

國立宜蘭大學

107 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。

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

- a. F EW PRQVMARINE
- b. FE WPRQVD MARINE
- c. FEWPR QVDMAR INE
- d. FEWPRQVDM ARINE

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

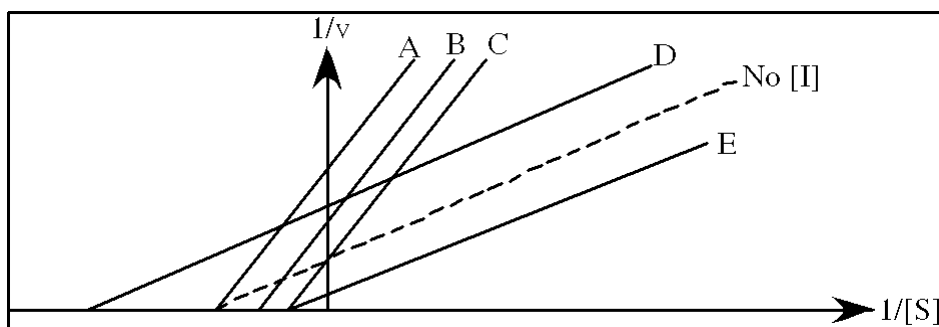
- a. PQR KYPIG
- b. PQRK YPIG
- c. PQR K YPIG
- d. PQ R KPIG0

3. Cyanogen bromide (CNBr) cleaves proteins

- a. after positively charged residues, such as K & R.
- b. after negatively charged residues, such as D & E.
- c. after aromatic residues, such as Y & W.
- d. after methionine residues.

4. "Hindrate" is an inhibitor of triose phosphate isomerase. When it is added to cells at a concentration of 0.1 nM, the enzyme's K_M for the substrate is unchanged, but the apparent V_{max} is altered to 50 nM/sec.

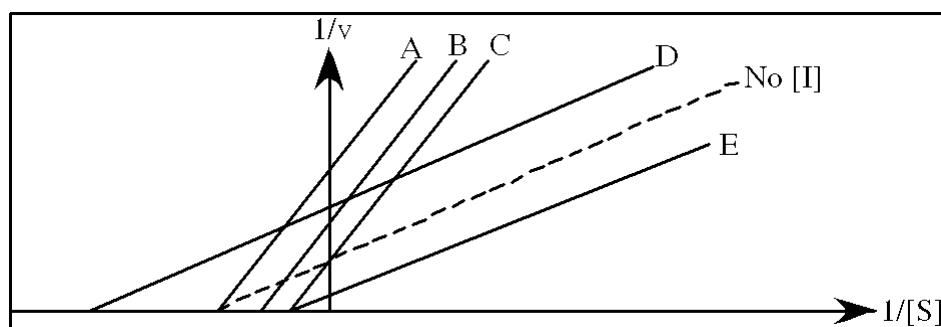
In the following graph, which line best represents the Lineweaver-Burk plot obtained in the presence of hindrate?



- a. A
- b. B
- c. C
- d. D
- e. E

5. "Restrainin" is an inhibitor of triose phosphate isomerase. When it is added to cells at a concentration of 0.4 nM, the enzyme's apparent K_M for the substrate is altered to 100 μM , but the V_{max} is unchanged.

In the following graph, which line best represents the Lineweaver-Burk plot obtained in the presence of restrainin?



- A
- B
- C
- D
- E

6. Glycogen phosphorylase between a and b are modified by which way?

- Phosphorylation of covalent bond
- Allosteric modification by ATP
- Allosteric modification by Glucose

7. Glycogen phosphorylase a between R state and T state are modified by which way?

- Phosphorylation of covalent bond
- Allosteric modification by ATP
- Allosteric modification by Glucose

8. Which of the following statements about Na^+ , K^+ -pump is true?

- The Na^+ , K^+ ATPase pumps 3 Na^+ inside and 2 K^+ outside the cell membrane.
- The Na^+ , K^+ ATPase is modified by phosphorylation of covalent bond.
- This enzyme does not require ATP.
- It is a kind of allosteric enzyme.

9. Histones contain large amounts of which of the following amino acids?

- a. histidine
- b. glutamic acid
- c. lysine
- d. leucine
- e. tryptophan

10. 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

11. 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 CO₂ 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.

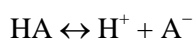
12. In allosteric interactions

- a. proteins that consist of a single polypeptide chain form aggregates.
- b. disulfide bonds are broken.
- c. changes that take place in one site of a protein cause changes at a distant site.
- d. metal ions always bind to the protein.

13. What is the maximum number of hydrogen bonds a single water molecule can form?

- a. 1
- b. 2
- c. 3
- d. 4
- e. 5

14. For an acid that undergoes this reaction:



$K_a =$

- a. $[\text{H}^+][\text{A}^-]/[\text{HA}]$
- b. $[\text{H}^+][\text{HA}]/[\text{A}^-]$
- c. $[\text{HA}][\text{A}^-]/[\text{H}^+]$

- d. $[A^-]/[HA][H^+]$
e. $[H^+]/[HA][A^-]$
15. The dissociation constant for an acid with a pK_a value of 8.0 is
a. -1×10^8
b. 1×10^{-8}
c. 1×10^8
d. -1×10^{-8}
16. If the pH of 1 liter of a 1.0 M carbonate buffer is 7.4, what is the molar ratio of HCO_3^- to H_2CO_3 ? ($pK = 6.4$)
a. 1.0
b. 0.1
c. 6.4
d. 7.00
17. The overall, net ionic charge on this peptide Cys-Ala-Gly-Arg-Gln-Met at $pH = 7$ would be:
a. +2
b. +1
c. 0
d. -1
e. -2
18. The following is true about the hydroxyproline in collagen:
a. Hydroxyproline is incorporated into the chain during polymerization of amino acids.
b. Vitamin C is necessary for the synthesis of hydroxyproline.
c. Hydroxyproline is important in holding the 3 strands of collagen together.
d. Hydroxyproline requires Vitamin C for its synthesis and it holds the collagen helix together.
e. All of these.
19. A prokaryotic replisome typically contains two molecules of DNA pol III, but only one molecule of DNA pol I. Why?
a. The DNA pol I works on the leading strand, while DNA pol IIIs work on the Okazaki fragments. since there are several of those, it takes more proteins to keep up.
b. DNA pol I has a built-in proofreading exonuclease; DNA pol III does not. The second

- DNA pol III is needed to follow the first to accomplish the necessary proofreading.
- c. The DNA pol IIIs do most of the work. DNA pol I only has to work on the telomers.
 - d. DNA pol I replaces the RNA primers with DNA, which really only needs to be done repetitively on one strand, while both strands are worked on by the DNA pol IIIs.
20. Ultra-violet light principally causes which of the following damages to DNA?
- a. mismatches between stands
 - b. breaks in the phosphodiester backbone of the DNA strand
 - c. thymine dimerization
 - d. methylation of specific bases
21. How do the Okazaki fragments of eukaryotes and prokaryotes compare?
- a. The Okazaki fragments are much longer in eukaryotes than in prokaryotes.
 - b. The Okazaki fragments are much shorter in eukaryotes than in prokaryotes.
 - c. The Okazaki fragments of eukaryotes are on the leading strand, rather than the lagging strand.
 - d. There is little to no difference between the Okazaki fragments of eukaryotes and prokaryotes.
22. Which of the following is a characteristic of eukaryotic, but not prokaryotic, DNA replication?
- a. Topoisomerases are required.
 - b. A primer is needed on the lagging strand only.
 - c. Histone biosynthesis must take place.
 - d. There is only one origin of replication.
23. 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.
 - e. All of these.
24. Operons
- a. control the expression of constitutive genes.
 - b. are subject to positive or to negative control.
 - c. are not affected by mutations in the genes for repressors or inducers.

d. occur in both prokaryotes and eukaryotes.

25. 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

26. Collagen is consisted by repeating sequences of

- (a) X-Pro-Gly and X-Hyp-Gly
- (b) X-Pro-Pro and X-Hyp-Pro
- (c) Pro-X-Gly and Hyp-X-Gly
- (d) Pro-Gly-Gly and Hyp-Gly-Gly

27. Control of transcription in prokaryotes does not involve

- a. enhancers.
- b. silencers.
- c. leucine zipper proteins.
- d. alternative σ factors.

28. Where is the TATA box located?

- a. At the transcription start site (+1).
- b. -10 region.
- c. -25 region.
- d. -40 region.

29. In affinity chromatography

- a. there is nonspecific binding of proteins to column material
- b. only minor purifications can be obtained
- c. the mobile phase is always pure water

- d. the ligand is always specific for one type of protein to be bound
 - e. there can be molecule specific ligands or group specific ligands
30. The isoelectric point is
- a. the pH at which a substance has no net charge
 - b. the pH at which a substance has a net positive charge
 - c. the pH at which a substance has a net negative charge
 - d. the pH at which a substance has no charge groups of any kind
31. 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.
32. Which of the following is a unique feature of qPCR compared to the original PCR?
- a. qPCR uses a DNA polymerase from a heat stable source
 - b. qPCR requires a primer
 - c. qPCR allows the reaction to run until all of the primers have been exhausted
 - d. In qPCR, the speed with which the DNA is produced is used to estimate how much of the original template was in the reaction vessel
33. In humans, pyruvate can be converted to
- a. acetyl-CoA only.
 - b. lactate only.
 - c. ethanol only.
 - d. acetyl-CoA and lactate.
34. 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

35. Capping of eukaryotic mRNA
- occurs at the 5' end.
 - occurs at the 3' end.
 - occurs at both ends.
 - doesn't occur at all.
36. Which of the following best describes the structure of a nucleosome?
- DNA wrapped around an octomer containing two each of H2A, H2B, H3, and H4 with H1 on the outside.
 - DNA wrapped around an octomer of H1 with H2A,B, H3 & H4 on the outside.
 - DNA wrapped around a octomer of either H2A/H2B or H3/H4 with H1 on the outside.
 - DNA wrapped around a tetramer of either H2A/H2B or H3/H4 with H1 on the outside.
37. Which of the following sequences of DNA is most likely to form Z-DNA?
- 5' -ATCTACATCTACATAGATAT-3'
3' -TAGATGTAGATGTATCTATA-5'
 - 5' -AAAAAAAAAAAAAAAAAAAAA-3'
3' -TTTTTTTTTTTTTTTTTTTTTTT-5'
 - 5' -GCGCGCGCGCGCCGCGCGCG-3'
3' -CGCGCGCGCGCGCGCGCGCG-5'
 - 5' -GGGGGGGGGGGGGGGGGGGGG-3'
3' -CCCCCCCCCCCCCCCCCCCCC-5'
38. What is the net yield of ATP per glucose molecule that passes through all of aerobic respiration (glucose → CO₂ + H₂O)?
- 2
 - 4
 - 6
 - 30 – 32, dependent on the shuttle system used.
39. The yield of ATP from the complete oxidation of glucose is lower in muscle and brain from that in kidney, liver, and heart because
- there are fewer mitochondria in muscle and brain cells
 - muscle and brain cells have a lower requirement for ATP
 - different shuttle mechanisms operate to transfer electrons from the cytosol to the mitochondrion in the two sets of tissues
 - none of the above

40. The following cellular component is the defining component of eukaryotic cells:
- Nucleus
 - Ribosomes
 - Chloroplasts
 - Mitochondria
 - Cell membranes
41. The mitochondrial matrix
- is the location of enzymes needed for oxidation reactions
 - contains an array of microtubules
 - is part of the endoplasmic reticulum
 - lies between the inner and outer mitochondrial membrane
42. The following cellular component is the defining component of most plant cells:
- Nucleus
 - Ribosomes
 - Chloroplasts
 - Mitochondria
 - Cell walls
43. The structure of myoglobin consists
- almost entirely of α -helices.
 - almost entirely of β -sheets.
 - of a mixture of α -helices and β -sheets.
 - of a unique secondary motif that is neither α -helix nor β -sheet.
44. Which of the following best describes what happens when hemoglobin binds *bisphosphoglyceric acid* (BPG)?
- Binding of BPG leads to tighter binding of oxygen.
 - Binding of BPG allows maternal (adult) Hb to bind oxygen more tightly than fetal Hb.
 - Binding of BPG causes oxygen to dissociate from Hb.
 - Binding of BPG causes the subunits of hemoglobin to separate.
45. Which of the following proteins is not homologous with the others?
- myoglobin

- b. α -chain of hemoglobin
 - c. β -chain of hemoglobin
 - d. collagen
46. 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
47. The majority of protein synthesis occurs in the
- a. nucleus
 - b. mitochondrion
 - c. ribosome
 - d. nucleolus
48. Which of the following codons does not code for an amino acid?
- a. AUG
 - b. UGA
 - c. CAU
 - d. GUU
 - e. All of these code for an amino acid
49. What provides the energy for rho-dependent chain termination?
- a. ATP hydrolysis distinct from any incorporation into the chain.
 - b. Nucleotide hydrolysis associated with incorporation into the chain.
 - c. Torsional stress built into the separating DNA strands.
 - d. There is no energy requirement.
50. What is the function of the sigma (σ) subunit of RNA polymerase in *E. coli*?
- a. It recognizes promoters where transcription should begin.
 - b. It contains the active site for synthesis of RNA.
 - c. It ensures proper processivity of the polymerase, so it doesn't stop prematurely.
 - d. It is involved in chain termination.