

國立宜蘭大學

109 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 選擇題 50 題，一題 2 分，共計 100 分。
- 4.請將答案寫在答案卷上。
- 5.考試中禁止使用手機或其他通信設備。
- 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。
- 9.試題最後一頁另備計算紙 1 張。

- Unsaturated fatty acids usually have ____ double bonds.
(A) Cis
(B) trans
- Which of the following compounds yields the most energy per gram?
(A) Triacylglycerols
(B) Carbohydrates
(C) Proteins
(D) They all yield about the same amount of energy per gram.
- In the sodium-potassium pump
(A) sodium is transported out of the cell and potassium into the cell, both against concentration gradients
(B) sodium is transported into the cell and potassium out of the cell, both against concentration gradients
(C) sodium is transported out of the cell and potassium into the cell, both in the same direction as concentration gradients
(D) sodium and potassium are both transported out of the cell against concentration gradients
- Which of the following is a metabolic precursor of prostaglandins & leukotrienes?
(A) vitamin A.
(B) arachidonic acid.
(C) sphingomyelin.
(D) cholesterol.

Exhibit A

Amino acid	α -carboxyl group pK_a	α -amino group pK_a	R-group pK
Ala	2.3	9.7	
Arg	2.2	9.0	12.5
Asn or Gln	2.1	9.0	
Asp or Glu	2.2	9.8	4.0
Cys	1.7	10.8	8.3
His	1.8	9.2	6.0
Ser	2.2	9.2	
Tyr	2.1	9.1	10.1

- Refer to Exhibit A.** The pI of an amino acid is the pH at which it has a zero net charge. What is the increasing order of isoelectric points (low pH to high) for these three amino acids?
(A) ALA, HIS, ASP
(B) ASP, ALA, HIS
(C) HIS, ALA, ASP

- (D) ALA, ASL, HIS
- (E) ASP, HIS, ALA

6. **Refer to Exhibit A.** Which of these amino acids could act as a good buffer at pH = 4.5

- (A) Alanine
- (B) Asparagine
- (C) Asparagine
- (D) Cysteine
- (E) Aspartic Acid

7. **Refer to Exhibit A.** The pI of the peptide ALA-GLN-ARG-SER-HIS would be:

- (A) Strongly acid
- (B) Weakly acid (4-6)
- (C) About neutral (6-8)
- (D) Weakly basic (8-10)
- (E) Strongly basic

8. Which amino acid is **not** a precursor to a neurotransmitter?

- (A) Glutamic Acid
- (B) Phenylalanine
- (C) Serine
- (D) Tryptophan
- (E) Tyrosine

9. The main intracellular buffer system is

- (A) $\text{H}_3\text{PO}_4/\text{H}_2\text{PO}_4^-$
- (B) $\text{H}_2\text{PO}_4^-/\text{HPO}_4^{2-}$
- (C) $\text{HPO}_4^{2-}/\text{PO}_4^{3-}$
- (D) $\text{H}_3\text{PO}_4/\text{PO}_4^{3-}$

10. If the pH of 1 liter of a 1.0 M carbonate buffer is 7.0, what is actual number of moles of H_2CO_3 and HCO_3^- ? (pK = 6.37)

	moles of H_2CO_3	moles of HCO_3^-
I.	0.86	0.14
II.	0.81	0.19
III.	0.76	0.24
IV.	0.19	0.81
V.	0.14	0.86

- (A) I

- (B) II
- (C) III
- (D) IV
- (E) V

11. The main blood buffer system is

- (A) $\text{H}_2\text{CO}_3/\text{HCO}_3^-$
- (B) $\text{HCO}_3^-/\text{CO}_3^{2-}$
- (C) $\text{H}_2\text{CO}_3/\text{CO}_3^{2-}$
- (D) none of the above

12. The Bohr effect for oxygen binding states that

- (A) Mb binds oxygen more tightly than Hb.
- (B) Hb will bind oxygen very tightly when the CO_2 concentration is high.
- (C) as the pH goes down, Hb binds oxygen less tightly.
- (D) Hb's ability to bind oxygen increases with higher oxygen concentration.

13. Which would be best to separate positively charged proteins?

- (A) Gel filtration
- (B) Affinity chromatography
- (C) Cation exchange
- (D) Anion exchange
- (E) Cation or anion exchange

14. Determination of the sequence of amino acids in a peptide is done by

- (A) x-ray crystallography
- (B) Edman degradation
- (C) treatment with cyanogen bromide
- (D) trypsin hydrolysis

15. If a protein with the sequence PQRKYPIG is treated with trypsin, what will the products be?

- (A) PQR KYPIG
- (B) PQRK YPIG
- (C) PQR K YPIG
- (D) PQ R KPIG0

16. If a protein with the sequence FEWPRQVDMARINE is treated with chymotrypsin, what will the products be?

- (A) F EW PRQVDMARINE
- (B) FE WPRQVD MARINE

- (C) FEWPR QVDMAR INE
(D) FEWPRQVDM ARINE

17. If the y-intercept of a Lineweaver-Burk plot = 1.91 (sec/millimole) and the slope = 75.3 L/sec, K_M equals:

- (A) 0.0254 millimolar (mM).
(B) 0.523 millimolar (mM).
(C) 5.23 millimolar (mM).
(D) 39.4 millimolar (mM).
(E) 75.3 millimolar (mM).

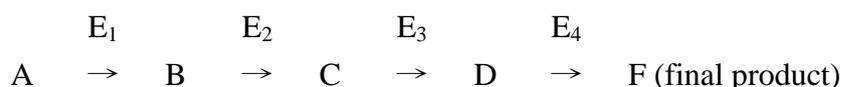
18. Which of the following is more likely to inhibit regulatory subunits of an allosteric enzyme?

- (A) A competitive inhibitor
(B) A non-competitive inhibitor
(C) An irreversible inhibitor
(D) All of these are equally likely to inhibit a regulatory subunit

19. If an inhibitor changes the slope of the Lineweaver-Burk graph, but not the y-intercept, it is this type of inhibition:

- (A) Competitive.
(B) Non-competitive.
(C) Mixed Inhibition (uncompetitive inhibition).
(D) You cannot tell from the data given.
(E) More than one answer is correct.

20. Many metabolic pathways involve multistep reactions. Consider the following pathway.



Which of the following would be an example of feedback inhibition?

- (A) the product of the final reaction, F, interacting with E_1 .
(B) F interacting with an allosteric site in E_4 .
(C) B interacting with an allosteric site in E_1 .
(D) all of the intermediates or products in the reaction interacting with the active site in E_1 .

21. The oligonucleotide AGGUCCAUUGAAp, is best described as

- (A) an RNA oligonucleotide with a 3'phosphate
(B) an RNA oligonucleotide with a 5'phosphate
(C) a DNA oligonucleotide with a 3'phosphate
(D) a DNA oligonucleotide with a 5'phosphate

22. Which of the following sequences of DNA is most likely to form Z-DNA?

- (A) 5' -ATCTACATCTACATAGATAT-3'
3' -TAGATGTAGATGTATCTATA-5'
- (B) 5' -AAAAAAAAAAAAAAAAAAAAA-3'
3' -TTTTTTTTTTTTTTTTTTTTTTT-5'
- (C) 5' -GCGCGCGCGCGCCGCGCGCG-3'
3' -CGCGCGCGCGCGCGCGCGCG-5'
- (D) 5' -GGGGGGGGGGGGGGGGGGGGG-3'
3' -CCCCCCCCCCCCCCCCCCCCC-5'

23. Supercoiling of DNA

- (A) is not observed in prokaryotes
- (B) requires the action of topoisomerase enzymes
- (C) does not require ATP
- (D) is not observed in eukaryotes

24. Protein synthesis can occur while the mRNA molecule is being synthesized in:

- (A) Prokaryotes only.
- (B) Eukaryotes only.
- (C) Unicellular organisms only.
- (D) Multicellular organisms only.

25. Which of the following is not a function of DNA Polymerase III?

- (A) Polymerization.
- (B) Ligating the final products.
- (C) Proofreading.
- (D) Clamping on to the template.
- (E) All of these.

26. The following enzyme is responsible for the bulk of DNA synthesis during replication.

- (A) DNA Polymerase I
- (B) DNA Polymerase II
- (C) DNA Polymerase III
- (D) DNA Polymerases IV
- (E) All four can make lots of DNA rapidly.

27. Which of the following activities does *E. coli* DNA polymerase III lack?

- (A) 5' → 3' polymerase
- (B) 5' → 3' exonuclease
- (C) 3' → 5' exonuclease

(D) *E. coli* DNA polymerase III has ALL of the above activities.

28. 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 these are true.

29. *E. coli* replication on the lagging strand

- (A) is carried out by DNA polymerase I
- (B) is initially synthesized as Okazaki fragments
- (C) is synthesized continuously
- (D) has this DNA strand synthesized in a 3' → 5' direction

30. The enzyme that attaches the Okazaki fragments together is called

- (A) ligase.
- (B) primase.
- (C) DNA polymerase I
- (D) DNA polymerase III

31. Which of the activities of DNA Polymerase I is most important in removing the primer?

- (A) Polymerase activity.
- (B) Ability to nick intact double stranded DNA.
- (C) 5' → 3' exonuclease.
- (D) 3' → 5' exonuclease.
- (E) None of these is used for primer removal.

32. In eukaryotic replication, the RNA primers are degraded by:

- (A) the 5' to 3' exonuclease activity of pol δ
- (B) DNA ligase
- (C) Helicase
- (D) FEN-1 and RNase H1

33. The enzyme telomerase uses mechanisms that involve:

- (A) Repeating sequences at the telomeres.
- (B) Having RNA oligonucleotides to act as templates as part of the enzyme.
- (C) Allowing the end of the chromosome to get a little shorter each time a cell divides.
- (D) Both repeating sequences at the end of chromosomes and RNA oligonucleotides to act as templates as part of the enzyme.

34. RNA synthesis begins at the base in the DNA sequence designated by the following number:

- (A) +1 (plus one)
- (B) 0 (zero)
- (C) -1 (minus one)
- (D) -10 region (minus ten)
- (E) It varies among genes.

35. The promoter site is

- (A) the start site for transcription in DNA
- (B) the binding site for regulatory proteins that stimulate transcription
- (C) the general region of DNA downstream from the start site
- (D) the site on DNA at which RNA polymerase binds to initiate transcription

36. Which of the following is the best description of an operon?

- (A) An enhancer that positively regulates gene expression.
- (B) An silencer that negatively regulates gene expression.
- (C) A binding element for the sigma (σ) factor.
- (D) A group of genes under the control of a common promoter.

37. Which of the conditions would result in the greatest amount of transcription of the *lac* operon?

	[glucose]	[lactose]
I.	high	high
II.	low	low
III.	high	low
IV.	low	high

- (A) I
- (B) II
- (C) III
- (D) IV

38. Which of the following is not a structural motif encountered in DNA-binding proteins?

- (A) helix-turn-helix
- (B) leucine zipper
- (C) zinc finger

(D) β -barrel

39. The sequences in eukaryotic DNA known as introns are
(A) those included in the final sequence of messenger RNA
(B) the intervening sequences not expressed in the final sequence of messenger RNA
(C) the binding sites for DNA polymerase
(D) the binding sites for RNA polymerase
40. Which of the following is true about micro RNAs?
(A) They are a type of non-coding RNA
(B) They are a type of small interfering RNA
(C) They have been found only in simple organisms like roundworms
(D) All of these are true
41. Which of the following codons does not code for an amino acid?
(A) AUG
(B) UAA
(C) CAU
(D) GUU
(E) All of these code for an amino acid
42. The initial step in the formation of an aminoacyl-tRNA is
(A) esterification of the tRNA
(B) activation of the amino acid by reaction with ATP
(C) activation of the tRNA by reaction with ATP
(D) interaction of the mRNA with the tRNA
43. Which linkage best describes the covalent bond between an amino acid (AA) and its tRNA?
(A) Amino group of AA linked to 5' -OH of tRNA.
(B) Amino group of AA linked to 5' phosphate of tRNA.
(C) Carboxyl group of AA linked to 3' -OH of tRNA.
(D) Carboxyl group of AA linked to 3' phosphate of tRNA.
44. What is the start codon on the mRNA for prokaryotic translation?
(A) AUG
(B) UAA
(C) UAG
(D) UGA
45. A Shine-Dalgarno Sequence is a
(A) sequence of nucleotides in the DNA that interacts with the σ -subunit of RNA polymerase to

begin transcription.

- (B) sequence of nucleotides in an mRNA that interacts with the small subunit of a ribosome to begin translation.
- (C) sequence of nucleotides in the DNA that interacts with ρ -protein to terminate transcription.
- (D) sequence of nucleotides in an mRNA that functions to terminate translation.

46. The final form of mRNA in eukaryotes has all these features, except:

- (A) There will be a special nucleotide cap on the 5' end of the mRNA.
- (B) There is usually a poly A tail on the 3' end of the mRNA.
- (C) The mature, active mRNA contains introns.
- (D) Only a single protein is made from any mature mRNA molecule.
- (E) All of these are true.

47. The protein which marks proteins for degradation is called:

- (A) Chaperonin
- (B) Ubiquitin
- (C) Proteasomin
- (D) Apoptosin
- (E) None of these names is correct.

48. The ultimate electron acceptor in the electron transport chain is

- (A) NAD^+
- (B) FAD.
- (C) oxygen.
- (D) ADP.

49. What is the net yield of ATP per glucose molecule that passes through all of aerobic respiration ((glucose \rightarrow $\text{CO}_2 + \text{H}_2\text{O}$)?)

- (A) 2
- (B) 4
- (C) 6
- (D) 30 - 32, dependent on the shuttle system used.

50. Of the various forms of glycogen phosphorylase, the most active would be:

- (A) the phosphorylated R form
- (B) the unphosphorylated R form
- (C) the phosphorylated T form
- (D) the unphosphorylated T form
- (E) all of the forms have the same activity