

科目：生物化學

系所組：生命科學

有關測驗之計分規定：

1. 未按作答格式(範例)作答者，扣該科總分10分。
2. 未在彌封答案卷內作答者，不予計分。
3. 考生於作答時不可使用計算機、字典、其他資料或工具。

(範例)選擇題作答格式，以橫式書寫方式將全部答案寫在彌封答案卷，答案字母請用正楷大寫(A, B, C, D)。

1. A	2. D	3. D	4. B	5. C
6. A	7. A	8. B	9. B	10. D
11. A	12. A	13. A	14. A	15. A

(範例)問答題作答格式以橫式方式書寫，將全部答案寫在彌封答案卷。

二. Protein
三. DNA
四. RNA

試題分A及B二部分，各佔50分。

A 部分

- 一. 單選題，每題2分，請按作答方式，由左至右，每行填寫五題答案。
1. All of the following electron carriers are components of the mitochondrial electron transport chain except for (A) NADP^+ . (B) NAD^+ . (C) FMN. (D) FAD.
 2. The first product of glycogenolysis is (A) glucose-6-phosphate. (B) glucose-1,6-phosphate. (C) fructose-1-phosphate. (D) glucose-1-phosphate.
 3. All of the following statements regarding the function of the tricarboxylic acid cycle are correct except that (A) it generates NADH and FADH_2 . (B) it generates GTP. (C) it catalyzes the complete oxidation of acetyl CoA to CO_2 and water. (D) it provides for the net synthesis of oxaloacetate from acetyl CoA.
 4. The pH of a sample of blood is 7.4. The pH of a sample of gastric juice is 1.4. The blood sample has: (A) 5.29 times lower $[\text{H}^+]$ than the gastric juice. (B) 6 times lower $[\text{H}^+]$ than the gastric juice. (C) 6,000 times lower $[\text{H}^+]$ than the gastric juice. (D) a million times lower $[\text{H}^+]$ than the gastric juice.
 5. An octapeptide composed of four repeating glycylalanyl units has: (A) two free amino and two free carboxyl groups. (B) a single free amino group on an alanyl residue.

mutation mimicking the phosphorylated state of CaMKII causes a dramatic decrease in Thr287 autophosphorylation levels and greatly reduces the catalytic activity, while the S26A mutation has no effect. These data combined with molecular modeling indicate that a negative charge at Ser26 of CaMKII gamma inhibits the catalytic activity of the enzyme towards its autophosphorylation site at Thr287 most likely by blocking ATP binding.

Questions: 每小題 5 分

1. What is “EF-hand”?
2. What is “amino acid D” and “amino acid A”?
3. Explain the meaning of “autophosphorylation”
4. Give a possible explanation why the S26D mutation of CaMKII gamma reduces the catalytic activity of the enzyme, while the S26A mutation has no effect.

B 部分

一. 單選題 (每題 1 分, 共 30 分), 請按作答方式, 由左至右, 每行填寫五題答案。

1. Which of the following molecules are synthesized according to the direction of existing template?
(A) trypsin (B) poly A tail on eukaryotic mRNA (C) CCA residue on tRNA (D) starch.

Question 2-4: for a given peptide sequence, SDSGRVEDEKVAA

2. What would be charge of it at pH 7?
(A) +2 (B) 1 (C) 0 (D) -2.
3. How many peptide fragments can be found if complete digestion of trypsin is performed?
(A) 1 (B) 2 (C) 3 (D) 4.
4. How many base pairs of the corresponding DNA template are encoded the given peptide?
(A) 13 (B) 26 (C) 39 (D) 52 base pairs.
5. In a pH 7.2 environment, what would be the charge status of the protein molecule with pI= 9.5?
(A) positive charge (B) negative charge (C) no charge (D) none of the above.
6. For homodimeric protein X with two 60 kD subunits, if the proteolytic degradation occurs at the middle of subunit, which of the protein band will be observed after SDS-PAGE?
(A) 240 kD (B) 120 kD (C) 60 kD (D) 30 kD.
7. Which of the detergent is categorized as “ionic” ?
(A) SDS (B) Triton X-100 (C) Tween-20 (D) CHAPS.
8. Which of the following glycosidic bond is found in the structural glucan of plants?
(A) α -1,2 (B) α -1,4 (C) α -1,6 (D) β -1,4.
9. If a linear starch (amylose) with 100 glucose unit is completely hydrolyzed by β -amylase, the reducing power will increase
(A) 1 (B) 2 (C) 50 (D) 100 folds.
10. Which of the following fatty acid with highest melting point than others?
(A) linoleate (B) palmitate (C) laurate (D) arachidonate.
11. Which of the following lipid should “NOT” be found in the biological membrane?

- (A) triacylglycerols (B) glycerophospholipids (C) sphingolipids (D) cholesterol.
12. In the signal transduction adenylyl cyclase signaling pathway, what is the major second messenger?
(A) AMP (B) ADP (C) cAMP (D) ATP
13. Please specify the correct full name for ATP.
(A) adenine (B) adenosine (C) adenosine 5'-triphosphate (D) deoxyadenosine
14. Which of the following interaction can "NOT" stabilize the structure of DNA double helix?
(A) hydrogen bonding (B) interaction between stacking base pair
(C) hydrophobic interaction (D) charge-charge interaction
15. For the DNA with sequence ATTGCTATCCTTTAAAAT with melting temperature about 55°C, what will possible be the melting temperature for sequence GGCGATATGTACCCC?
(A) 35°C (B) 45°C (C) 55°C (D) 65°C
16. DNA isolated from cow liver cells contains 28% A; what percent will be C?
(A) 14% (B) 22% (C) 28% (D) 36%
17. Which of the following molecule is the common catabolic intermediate for amino acid, glucose and fatty acid decomposition?
(A) pyruvate (B) acetyl-coA (C) oxaloacetate (D) phosphoenolpyruvate
18. Which of the following compound is the methyl group donor in the conversion from phosphatidylethanolamine to phosphatidylcholine?
(A) S-adenosyl methionine (B) 5-methyl THF (C) 5,10-methelene THF (D) 10-formyl THF.
19. The conversion of acetyl-CoA to malonyl-CoA is catalyzed by
(A) acetyl-CoA:ACP transacylase (B) acetyl-CoA carboxylase
(C) succinyl-coA transferase (D) malonyl-CoA:ACP transacylase.
20. The key enzyme responsible for the synthesis of cholesterol is
(A) HMG-CoA lyase (B) acetoacetyl-CoA thiolase (C) HMG-CoA synthase (D) HMG-CoA reductase.
21. In the urea cycle, the two nitrogen sources for urea molecule is from
(A) carbamoyl phosphate and aspartate (B) carbamoyl phosphate and glutamate
(C) ornithine and aspartate (D) carbamoyl phosphate and ornithine.
22. Which of the following metabolic pathway "DOES NOT" require 5-phospho-ribosyl-pyrophosphate (PRPP)?
(A) purine synthesis (B) pyrimidine synthesis (C) salvage pathway (D) phenylalanine synthesis
23. All known transaminase requires the coenzyme (A) CoA (B) PLP (C) THF (D) biotin to catalyze the ping-pong kinetic mechanism.
24. Which of the following compound does not donate any structure moiety to the heterocyclic ring of purine?
(A) PRPP (B) 10-formyltetrahydrofolate (C) aspartate (D) glycine
25. Which of the following reducing power is used in the reduction of ribonucleotides to deoxyribonucleotides? (A) NADH (B) NADPH (C) FADH₂ (D) QH₂
26. Which of the following does NOT participate in the generation of charged tRNA?
(A) aminoacyl-tRNA synthetase (B) amino acid (C) ATP (D) GTP

27. Which one of the following statements about bacterial operon is "CORRECT" ?
- (A) Adjacent genes that are transcribed in opposite directions along the DNA.
 - (B) A unit of transcription in bacteria under the control of a single promoter.
 - (C) A tandemly arranged group of genes containing only one associated ribosome binding site.
 - (D) A unit of transcription giving a single RNA species from which one or more introns are removed by splicing.
28. Polycistronic mRNA contains (A) many promoters (B) many genes (C) many Shine Dalgarno sequences (D) many operators.
29. In *E. coli*, the synthetic rate for DNA polymerase III holoenzyme is about 1,000 nucleotides per second. Which of the following responsible for the "processivity"? (A) α (B) β (C) γ (D) δ subunit
30. The joint of Okazaki fragments to continuous DNA strand was "NOT" accomplished by the following enzyme? (A) DNA ligase (B) DNA pol I (C) DNA pol III (D) SSB

二 問答題 (共 20 分)

1. Please describe the mechanism of the Nobel awarded phenomenon of RNA interference (RNAi). (3 分)
2. The study of protein-protein interaction may be one of the most fascinating subjects in life science researches. Other than the van der Waals forces, describe the other four possible forces or bonding involved in protein-protein interactions. (4 分)
3. The molecular weight for actin is 40,000 Da.
 - (A) What will be the total weight of 2 fmol of actin. (please describe as ng) (3 分)
 - (B) Calculate molar concentration (nM) for 0.5 mg/mL actin solution. (3 分)
 - (C) If the copy numbers of actin in a single U937 cell is about 10^6 , in one sample, what would be the minimal cell numbers needed for visualization of an actin protein spot in CBR stained 2-DE gels? The theoretical sensitivity of CBR staining is about 10 ng/protein spots). (5 分)
4. Describe the complete procedure of making 0.25 L of 100 mM Tris solution starting from Tris powder (MW 121.1) and water. (2 分)

※ 注意：1. 考生須在「彌封答案卷」上作答。

2. 本試題紙空白部份可當稿紙使用。

3. 考生於作答時可否使用計算機、法典、字典或其他資料或工具，以簡章之規定為準。