

(101) 輔仁大學碩士班招生考試試題 考試日期: 101年3月9日第3節
科目: 生物化學 系所組: 生科系 本試題共5頁

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, 共20分)

1. The standard free energy ΔG° is the free energy of a reaction
(A) at standard conditions including 1 M reactant and product.
(B) at conditions of all reactant and no product.
(C) at conditions found in the cell.
(D) at equilibrium.
2. In glycolysis the energy liberated by the cleavage of glucose is captured in the energy intermediate
(A) NADH.
(B) ATP.
(C) lactate.
(D) NADH and ATP
3. Dinitrophenol is a so-called uncoupler because it uncouples electron transport and ATP synthesis in the mitochondria. It provides an alternative route for H^+ to

cross the inner mitochondrial membrane. How does this affect ATP synthesis?

- (A) ATP synthesis increases due to greater permeability of the inner side of the membrane.
 - (B) ATP synthesis decreases because the H^+ gradient is dissipated so that there is little or no proton motive force to drive ATP synthase.
 - (C) ATP synthesis decreases because the electron transport chain can no longer pump H^+ across the membrane and electron transport is also blocked.
 - (D) ATP synthesis is unaffected since H^+ is not required in the reaction $ADP + P_i \rightarrow ATP$.
4. A protein is a polymer composed of
- (A) L- amino acids linked by bonds formed through a condensation reaction.
 - (B) D-amino acids linked by bonds formed through a condensation reaction.
 - (C) a mixture of L-and D- amino acids linked by bonds formed through a condensation reaction.
 - (D) L-amino acids linked by hydrogen bonds.
5. Separation of one protein from other proteins on the basis of molecular size can not be achieved by
- (A) Two-dimensional gel electrophoresis
 - (B) Gel filtration
 - (C) Affinity chromatography
 - (D) Size exclusion chromatography
6. The value K_m is a measure of the
- (A) affinity of the enzyme for the substrate.
 - (B) stability of the enzyme.
 - (C) optimal substrate concentration for enzyme activity.
 - (D) substrate concentration when the reaction is halfway to equilibrium.
7. What is the function of chaperone proteins?
- (A) Facilitate the recognition of the signal sequence by the SRP
 - (B) Facilitate glycosylation of nascent proteins in the lumen of the endoplasmic reticulum
 - (C) Facilitate the correct folding and inhibit aggregation of nascent proteins
 - (D) Facilitate the insertion of transmembrane proteins into the endoplasmic reticulum membrane
8. Which of the following statements about protein N-glycosylation is **false**?
- (A) Protein glycosylation occurs as the protein is translocated across the membrane of endoplasmic reticulum.
 - (B) Sugars are added to the nascent protein on the amino acid asparagine.
 - (C) Sugars are added to the nascent protein on the lumen side of the membrane

of endoplasmic reticulum.

- (D) Sugars (glucose and mannose) are added one at a time directly to the nascent protein to form the oligosaccharide structure.
9. The term *Edman degradation* refers to
- (A) a metabolic pathway for the catabolism of proteins
 - (B) a chemical method for the determination of the amino terminal sequence of a protein
 - (C) a chemical method for the determination of the carboxyl terminal sequence of a protein
 - (D) a chemical method for the complete degradation of proteins
10. An Acid with pK_a values of 1.3, 4.1, and 8.8 serves best as a buffer at
- (A) pH 4.5
 - (B) pH 5.5
 - (C) pH 6.5
 - (D) pH 7.5

ii. Read the following paragraphs and answer the questions:

Glutathione S-transferase (GST) enzymes are found from bacteria to humans. Three major families of proteins exhibit glutathione transferase activity. Two of these, the cytosolic and mitochondrial GST enzymes, comprise soluble enzymes that are only distantly related. The third family comprises microsomal GST enzymes, which are now referred to as membrane-associated proteins in eicosanoid and glutathione metabolism. Cytosolic GST enzymes represent the largest family. In humans, constitutive expression of the isoforms of GST is tissue specific, suggesting that some isoforms may have specialized functions.

To obtain large amount of GST, His₆-tagged glutathione S-transferase (GST-(His₆)) were expressed in *E. coli*. Following expression of GST-(His₆) in *E. coli*, cells were disrupted using a chemical extraction technique. The extracted GST-(His₆) was purified using a 1 mL HiTrap chelating column loaded with nickel metal ions (50 mM NiSO₄) and equilibrated with buffer containing 50 mM Tris, 8 M urea, pH 8. Immediately prior to sample loading, the chemical extract was centrifuged (15,000×g, 4°C, 20 min) and filtered with a 0.45 μm syringe driven filter. The clarified protein solution was then applied to the column, followed by 7.5 mL of the equilibration buffer to reach a stable baseline of the UV absorbance at 280 nm. Loosely bound proteins were then washed from the column with 10 mL of the same buffer containing 40 mM imidazole. GST-(His₆) was then eluted with buffer containing 500 mM imidazole, 50 mM Tris, 8 M urea, pH 8. Protein purity was confirmed by the presence of a single protein band when analyzed using SDS-polyacrylamide gel

electrophoresis.

Questions: 每小題 6 分

1. What is the function of “Glutathione *S*-transferase (GST)”?
2. What is “eicosanoid”?
3. What is “constitutive expression of the isoforms of GST”?
4. What column was used in the immobilized metal affinity chromatography?
5. In the experiment, GST-(His₆) was eluted with buffer containing 500 mM imidazole, 50 mM Tris, and 8 M urea, pH 8. What is the purpose of using imidazole?

B 部分

一. 單選題 (每題 2 分, 共 30 分)

1. How many reducing ends can be found on one glycogen molecule? (A) 0 (B) 1 (C) 2 (D) none of above.
2. Which of the following antibiotics inhibits the synthesis of peptidoglycan? (A) ampicillin (B) penicillin (C) tetracyclin (D) kanamycin.
3. Which of the following lipid should “NOT” be found in the biological membrane ? (A) Triacylglycerols (B) Glycerophospholipids (C) Sphingolipids (D) Cholesterols.
4. Which of the following molecules are synthesized according to the direction of existing template? (A) starch (B) the CCA residue on tRNA (C) poly A tail on eukaryotic mRNA (D) trypsin.
5. In general, which of the following method is often used for precipitating DNA (A) ammonium sulfate precipitation (B) acetone precipitation (C) ethanol precipitation (D) TCA precipitation.
6. Which of the following metabolites is the common intermediate for the synthesis of Lysine, Methionine and Threonine ? (A) Homoserine (B) Aspartate β -semialdehyde (C) Glutamate γ -semialdehyde (D) Cysteine.
7. 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.
8. 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.
9. (A) Pyruvate (B) Acetyl-coA (C) Oxaloacetate (D) Phosphoenolpyruvate is the

common catabolic intermediate for amino acid, glucose and fatty acid decomposition.

10. 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.
11. Which of the following enzyme is used for the generation of NO? (A) NOS (B) arginosuccinate lyase (C) arginase (D) glutamate synthase.
12. All known transaminase requires the coenzyme (A) CoA (B) PLP tetrahydrofolate (C) biotin (D) to catalyze the ping-pong kinetic mechanism.
13. Which of the following amino acid is "NOT" classified as "essential amino acid"? (A) P (B) V (C) T (D) W.
14. Which of the following compound does not donate any structure moiety to the heterocyclic ring of purine? (A) PRPP (B) glycine (C) aspartate (D) 10-formyltetrahydrofolate.
15. Which of the following reducing power is used in the reduction of ribonucleotides to deoxyribonucleotides? (A) NADH (B) NADPH (C) FADH₂ (D) QH₂.

二. 問答題 (共 20 分)

1. The molecular weight for Heat Shock Protein 70 (HSP70) is 70,000 Da,
(A) What will be the total weight of 1 fmol of HSP70. (please describe as ng) (3 分)
(B) Calculate molarity concentration (nM) for 0.1 mg/mL HSP70 solution. (3 分)
(C) If the copy numbers of HSP70 in a single U937 cell is about 10^5 , in one sample, what would be the minimal cell numbers needed for visualization of a HSP70 protein spot in silver stained 2-dimensional gels ? (The theoretical sensitivity of silver staining is about 3 ng/protein spots). (4 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. Please describe the mechanism of the Nobel awarded phenomenon of RNA interference. (4 分)
4. Describe the complete procedure of making 0.5 L of 200 mM Tris solution starting from Tris powder (MW 121.1) and water. (2 分)