

# 國立宜蘭大學

101 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：

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### 《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 50 題單選題，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 three-dimensional structure of protein is formed and maintained primarily through noncovalent interactions. Which one of the following is *NOT* considered a noncovalent interaction?  
(A) disulfide bonds (B) hydrogen bonds (C) hydrophobic interactions  
(D) ionic interactions (E) van der Waals interactions
2. 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.
3. Water derives all its special properties from its:  
(A) cohesiveness and adhesiveness (B) high boiling point and melting point  
(C) small degree of ionization (D) polarity and hydrogen-bonding capacity  
(E) high dielectric constant
4. 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.
5. One method used to prevent disulfide bond interference with protein sequencing procedure is:  
(A) cleaving proteins with proteases that specifically recognize disulfide bonds.  
(B) protecting the disulfide bridge against spontaneous reduction to sulfhydryl groups.  
(C) reducing disulfide bridges and preventing their re-formation by further modifying the  $-SH$  groups.  
(D) removing cystines from protein sequences by proteolytic cleavage.  
(E) sequencing proteins that do not contain cysteinyl residues.
6. 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.

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. Determining the precise spacing of atoms within a large protein is possible only through the use of:
- (A) electron microscopy. (B) light microscopy. (C) X-ray diffraction.
  - (D) molecular model building. (E) Ramachandran plots.
9. Which of the following is not known to be involved in the process of assisted folding of proteins?
- (A) Chaperonins (B) Disulfide interchange (C) Heat shock proteins
  - (D) Peptide bond hydrolysis (E) Peptide bond isomerization
10. In hemoglobin, the transition from T state to R state (low to high affinity) is triggered by:
- (A)  $\text{Fe}^{2+}$  binding (B) heme binding (C) oxygen binding (D) subunit association
  - (E) subunit dissociation
11. 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  $[\text{S}]$  at which  $V=1/2 V_{\max}$ .
12. In glycoproteins, the carbohydrate moiety is always attached through the amino acid residues:
- (A) asparagine, serine, or threonine (B) aspartate, glutamate or threonine
  - (C) glutamine, lysine, or arginine (D) glycine, alanine, or aspartate
  - (E) tryptophan, phenylalanine, or tyrosine
13. A small molecule (generally under  $M_r$  5000) that can attach to larger molecules in order to elicit an immune response is called:
- (A) antigen (B) allergen (C) hapten (D) isotope (E) epitope
14. The DNA is *NOT* composed of:
- (A) adenine (B) uracil (C) guanine (D) cytosine (E) thymine.

15. 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.
16. Which is the most common form of DNA under the conditions found in cells?  
(A) A-DNA (B) B-DNA (C) C-DNA (D) D-DNA (E) E-DNA.
17. Which of the following is a disaccharide?  
(A) glucose (B) galactose (C) fructose (D) lactose (E) cellulose.
18. Disaccharide is composed of two monosaccharides by what kind of linkage:  
(A) phosphodiester bond (B) hydrogen bond (C) glycosidic bond  
(D) peptide bond (E) ester bond.
19. Which of the following is a saturated fatty acid?  
(A) C18:0 (B) C18:1 (C) C18:2 (D) C18:3 (E) C20:4.
20. Which of the following can *NOT* be found in the cell membrane of mammalian cells?  
(A) protein (B) lipid (C) oligosaccharide (D) cholesterol (E) RNA.
21. Which of the following is *NOT* a lipid-soluble vitamin:  
(A) vitamin A (B) vitamin C (C) vitamin D (D) vitamin E (E) vitamin K.
22. An enzyme able to remove a phosphate group from its substrate is called:  
(A) kinase (B) phosphodiesterase (C) phosphatase (D) caspase (E) lipase.
23. Phospholipase C catalyzes the hydrolysis of PIP<sub>2</sub> to inositol 1,4,5-triphosphate (IP<sub>3</sub>) and a diacylglycerol (DAG). IP<sub>3</sub> stimulates the release of Ca<sup>2+</sup> from:  
(A) endoplasmic reticulum (B) mitochondria (C) lysosome (D) nucleus  
(E) Golgi apparatus.
24. Bruce A. Beutler and Jules A. Hoffmann won the Nobel Prize in Physiology or Medicine 2011 and their discoveries concerning the activation of innate immunity. Which receptor is their major finding in the innate immunity:  
(A) insulin receptor (B) hormone receptor (C) toll-like receptor (D) cytokine receptor  
(E) G-protein coupled receptor.
25. In the cellular signaling, which of the following serves as the second messenger:  
(A) ATP (B) ADP (C) cAMP (D) GTP (E) NADPH.
26. Mirror image stereoisomers are called:  
(A) anomers. (B) diastereomers. (C) enantiomers. (D) epimers. (E) monomers.
27. In a Fischer projection, which chiral carbon determines whether the sugar is the D- or the L-isomer?  
(A) highest numbered carbon atom (B) lowest numbered asymmetric carbon atom  
(C) lowest numbered carbon atom (D) highest numbered asymmetric carbon atom  
(E) lowest numbered oxygen atom

28. Which of the following is **NOT** an end product of glucose metabolism via either aerobic or anaerobic means?  
(A) ethanol (B) carbon dioxide (C) lactate (D) fructose  
(E) all of these are end products of glucose metabolism
29. Which of the following enzymes of glycolysis is **NOT** involved in regulation of the pathway?  
(A) Hexokinase (B) Phosphofructokinase (C) Aldolase (D) Pyruvate kinase  
(E) All of these proteins regulate glycolysis.
30. Methanol is extremely toxic, but not directly. In the body, it is converted into formaldehyde; that's what's actually the poison. What kind of enzyme catalyzes this conversion?  
(A) a kinase (B) a dehydrogenase (C) an isomerase (D) a mutase (E) a protease
31. The glyoxylate pathway bypasses part of the citric acid cycle by converting isocitrate to glyoxylate and:  
(A)  $\alpha$ -ketoglutarate. (B) fumarate. (C) succinyl-CoA. (D) succinate. (E) pyruvate.
32. The metabolically activated form of a fatty acid is:  
(A) an ester. (B) a Schiff base. (C) a thioester. (D) a phosphate ester.  
(E) a phosphoanhydride.
33. Where in the cell does  $\beta$ -oxidation occur?  
(A) Cytoplasm. (B) Outer mitochondrial membrane.  
(C) Mitochondrial intermembrane space. (D) Inner mitochondrial membrane.  
(E) Mitochondrial matrix.
34. A key intermediate in the formation of "ketone bodies" is:  
(A) succinyl-CoA. (B) acetoacetyl-CoA. (C) malonyl-CoA. (D) propionyl-CoA.  
(E) methyl malonyl-CoA.
35. A metabolic intermediate that is **NOT** a precursor for an amino acid family is:  
(A)  $\alpha$ -ketoglutarate. (B) pyruvate. (C) glyceraldehyde-3-phosphate.  
(D) oxaloacetate. (E) propionate.
36. Which of the following is **NOT** a stop codon?  
(A) UAA (B) UGA (C) UAG (D) UGG (E) all of the above.
37. In eukaryotes, the most common mechanism for targeting protein for destruction in a proteasome is by: (A) ubiquitinylation. (B) glycosylation. (C) phosphorylation.  
(D) acetylation. (E) methylation.
38. Which of the following is **NOT** part of RNA processing in eukaryotes?  
(A) addition of 5' cap (B) addition of a poly A tail (C) reverse transcription  
(D) removal of introns (E) joining of exons.
39. The specific enzyme that produce DNA pieces of manageable size is called:  
(A) *Taq* DNA polymerase (B) restriction endonuclease (C) DNA ligase  
(D) Helicase (E) Topoisomerase

40. Which of the following technique is most widely used for separating DNA or protein by their size and charge?
- (A) Cloning
  - (B) Transformation
  - (C) PCR
  - (D) Gel electrophoresis
  - (E) Gel filtration chromatography
41. The primer for *in vivo* DNA replication is:
- (A) The 3' hydroxyl of the preceding Okazaki fragment.
  - (B) A short piece of RNA.
  - (C) A nick made in the DNA template.
  - (D) A primer is not always required for DNA replication.
  - (E) All of the above are true.
42. Which of the following activities does *E. coli* DNA polymerase III lack?
- (A) 5' → 3' exonuclease activity
  - (B) 3' → 5' exonuclease activity
  - (C) 5' → 3' polymerase activity
  - (D) All of the above
  - (E) None of the above
43. In bacteria the elongation stage of protein synthesis does **NOT** involve:
- (A) aminoacyl-tRNAs.
  - (B) EF-Tu.
  - (C) GTP.
  - (D) IF-2.
  - (E) peptidyl transferase.
44. Semiconservative replication of DNA was established experimentally by:
- (A) gel electrophoresis
  - (B) ultraviolet spectroscopy
  - (C) column chromatography
  - (D) flow cytometry
  - (E) density-gradient centrifugation
45. The sigma factor of *E. coli* RNA polymerase:
- (A) associates with the promoter before binding to core enzyme.
  - (B) combines with the core enzyme to confer specific binding to a promoter.
  - (C) is inseparable from the core enzyme.
  - (D) is required for termination of an RNA chain.
  - (E) will catalyze synthesis of RNA from both DNA template strands in the absence of the

core enzyme.

46. Aptamers are:
- (A) double-stranded RNA products of nuclease action on hairpin RNAs.
  - (B) repeat sequence elements at the ends of transposons.
  - (C) small RNA molecules selected for tight binding to specific molecular targets.
  - (D) the RNA primers required for retroviral replication.
  - (E) the short tandem repeat units found in telomeres.
47. Which of the following can *NOT* be used for measuring molecular weight of proteins?
- (A) SDS-PAGE
  - (B) Gel filtration
  - (C) Mass spectrometry
  - (D) Northern blotting
  - (E) None of the above
48. Which of the following is *NOT* a major technique applied in proteomic studies?
- (A) Two-dimensional gel electrophoresis
  - (B) Mass spectrometry
  - (C) Bioinformatics
  - (D) DNA microarray
  - (E) None of the above
49. Ni-NTA is a metal chelate affinity chromatography for purification of proteins with:
- (A) His<sub>6</sub>-tags
  - (B) Flag-tags
  - (C) HA-tags
  - (D) GST-tags
  - (E) All of the above
50. Which of the following methods can *NOT* be used for analyzing protein-protein interactions?
- (A) Yeast two hybrid
  - (B) Ultrafiltration
  - (C) Phage display
  - (D) Co-immunoprecipitation
  - (E) None of the above