國　立　宜　蘭　大　學

110 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 50 題選擇題，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。

選擇題：（共 50 題，每題 2 分）

1. Which of the following is the most distinguishing difference between a purine and a pyrymidine
   (A) purines are found in DNA while pyrimidines are found in RNA
   (B) purines have nitrogens in the rings while pyrimidines do not
   (C) pyrimidines have nitrogens in the rings while purines do not
   (D) purines are found in RNA while pyrimidines are found in DNA
   (E) purines are double ring structures while pyrimidines have a single ring

2. The fundamental differences between RNA and DNA are
   (A) the organic bases only
   (B) bases, ribose units, and the phosphodiester linkage
   (C) bases, ribose units, and the glycosidic bond type
   (D) bases and the ribose units only

3. Which contains a phosphoanhydride bond?
   (A) DNA
   (B) RNA
   (C) ATP
   (D) AMP
   (E) None of these

4. Which of the following best describes the structure of a nucleosome?
   (A)DNA wrapped around an octomer containing two each of H2A, H2B, H3, and H4 with H1 on the outside.
   (B)DNA wrapped around an octomer of H1 with H2A,B, H3 & H4 on the outside.
   (C)DNA wrapped around a octomer of either H2A/H2B or H3/H4 with H1 on the outside.
   (D)DNA wrapped around a tetramer of either H2A/H2B or H3/H4 with H1 on the outside.
   (E)None of these

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

(A) 5'-ATCTACATCTACATAGATAT-3'
3'-TAGATGTAGATGTATCTATA-5'

(B) 5'-AAAAAAAAAAAAAAAAAAAA-3'
3'-TTTTTTTTTTTTTTTTTTTT-5'

(C) 5'-GCGCGCGCGCGCCGCGCGCG-3'
3'-CGCGCGCGCGCGCGCGCGCG-5'

(D) 5'-GGGGGGGGGGGGGGGGGGGG-3'
3'-CCCCCCCCCCCCCCCCCCCC-5'

6. The human genome is though to have about how many genes?

(A) 10,000
(B) 25,000
(C) 50,000
(D) 100,000
(E) None of these is close to the estimate

7. Which of the following RNAs is the **least** abundant in a typical cell?

(A) mRNA
(B) rRNA
(C) snRNA
(D) tRNA

8. The following types of RNA are common to all organisms, **except**:

(A) mRNA
(B) rRNA
(C) snRNA
(D) tRNA
(E) All types are found in all organisms.

9. 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.

10. In *E. coli*,
   (A)the leading strand is synthesized in one piece while the lagging strand is synthesized discontinuously.
   (B)the leading strand is synthesized discontinuously while the lagging strand is synthesized in one piece.
   (C)both the leading and lagging strands are synthesized in one piece.
   (D)both the leading and lagging strands are synthesized discontinuously.

11. 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.

12. 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.

13. Which of the following characteristics is not associated with *E. coli* primase?
   (A)it synthesizes the RNA primer in DNA replication
   (B)it synthesizes a primer with a free 3'−OH end
   (C)it is essential for DNA replication
   (D)it is essential for RNA replication

14. 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.

15. The enzyme that attaches the Okazaki fragments together is called
(A)ligase.
(B)primase.
(C)DNA polymerase I
(D)DNA polymerase III

16. Replication of eukaryotic DNA
(A)must occur faster than replication of prokaryotic DNA
(B)must be controlled to coordinate with the cell cycle
(C)takes place during mitosis
(D)takes place twice during each cell cycle

17. In eukaryotic replication, the RNA primers are degraded by:
(A)the 5’ to 3’ exonuclease activity of pol ä
(B)DNA ligase
(C)Helicase
(D)FEN-1 and RNase H1

18. Which of the following correctly describes a difference between RNA & DNA polymerases?
(A)RNA polymerases usually do not need a template, while DNA polymerases do.
(B)DNA polymerases usually require a primer (i.e., they can only continue a strand, not start one), while most RNA polymerases do not.
(C)RNA polymerases usually synthesize introns, while DNA polymerases synthesize cistrons.
(D)RNA polymerases polymerize 5' → 3', while DNA polymerases polymerize 3' → 5'.
(E)None of these

19. At what point does the sigma (σ) subunit of RNA polymerase released from the core enzyme?
(A)Prior to the incorporation of any nucleotides into an RNA strand.
(B)After transcription begins and about 10 nucleotides have been added to the RNA chain.
(C)Just prior to chain termination.
(D)Never; it is an intrinsic part of the core enzyme.
(E)After RNA polymerase discovers an inverted repeat

20. 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
(E)None of these

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

	[glucose]	**[lactose]**
(A)	high	high
(B)	low	low
(C)	high	low
(D)	low	high

22. CREB contains the following structural motif:
(A)Helix-turn-helix
(B)β−barrel
(C)Zinc finger
(D)Leucine zipper

23. The eukaryotic TATA-binding protein (TBP) functions in a manner similar to
(A)sigma (σ) factor in *E. coli.*
(B)rho (ρ) factor in *E. coli.*
(C)lac I in *E. coli.*
(D)CAP in *E. coli.*

24. Capping of eukaryotic mRNA
(A)occurs at the 5' end.
(B)occurs at the 3' end.
(C)occurs at both ends.
(D)doesn't occur at all.

25. Polyadenylation of eukaryotic mRNA
(A)occurs at the 5' end.
(B)occurs at the 3' end.
(C)occurs at both ends.
(D)doesn't occur at all.

26. 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

27. 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

28. A tRNA was determined to have the following anticodon sequence:
3'−GAI−5' (I represents the base hypoxanthine),Which of the following codons can form base pairs with this anticodon?
(A)5'−CUA−3'
(B)5'−CUC−3'
(C)5'−CUU−3'
(D)all of these

29. The mRNA must contain the following to allow for initiation of protein synthesis in *E. coli*.
(A) A purine rich sequence to bind to the ribosome.
(B) A pyrimidine rich sequence to bind to the ribosome.
(C) A Shine-Delgarno sequence.
(D) A purine rich sequence to bind to the ribosome and a Shine-Delgarno sequence.
(E) A pyrimidine rich sequence to bind to the ribosome and a Shine-Delgarno sequence.

30. An aminoacyl-tRNA is initially bound to the ribosome
(A) at the A site on the 50S subunit
(B) at the P site on the 50S subunit
(C) at the A site on the 30S subunit
(D) at the P site on the 30S subunit

31. At what point does the formylation reaction take place to produce *N*-formylmethionine?
(A) On the free amino acid prior to its addition to a tRNA.
(B) After methionine has been added to a specific tRNA.
(C) After the methionine-tRNA adduct has complexed with the ribosome.
(D) After the first peptide bond is formed on the ribosome.

32. What is the start codon on the mRNA for prokaryotic translation?
(A) AUG
(B) UAA
(C) UAG
(D) UGA

33. The protein which marks proteins for degradation is called:
(A) Chaperonin
(B) Ubiquitin
(C) Proteasomin
(D) Apoptosin
(E) None of these names is correct.

34. Identify the component required for the chain initiation step of protein synthesis.
(A)DNA helicase
(B)Release factors
(C)30S ribosomal subunit
(D)UAA

35. A plasmid is
(A)a virus that infects bacteria.
(B)a piece of DNA derived from two or more sources.
(C)a small circular DNA that is not part of a bacterial chromosome.
(D)an artificially created cytoplasm.

36. The "c" in cDNA stands for this word:
(A)Complete.
(B)Circular.
(C)Complementary.
(D)Chromosomal.
(E)Confusing.

37. In humans, pyruvate can be converted to
(A)acetyl-CoA only.
(B)lactate only.
(C)ethanol only.
(D)acetyl-CoA and lactate.

38. The following item was the most important one for the development of PCR as a commercially successful and widely-used procedure:
(A)*Taq* DNA Polymerase.
(B)Heat-resistant DNA.
(C)Heat-resistant primers for DNA synthesis.
(D)Robotic machines to run the PCR® procedure.
(E)Heat-resistant nucleoside triphosphate substrates.

39. What is the net ATP yield per glucose during glycolysis?

(A)1

(B)2

(C)3

(D)4

(E)6

40. What is the relationship between glycolysis and cancer?

(A)cancer cells lack a glycolytic pathway

(B)cancer cells use a modified version of glycolysis

(C)cancer cells exhibit a much higher level of anaerobic glycolysis than normal cells

(D)none of these

41. When mitochondria are actively carrying out aerobic respiration

(A)the pH of the matrix is greater than the pH of the intermembrane space.

(B)the pH of the matrix is less than the pH of the intermembrane space.

(C)the pH of the matrix is about the same as the pH of the intermembrane space.

(D)the pH of the matrix versus the intermembrane space has nothing to do with whether not aerobic respiration is occurring.

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

(A)NAD^+.

(B)FAD.

(C)oxygen.

(D)ADP.

(E)none of these

43. Chemiosmotic coupling involves this process:

(A)Using an electron gradient to synthesize ATP.

(B)Using a proton gradient to synthesize ATP.

(C)Using oxygen flow to synthesize ATP.

(D)Using a proton gradient to make water from oxygen.

(E)These are all chemiosmotic processes.

44. Which of the following are related for a given enzyme?
(A) V_{max}, K_M, and percentage of α-helix
(B) V_{max}, k_{cat}, and percentage of β-sheet
(C) V_{max}, k_{cat}, and turnover number
(D) V_{max}, K_M, and molecular weight
(E) None of these are related in any way

45. The K_M of hexokinase for glucose = 0.15 mM and for fructose, K_M = 1.5 mM. Which is the preferred substrate?
(A) Glucose.
(B) Fructose.
(C) Neither substrate is preferred over the other.
(D) You cannot tell from the data given.
(E) None of these answers is correct.

46. The value of V_{max} changes in
(A) competitive inhibition
(B) noncompetitive inhibition
(C) both forms of inhibition
(D) neither form of inhibition

47. 57. What is the pH of an acetic acid solution where the concentration of acetic acid is 2 mM and the concentration of sodium acetate is 20 mM. The pK_a of acetic acid is 4.76.

(A)5.76

(B)10.6

(C)12.6

(D)8.8

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

48. **Refer to Exhibit A.** Calculate the pI of ASN:

(A)2.5

(B)5.0

(C)5.5

(D)6.0

(E)10.7

49. **Refer to Exhibit A.** Calculate the pI of CYS?

(A)1.7

(B)5.0

(C)8.3

(D)9.6

(E)10.8

50. **Refer to Exhibit A.** Which one has the R-group with the highest pK?

(A) Alanine

(B) Arginine

(C) Histidine

(D) Cysteine

(E) Aspartic Acid