

國立臺灣師範大學 100 學年度碩士班招生考試試題

科目：生物化學

適用系所：生命科學系

注意：1.本試題共 8 頁，請依序在答案卷上作答，並標明題號，不必抄題。2.答案必須寫在指定作答區內，否則不予計分。

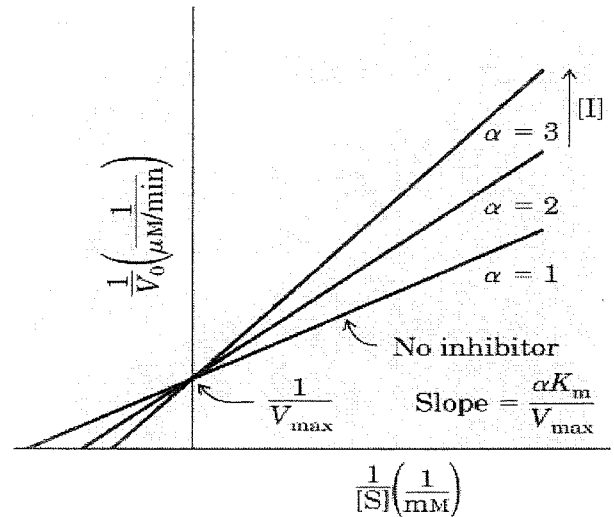
一、選擇題，每題只有一個正確答案，答錯不倒扣。(每題 2 分，共 100 分)

1. If the rate constant for the enzyme catalyzed reaction is $2 \times 10^5/\text{sec}$ and the rate constant for the uncatalyzed reaction is $1 \times 10^{-6}/\text{sec}$, the catalytic power of the enzyme is:

- (A) 10^{11}
- (B) 2×10^{-11}
- (C) 10^{-11}
- (D) 2×10^{11}

2. Identify the type of reaction that would give the right graph:

- (A) competitively inhibited
- (B) uncompetitive inhibition.
- (C) pure noncompetitively inhibited
- (D) mixed noncompetitively inhibited



3. For an enzyme-catalyzed reaction, the initial velocity was determined at two different concentrations of the substrate. Estimate the value of V_{max} .

[S] (mM)	V_o (mM/min)
1.0	2.0
4.0	2.8

(A) 4.7 mM/min ; (B) 0.67 mM/min ; (C) 3.19 mM/min ; (D) 1.5 mM/min

4. 承上一題，Estimate the value of K_m .

(A) 0.17 mM ; (B) 5.7 mM ; (C) 2.7 mM ; (D) 0.60 mM

5. _____ side-chains are often involved in general acid-base catalysis, because its pK_a is near 7.0.

(A) histidine ; (B) glutamate ; (C) lysine ; (D) cysteine

6. When binding one substrate to an allosteric protein decreases the binding of additional same substrate to the same protein, it is termed a:

- (A) negative heterotropic effector.
- (B) positive heterotropic effector.
- (C) negative homotropic effector.
- (D) positive homotropic effector.

7. 下列有關血紅素 (Hb) 與肌紅素 (Mb) 的敘述何者錯誤?

- (A) Mb shows sigmoidal, whereas Hb shows hyperbolic oxygen saturation curves.
- (B) Hb shows cooperativity, whereas Mb does not.
- (C) Mb binds O_2 more tightly than Hb.

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- (D) Oxygen binds to a ferrous ion in both proteins.
8. Which of following is an anomeric pair?
- (A) D-glucose and D-fructose
 - (B) α -D-glucose and β -D-glucose
 - (C) D-glucose and L-glucose
 - (D) α -D-glucose and β -L-glucose
9. The biochemical property of **lectins** that is the basis for most of their biological effects is their ability to bind to:
- (A) hydrophobic molecules.
 - (B) specific lipids.
 - (C) specific oligosaccharides.
 - (D) specific peptides.
10. Biological oxidation-reduction reactions always involve:
- (A) direct participation of oxygen.
 - (B) transfer of electron(s).
 - (C) formation of water.
 - (D) transfer of hydrogens.
11. The anaerobic conversion of 1 mol of glucose to 2 mol of lactate by fermentation is accompanied by a net gain of:
- (A) 1 mol of ATP.
 - (B) 1 mol of NADH.
 - (C) 2 mol of ATP.
 - (D) 2 mol of NADH.
12. Which of the following substrates can **NOT** contribute to net gluconeogenesis in mammalian liver?
- (A) palmitate
 - (B) alanine
 - (C) glutamate
 - (D) pyruvate
13. In a tissue that metabolizes glucose via the pentose phosphate pathway, C-1 of glucose would be expected to end up principally in:
- (A) carbon dioxide.
 - (B) glycogen.
 - (C) pyruvate.
 - (D) ribulose 5-phosphate.

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14. In amino acid catabolism, the first reaction for many amino acids is a(n):
(A) decarboxylation
(B) oxidative deamination
(C) reduction
(D) transamination
15. Transamination from alanine to α -ketoglutarate requires the coenzyme:
(A) biotin.
(B) NADH.
(C) pyridoxal phosphate (PLP).
(D) thiamine pyrophosphate (TPP).
16. If a person's urine contains unusually high concentrations of urea, which one of the following diets has he or she probably been eating recently?
(A) Very high carbohydrate, low protein, low fat
(B) Very low carbohydrate, high protein, low fat
(C) Very low carbohydrate, low protein, high fat
(D) Very high carbohydrate, high protein, high fat
17. 下列何種生物分子(biomolecules)具有緩衝劑(buffer systems)的作用?
(A) glycerol ; (B) amino acid ; (C) glucose ; (D) triacylglycerol
18. 下列何種現象是因為分子之間的疏水作用力(Hydrophobic interactions)而產生的結果:
(A) binding of a hormone to its receptor protein.
(B) enzyme-substrate interactions.
(C) three-dimensional folding of a polypeptide chain.
(D) All of the above are true.
19. 下列何種生物分子的官能基，不會形成氫鍵 (hydrogen bonds) ?
(A) hydroxyl group of alcohol
(B) methyl group of fatty acid
(C) carbonyl group of ketone
(D) peptide group of protein
20. 生物細胞演化出多種機制以適應環境，下列何者與「避免細胞發生 osmotic lysis」無關?
(A) In bacteria and plants, cell wall.
(B) Certain freshwater protists, contractile vacuole.
(C) In mammals, high concentration of albumin and other proteins in blood plasma.
(D) In bacteria and plants, cell membrane.
21. 那一種鹽類是細胞質內維持 pH 值衡定的主要鹽類?
(A) phosphate

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- (B) acetate
(C) sulfate
(D) bicarbonate
22. 下列何者不屬於脂肪酸 (fatty acids)的衍生物？
(A) Prostaglandins ; (B) Choline ; (C) Sphingolipids ; (D) Triacylglycerols
23. ATP 水解反應為一自發反應(spontaneous reaction)，標準自由能差(G'°) 是負值，然而 ATP 在水溶液中卻很穩定，不易發生水解的原因是？
(A) ATP 水解產生的磷酸 (phosphates) 中具有電子共振效應 (resonance stabilization)，很穩定
(B) ATP 結構中具有電子共振效應 (resonance stabilization)
(C) ATP 水解反應需要吸收能量 (endergonic)
(D) ATP 水解反應具有高活化能 (activation energy)
24. 哺乳類生物不具有下列那一種代謝途徑？
(A) Citric acid cycle ; (B) Urea cycle ; (C) Cori Cycle ; (D) Glyoxylate cycle
25. 在粒線體中的電子傳遞鏈，每兩個電子從 NADH 傳遞至 O_2 之後，可以產生多少 ATP？
(A) 1 ; (B) 1.5 ; (C) 2 ; (D) 2.5
26. In the Watson-Crick model of DNA structure:
(A) phosphate groups project toward the middle of the helix, where they are protected from interaction with water.
(B) T can form three hydrogen bonds with either G or C in the opposite strand.
(C) the distance between the sugar backbone of the two strands is just large enough to accommodate either two purines or two pyrimidines.
(D) the distance between two adjacent bases in one strand is about 3.4 Å.
27. In comparison with DNA-DNA double helices, the stability of DNA-RNA and RNA-RNA helices is:
(A) DNA-DNA > DNA-RNA > RNA-RNA.
(B) RNA-DNA > RNA-RNA > DNA-DNA.
(C) RNA-RNA > DNA-DNA > DNA-RNA.
(D) RNA-RNA > DNA-RNA > DNA-DNA.
28. Which one of the following analytical techniques does **NOT** help illuminate a gene's cellular function?
(A) DNA microarray analysis
(B) Protein chip analysis
(C) Southern blotting
(D) Two-dimensional gel electrophoresis

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29. The *E. coli* recombinant plasmid pBR322 has been widely utilized in genetic engineering experiments. pBR322 has all of the following features **except**:
- (A) a number of conveniently located recognition sites for restriction enzymes.
 - (B) a number of palindromic sequences near the EcoRI site, which permit the plasmid to assume a conformation that protects newly inserted DNA from nuclease degradation.
 - (C) a replication origin, which permits it to replicate autonomously.
 - (D) resistance to two different antibiotics, which permits rapid screening for recombinant plasmids containing foreign DNA.
30. Membrane fusion leading to neurotransmitter release requires the action of:
- (A) tSNARE and vSNARE.
 - (B) cadherins.
 - (C) selectins.
 - (D) flippases.
31. A ligand-gated ion channel (such as the nicotinic acetylcholine receptor) is:
- (A) a membrane protein that permits an ion to pass through the membrane only when opened by the appropriate ligand.
 - (B) a charged lipid in the membrane bilayer that allows ions to pass through.
 - (C) a membrane protein that permits a ligand to pass through the membrane only when opened by the appropriate ion.
 - (D) a molecule that binds to the membrane, thereby allowing ions to pass through.
32. Steroid hormones are carried on specific carrier proteins because the hormones:
- (A) cannot dissolve readily in the blood because they are too hydrophobic.
 - (B) cannot find their target cells without them.
 - (C) need them in order to pass through the plasma membrane.
 - (D) require subsequent binding to specific receptor proteins in the nucleus.
33. Ubiquitin is a:
- (A) component of the electron transport system.
 - (B) protein that tags another protein for proteolysis.
 - (C) protein kinase.
 - (D) protein phosphorylase.
34. In which group are all the amino acids closely interrelated metabolically?
- (A) Arginine, hydroxyproline, and histidine
 - (B) Arginine, tyrosine, and glutamate
 - (C) Ornithine, proline, arginine, and glutamate
 - (D) Ornithine, alanine, glycine, and valine

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35. Bile pigments are:
- (A) generated by oxidation of sterols.
 - (B) responsible for light reception in the vertebrate eye.
 - (C) secreted from the pancreas.
 - (D) formed in the degradation of heme.
36. In skeletal muscle:
- (A) at rest, fatty acids are the preferred fuel.
 - (B) large quantities of triacylglycerol are stored as fuel.
 - (C) phosphocreatine can substitute for ATP as the direct source of energy for muscle contraction.
 - (D) stored muscle glycogen can be converted to glucose and released to replenish blood glucose.
37. An elevated insulin level in the blood:
- (A) inhibits glucose uptake by the liver.
 - (B) stimulates synthesis of fatty acids and triacylglycerols in the liver.
 - (C) results from a below-normal blood glucose level.
 - (D) stimulates glycogen breakdown in the liver.
38. Topoisomerases can:
- (A) change the number of base pairs in a DNA molecule.
 - (B) change the linking number (Lk) of a DNA molecule.
 - (C) convert D isomers of nucleotides to L isomers.
 - (D) interconvert DNA and RNA.
39. Which of the following contributes to the structure of nucleosomes?
- (A) Plectonemic supercoiled DNA
 - (B) Relaxed closed-circular DNA
 - (C) Solenoidal supercoiled DNA
 - (D) Z (left-handed) DNA
40. The proofreading function of DNA polymerase involves all of the following **except**:
- (A) a $3' \rightarrow 5'$ exonuclease.
 - (B) base pairing.
 - (C) detection of mismatched base pairs.
 - (D) reversal of the polymerization reaction.
41. When bacterial DNA replication introduces a mismatch in a double-stranded DNA, the methyl directed repair system:
- (A) corrects the mismatch by changing the newly replicated strand.

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- (B) changes both the template strand and the newly replicated strand.
 - (C) corrects the DNA strand that is methylated.
 - (D) corrects the mismatch by changing the template strand.
42. Processing of a primary mRNA transcript in a eukaryotic cell does **NOT** normally involve:
- (A) attachment of a long poly(A) sequence at the 3' end.
 - (B) conversion of normal bases to modified bases, such as inosine and pseudouridine.
 - (C) excision of intervening sequences (introns).
 - (D) joining of exons.
 - (E) methylation of one or more guanine nucleotides at the 5' end.
43. Which one of the following statements about mRNA stability is true?
- (A) Degradation always proceeds in the 5' to 3' direction.
 - (B) Degradation of mRNA by polynucleotide phosphorylase yields 5'-nucleoside monophosphates.
 - (C) Secondary structure in mRNA (hairpins, for example) slows the rate of degradation.
 - (D) Rates of mRNA degradation are always at least ten-fold slower than rates of mRNA synthesis.
44. Splicing of introns in nuclear mRNA primary transcripts requires:
- (A) a guanine nucleoside or nucleotide.
 - (B) endoribonucleases.
 - (C) small nuclear ribonucleoproteins (snurps).
 - (D) RNA polymerase II.
45. Compared with DNA polymerase, reverse transcriptase:
- (A) does not require a primer to initiate synthesis.
 - (B) introduces no errors into genetic material because it synthesizes RNA, not DNA.
 - (C) makes fewer errors in synthesizing a complementary polynucleotide.
 - (D) makes more errors because it lacks the 3' → 5' proofreading exonuclease activity.
46. Which of the following is **NOT** true of tRNA molecules?
- (A) With the right enzyme, any given tRNA molecule will accept any of the 20 amino acids.
 - (B) Their anticodons are complementary to the triplet codon in the mRNA.
 - (C) They contain more than four different bases.
 - (D) They contain several short regions of double helix.
47. Posttranslational glycosylation of proteins is inhibited specifically by:
- (A) chloramphenicol.
 - (B) tunicamycin.
 - (C) puromycin.

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- (D) streptomycin.
48. Glycosylation of proteins inside the endoplasmic reticulum does **NOT** involve:
- (A) an Asn residue on the protein.
 - (B) dolichol phosphate.
 - (C) a His residue on the protein.
 - (D) N-acetylglucosamine.
49. Protein structural motifs often have general functions in common. Which one of the following motifs is known to be involved in protein dimer formation, but not in direct protein-DNA interactions?
- (A) zinc finger
 - (B) helix-turn-helix
 - (C) homeodomain
 - (D) leucine zipper
50. Gene silencing by RNA interference acts by _____ of the target gene.
- (A) inhibiting transcription
 - (B) inhibiting translation
 - (C) inhibiting splicing
 - (D) degradation of the mRNA