gene sequences
 - (B) enzyme specificity
 - (C) protein structure
 - (D) protein function
 - (E) protein-protein interaction
- () 11. The term "proteome" has been used to describe:
- (A) regions (domains) within proteins.
 - (B) regularities in protein structures.
 - (C) the complement of proteins encoded by an organism's DNA.
 - (D) the structure of a protein-synthesizing ribosome.
 - (E) the tertiary structure of a protein.

- () 12. In the binding of oxygen to myoglobin and hemoglobin, the relationship between the concentration of oxygen and the fraction of binding sites occupied can best be described as:
- (A) both are linear with a negative slope
 - (B) both are linear with a positive slope
 - (C) hyperbolic for myoglobin; sigmoidal for hemoglobin
 - (D) sigmoidal for myoglobin ; hyperbolic for hemoglobin
 - (E) none of the above
- () 13. Which of the following *can not* be used to determine molecular weight for proteins?
- (A) SDS-PAGE
 - (B) Gel filtration
 - (C) Southern blotting
 - (D) Mass spectrometry
 - (E) Bioinformatic tools
- () 14. The following methods are now frequently used for determination of three-dimensional structures of proteins, not including:
- (A) cryo-electron microscopy
 - (B) circular dichroism
 - (C) nuclear magnetic resonance (NMR)
 - (D) X-ray diffraction crystallography
 - (E) small-angle X-ray scattering
- () 15. In the binding of oxygen to myoglobin and hemoglobin, the relationship between the concentration of oxygen and the fraction of binding sites occupied can best be described as:
- (A) both are linear with a negative slope
 - (B) both are linear with a positive slope
 - (C) hyperbolic for myoglobin; sigmoidal for hemoglobin
 - (D) sigmoidal for myoglobin ; hyperbolic for hemoglobin
 - (E) none of the above
- () 16. Coenzymes NAD^+/NADH are commonly used as coupling reactions for enzyme activity assay. Which of the following best describes the measurement of NADH production?
- (A) $A_{340\text{ nm}}$ increases
 - (B) $A_{340\text{ nm}}$ decreases
 - (C) $A_{595\text{ nm}}$ increases
 - (D) $A_{595\text{ nm}}$ decreases

- (E) $A_{280\text{ nm}}$ increases
- () 17. In the Lineweaver-Burk plot for an enzyme-catalyzed reaction, the presence of a competitive inhibitor will alter the
- (A) V_{max} .
 - (B) intercept on the $1/V$ axis.
 - (C) intercept on the $1/[S]$ axis.
 - (D) curvature of the plot.
 - (E) none of the above
- () 18. Which of these statements about enzyme-catalyzed reactions is *false*?
- (A) At saturating levels of substrate, the rate of an enzyme-catalyzed reaction is proportional to the enzyme concentration.
 - (B) If enough substrate is added, the normal V_{max} of a reaction can be attained even in the presence of a competitive inhibitor
 - (C) The rate of a reaction decreases steadily with time as substrate is depleted.
 - (D) The activation energy for the catalyzed reaction is the same as for the uncatalyzed reaction, but the equilibrium constant is more favorable in the enzyme-catalyzed reaction.
 - (E) The Michaelis-Menten constant K_m equals the $[S]$ at which $V=1/2 V_{\text{max}}$.
- () 19. An enzyme able to remove a phosphate group from its substrate is called:
- (A) kinase
 - (B) phosphodiesterase
 - (C) phosphatase
 - (D) caspase
 - (E) lipase.
- () 20. Which of the following can be used as powerful inhibitors for an enzyme-catalyzed reaction, thus being promising candidates for novel drug design?
- (A) substrates
 - (B) transition-state analogs
 - (C) products
 - (D) reaction intermediates
 - (E) none of the above
- () 21. Where does translation occur?
- (A) nucleus
 - (B) cytosol
 - (C) lysosome
 - (D) all above
 - (E) none of the above

- () 22. The simplest aldotriose is:
(A) glyceraldehyde
(B) dihydroxyacetone
(C) acetone
(D) threose
(E) fructose
- () 23. Sucrose is composed of the following simple sugars:
(A) fructose only
(B) glucose only
(C) galactose and glucose
(D) glucose and fructose
(E) galactose and fructose
- () 24. Which of the following molecules is a disaccharide?
(A) glucose
(B) galactose
(C) fructose
(D) lactose
(E) all above
- () 25. Nucleotides are linked by
(A) peptide bond
(B) hydrogen bond
(C) phosphodiester bond
(D) disulfide bond.
(E) none of the above
- () 26. Which of the following terms describes an enzyme that makes glucose to glucose-6-phosphate?
(A) phosphatase
(B) dehydrogenase
(C) isomerase
(D) kinase
(E) all above.
- () 27. Which one cut mRNA?
(A) ribonuclease
(B) endonuclease
(C) exonuclease
(D) all above.
(E) none of the above

- () 28. Which one is *not* lipid-soluble vitamin:
- (A) vitamin A
 - (B) vitamin C
 - (C) vitamin D
 - (D) vitamin E
 - (E) vitamin K.
- () 29. Gluconeogenesis is the synthesis of:
- (A) fatty acids from glucose
 - (B) glucose from non-carbohydrate precursors
 - (C) glycogen from glucose
 - (D) pyruvate from glucose
 - (E) none of the above
- () 30. In the cellular signaling, which one is the second messenger:
- (A) ATP
 - (B) ADP
 - (C) cAMP
 - (D) GTP
 - (E) NADPH.
- () 31. The following sugar is also called blood sugar:
- (A) sucrose
 - (B) glucose
 - (C) fructose
 - (D) maltose
 - (E) none of the above
- () 32. Which of the following molecules have the highest degree of [1→6] branching linkages:
- (A) starch
 - (B) glycogen
 - (C) amylopectin
 - (D) amylase
 - (E) none of the above
- () 33. The DNA is *not* composed of:
- (A) adenine
 - (B) uracil
 - (C) guanine
 - (D) cytosine
 - (E) thymine.

- () 34. The major difference between DNA and RNA is the sugar, with what ribose in DNA:
(A) 1-deoxyribose
(B) 2-deoxyribose
(C) 3-deoxyribose
(D) 4-deoxyribose
(E) 5-deoxyribose.
- () 35. The components of lipoproteins such as LDL and HDL which makes them water soluble are:
(A) proteins
(B) phospholipids
(C) unesterified cholesterol
(D) proteins and phospholipids
(E) All of the above.
- () 36. The first committed precursor in the pathway for the synthesis of cholesterol is:
(A) Isoprene
(B) Lanosterol
(C) Mevalonic acid
(D) Squalene
(E) None of these is correct.
- () 37. Which of the following enzyme types is involved in **both** fatty acid synthesis and breakdown?
(A) Carboxylase.
(B) Transferase.
(C) Synthase.
(D) Both carboxylase and synthase.
(E) All three of these enzymes are used in fatty acid synthesis.
- () 38. Compared to β -oxidation, fatty acid synthesis requires this extra vitamin or cofactor.
(A) Biotin
(B) Riboflavin
(C) Niacin
(D) Pantothenic acid
(E) All of these are used in both pathways.
- () 39. How many NADPH are oxidized in the synthesis of palmitoyl-CoA from eight molecules of acetyl-CoA?
(A) 1

- (B) 7
(C) 8
(D) 14
(E) 16
- () 40. Where in the cell does fatty acid synthesis occur?
(A) Cytoplasm.
(B) Outer mitochondrial membrane.
(C) Mitochondrial intermembrane space.
(D) Inner mitochondrial membrane.
(E) Mitochondrial matrix.
- () 41. Which are the three most common ketone bodies?
(A) Acetone, formaldehyde, acetoacetate.
(B) Acetone, butyric acid and oxaloacetate.
(C) Acetone, β -hydroxybutyrate and acetoacetate.
(D) Acetone, β -hydroxybutyrate and oxaloacetate.
(E) Acetocetate, β -hydroxybutyrate and oxaloacetate.
- () 42. The reactions involved in β -oxidation of fatty acids include the following:
1. Cleavage of acetyl-CoA from the fatty acid.
2. Hydration of a double bond.
3. Formation of a C-C double bond.
4. Oxidation of an alcohol.
The correct order of these reactions is:
(A) 1 \rightarrow 2 \rightarrow 3 \rightarrow 4
(B) 4 \rightarrow 3 \rightarrow 2 \rightarrow 1
(C) 3 \rightarrow 2 \rightarrow 4 \rightarrow 1
(D) 2 \rightarrow 4 \rightarrow 3 \rightarrow 1
(E) 1 \rightarrow 4 \rightarrow 3 \rightarrow 2
- () 43. How many NAD⁺ are reduced in the degradation of palmitoyl-CoA to form eight molecules of acetyl-CoA?
(A) 1
(B) 7
(C) 8
(D) 14
(E) 16
- () 44. Which of the following is *not* an advantage of fatty acids as a form of energy storage?
(A) Fatty acids contain more highly reduced carbons than carbohydrates.

- () 45. How many ATP are required for the production of two ammonia molecules (NH_3) from one nitrogen molecule (N_2) ?
- (A) 2 ATP.
 - (B) 4 ATP.
 - (C) 8 ATP.
 - (D) 16 ATP.
 - (E) 32 ATP.
- () 46. Which of the following amino acids is *not* glucogenic?
- (A) Glycine.
 - (B) Alanine.
 - (C) Aspartic Acid.
 - (D) Leucine.
 - (E) All of these amino acids are glucogenic.
- () 47. Humans produce these as the major nitrogen waste products.
- (A) Ammonia.
 - (B) Urea.
 - (C) Uric Acid.
 - (D) Both Urea and Uric Acid.
 - (E) All three of these are used to dispose of nitrogen wastes by humans.
- () 48. Which of the following is *not* associated with pyrimidine synthesis?
- (A) Synthesis of the base while ribose is attached.
 - (B) Stimulation of synthesis by purines.
 - (C) An orotic acid intermediate.
 - (D) Inhibition by pyrimidines.
 - (E) All of these are features of pyrimidine synthesis.
- () 49. By a simple transamination reaction, intermediates in glycolysis or the Krebs's Cycle can be converted in one step to all of these amino acids, *except*:
- (A) Alanine.
 - (B) Aspartic Acid
 - (C) Glutamic Acid.
 - (D) Serine.
 - (E) All of these amino acids are only one step away from the major metabolic pathways.

- () 50. The two nitrogens in urea arise directly from:
- (A) Ammonia and aspartic acid.
 - (B) Carbamoyl phosphate and aspartic acid.
 - (C) Carbamoyl phosphate and glutamic acid.
 - (D) Ammonia and glutamic acid.
 - (E) Carbamoyl phosphate and glutamine.