

科目：

生物化學

系所組：

生命科學系

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，扣該科總分20分。
3. 請分第一部份與第二部分作答，各占50分。

(範例) 問答題作答格式

1. Protein
2. DNA
3. RNA

請依照上述範例之格式，以橫式書寫方式將全部答案寫在彌封答案卷。

(範例) 選擇題作答格式

1. A	2. A	3. B	4. B	5. C
6. A	7. A	8. B	9. B	10. C
11. A	12. A	13. B	14. B	15. C
16. A	17. A	18. B	19. B	20. C

請依照上述範例之格式，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)。

※ 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。

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第一部分 (共 50 分)

1. The proteasome is a multicatalytic protease complex responsible for the degradation of multiple intracellular proteins that are involved in DNA repair, cell cycle, survival and apoptosis. For example, p27, a key regulator for G1 to S transition in the cell cycle, is rapidly ubiquitinated and degraded by proteasomes leading to p27's short half-life. Answer the following questions:
 - (A) What is "multicatalytic protease complex"? (5%)
 - (B) Discuss the roles of ubiquitinated proteins within cells. (5%)
 - (C) Design an experiment to determine the half-life of p27. (5%)
 - (D) Discuss about protein degradation within cells. (5%)
2. There are two glucose 6-phosphate dehydrogenase (G6PDH, EC 1.1.1.49) isoforms: G6PDH-1 and G6PDH-2 in *Deinococcus radiophilus*, an extraordinarily UV-resistant bacterium. Both isoforms show dual coenzyme specificity for NAD^+ and NADP^+ . G6PDH-1 is a tetramer of 35 kDa subunits, whereas G6PDH-2 is a dimer of 60 kDa subunits. The pIs of G6PDH-1 and G6PDH-2 are 6.4 and 5.7, respectively. Both G6PDH-1 and G6PDH-2 are inhibited by both ATP and oleic acid, but G6PDH-1 is found to be more susceptible to oleic acid than G6PDH-2. Answer the following questions:
 - (A) What is G6PDH? Describe the reaction catalyzed by G6PDH. (5%)
 - (B) What is the meaning of "EC 1.1.1.49"? (5%)
 - (C) What is oleic acid? (5%)
 - (D) Draw the gel pattern of G6PDH-1 and G6PDH-2 separated on 10% SDS-polyacrylamide gel. (5%)
 - (E) Draw the gel pattern of G6PDH-1 and G6PDH-2 separated on 10% native polyacrylamide gel. (5%)
 - (F) What is "pI"? (5%)

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第二部分 (共 50 分)

一 單選題 (每題 1 分，共 20 分)

No1-No4, for a given peptide sequence, AAATESLRIEEDKL

1. () What would be charge of it at pH 7? (A) +2 (B) 1 (C) 0 (D) -2.
2. () For purification of this peptide, which of the following media can be used for adsorbing the peptide at pH 7 environment? (A) CM-Sephrose (B) DEAE-Sephacel (C) Phospho-cellulose (D) Sephadex G-10.
3. () How many peptide fragments can be found if complete digestion of trypsin is performed? (A) 1 (B) 2 (C) 3 (D) 4.
4. () What would be the approximate molecular weight of the corresponding DNA template for the given peptide? (A) 3500 daltons (B) 7000 daltons (C) 14000 dalton (D) 28000 daltons.
5. () In a pH 7.2 environment, what would be the charge of the protein molecule with a pI = 4.6? (A) Positive (B) Negative (C) Zero (D) None of the above.
6. () How many reducing ends can be found on one sucrose molecule? (A) 0 (B) 1 (C) 2 (D) Many.
7. () How many reducing ends can be found on one starch molecule? (A) 0 (B) 1 (C) 2 (D) Many.
8. () If a linear starch (amylose) with 200 glucose units is completely hydrolyzed by α -amylase, the reducing power will increase (A) 1 (B) 2 (C) 50 (D) 100 folds.
9. () Which of the following molecule can degrade the peptidoglycan of bacteria? (A) Trypsin (B) Penicillin (C) Lysozyme (D) Ampicillin.
10. () Which of the following fatty acid with a highest melting point than others? (A) Laurate (B) Palmitate (C) Stearate (D) Linoleate.
11. () Which of the following lipid can "NOT" be found in the biological membrane ? (A) Tripalmitin (B) Phosphatidylserine (C) Sphingomyelin (D) Cholesterol.
12. () In the signal transduction adenylyl cyclase signaling pathway, what could be the major second messenger? (A) AMP (B) cAMP (C) ADP (D) ATP.
13. () (A) Pyruvate (B) Acetyl-coA (C) Oxaloacetate (D) Phosphoenolpyruvate is the common catabolic intermediate for amino acid, glucose and fatty acid

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decomposition.

14. () For the DNA with sequence GGCGATATGTACCCC with melting temperature about 92C, what will possible be the melting temperature for sequence ATTGCTATCCTTTAAAAT? (A) 30C (B) 78C (C) 92C (D) 98C.
15. () 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.
16. () The synthesis of cholesterol take place mainly in cytosol, in which 3-Hydroxy-3-methylglutaryl CoA was converted to mevalonate by (A) HMG-CoA reductase (B) HMG-CoA lyase (C) HMG-CoA synthase (D) None of above.
17. () During fasting, the catabolism of glucose decrease and fewer oxaloacetate molecules presented than needed. In such circumstance, acetyl-CoA might not go into citric acid cycle but converted to acetone from HMG-CoA. Which of the following enzyme catalyzes the conversion of acetoacetate to acetone? (A) HMG-CoA reductase (B) HMG-CoA lyase (C) HMG-CoA synthase (D) none of above.
18. () Which of the following synthetic pathway “does NOT” require the structure moiety of 5-phospho-ribosyl-pyrophosphoate (PRPP)? (A) Purine synthesis (B) Pyrimidine synthesis (C) Tyrosine synthesis (D) Tryptophan synthesis.
19. () Specify the full name of dATP. (A) Adenine (B) Adenosine (C) Adenosine 5'-triphosphate (D) Deoxyadenosine 5'-triphosphate.
20. () Which of the following activity or mechanism “does NOT” contribute to the low error rate of DNA replication? (A) 5' to 3' Exonuclease activity on DNA polymerase (B) 3' to 5' Exonuclease activity on DNA polymerase (C) Recombination of DNA (D) DNA repair system.

二 多選題 (每題 1 分，共 5 分)

For the following enzymes: (A) glutamate dehydrogenase (B) glutamate synthase (C) glutamine synthetase (D) transaminase (E) carbamoyl phosphate synthetase I (F) carbamoyl phosphate synthetase II

(Use A to F to answer the below questions)

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- (1) Which of the above enzymes may utilize ammonium as the substrate?
- (2) Which of the above enzymes may produce glutamate as the product?
- (3) Which of the above enzymes may utilize aspartate as the substrate?
- (4) Which of the above enzymes may utilize glutamine as the substrate?
- (5) Which of the above enzymes balance the nitrogen supply in urea cycle?

三 問答題 (共 25 分)

1. Describe three ways that enzyme activity is regulated. (3%)
2. Describe the complete procedure of making 0.25 L of 10 mM Tris (pH 8.4) solution starting from the Tris powder (MW 121.1) and distilled water. (4%)
3. Define the following words.
 - (A) Gene (1%)
 - (B) Genome (1%)
 - (C) Genomics (1%)
 - (D) Transcriptomics (1%)
 - (E) Proteomics (1%)
 - (F) Metabolomics (1%)
4. The apparent weight of albumin is 66,000 Da,
 - (A) What will be the total weight of 1 pmol of albumin (please describe as ng). (2%)
 - (B) Calculate molarity concentration (nM) for 0.1 mg /mL albumin solution. (2%)
 - (C) If the copy numbers of albumin in a single K562 cell is about 10^8 , in one sample, what would be the minimal cell numbers needed for the visualization of an albumin protein spot in imidazole zinc reverse stained 2-DE gels? (The theoretical sensitivity of imidazole zinc reverse stain is about 1 ng / protein spot) (4%)
5. Describe RNA interference. (4%)

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