

考生注意事項：所有考題務必在答案卷上作答

一、選擇題(均為單選，每題 2 分，答錯倒扣 1 分)

1. Protein 之 higher levels structure 主要由 noncovalent interactions 來維持。關於此 interactions 下列何者是錯誤的？
(A) The forces involved are very weak and are short range in nature.
(B) One type of such interaction involves a pair of charged particles.
(C) Hydrogen bonding has the highest bond energy among the noncovalent forces.
(D) Disulfide bond is one type of noncovalent interaction.
(E) Dipole-dipole interaction is another example of noncovalent interaction.
2. 某一 buffer 含 0.5M sodium acetate 及 1M acetic acid 其 pH 值為？(acetic acid 之 pKa 為 4.76; $\log 2=0.3$)
(A) 4.16
(B) 4.46
(C) 4.76
(D) 5.06
(E) 5.36

Questions 3 to 4

- (A) histidine
(B) arginine
(C) cystine
(D) proline
3. 含有一 disulfide bond.
4. 含有一 imidazole group.
5. Lysine 之 pKa 為 2.2, 9.0 及 10.0 (side chain), glutamic acid 之 pKa 為 2.2, 4.2 (side chain) 及 9.7. 在 pH 7 時 dipeptide, Glu-Lys 之電荷為？
(A) +2
(B) +1
(C) neutral
(D) -1
(E) -2
6. 下列何者可用來決定 protein 之 N-terminal residues ?
(A) Ninhydrin
(B) Dansyl chloride
(C) Fluorescamine
(D) Cyanogen bromide
(E) Hydrazine
7. 以 trypsin 處理 peptide Gly-Tyr-Met-Lys-Pro-Arg-Val-Lys 可得何種產物？
(A) two dipeptides and a tetrapeptide.
(B) a tripeptide and a pentapeptide.
(C) a dipeptide and a hexapeptide.
(D) a dipeptide and two tripeptides.
(E) glycine, lysine and a hexapeptide.
8. 為了要決定某一 protein 之 amino acid composition, protein 先以 6N HCl 處理，接著應以下列何種方法分離 amino acid mixture ?
(A) gel-filtration
(B) cation-exchange chromatography
(C) isoelectric focusing
(D) affinity chromatography
(E) SDS-gel electrophoresis

9. 某一 amino acid mixture 含 glycine, aspartic acid, glutamine, lysine 及 tyrosine, 在 pH 6.0 跑 Paper electrophoresis, 各 amino acids 之 pKa 值如下所示:
- (A) Glycine: 2.3, 9.6
 - (B) Aspartic acid: 2.1, 3.9, 9.8
 - (C) Glutamine: 2.2, 9.1
 - (D) Lysine: 2.2, 9.0, 10.0
 - (E) Tyrosine: 2.2, 9.1, 10.1
- 選出朝陰極(cathode)跑得最快之 amino acids ?
10. 下列何者是錯誤的?
當血液通過組織之微血管時由 oxyhemoglobin 釋放出 oxygen 之反應可被下列何者促進?
- (A) an elevation in the partial pressure of CO₂.
 - (B) a decrease in the partial pressure of CO₂.
 - (C) the binding of 2,3-bisphosphoglycerate to hemoglobin.
 - (D) an increase of hydrogen ion concentration.
 - (E) a decrease in pH value.
11. 關於 collagen 下列何者是錯誤的?
- (A) forms the fibers found in the ground substance matrix of connective tissue.
 - (B) constitutes the dry weight of hair, wool and tortoise shell.
 - (C) is the most abundant protein in the body.
 - (D) has relatively poor nutritional quality as a food protein.
 - (E) has no capacity to stretch because of the tightness of coiling of the triple helix of tropocollagen and its cross-linkage.
12. 在 pH 7.7, H₂PO₄⁻/HPO₄⁼ 之比例為 (pKa=6.7)
- (A) 1/10
 - (B) 1/1
 - (C) 10/1
 - (D) 100/1
 - (E) none of the above
13. 當 pH 比 pKa (pH-pKa) 大 3 時, conjugate base 對 conjugate acid 之濃度比為
- (A) 0.01
 - (B) 0.1
 - (C) 10
 - (D) 100
 - (E) 1000
14. 下列何者在 pH 5.07 時具有最大之 buffer capacity ?
- (A) Tris (pKa=8.3)
 - (B) Imidazole (pKa=7.0)
 - (C) H₂PO₄⁼ (pKa=6.7)
 - (D) Acetic acid (pKa=4.76)
 - (E) Lactic acid (pKa=3.86)
15. Aspartic acids 之 pK 值為 2.09, 3.86 及 9.82, 其 pI 為
- (A) 2.98
 - (B) 5.26
 - (C) 5.96
 - (D) 6.84
 - (E) 9.82

16. 屬於大部分之 fibrous proteins 而非 globular proteins 之特徵為
 (A) a large percentage of aromatic amino acids.
 (B) a high ratio of length to cross-section.
 (C) high solubility in aqueous medium.
 (D) contain superhelical coiling.
 (E) is high in glycine and proline residues.
17. 成人之血紅素 (hemoglobin(HbA))
 (A) carrier one O₂ for each hemoglobin molecule.
 (B) exhibits a switch from a weak-binding state to a strong-binding state as depicted by Hill plot.
 (C) binds four molecules of BPG when present as deoxyhemoglobin.
 (D) contains two α chains and two γ chains.
 (E) binds one molecule of BPG when present as oxyhemoglobin.

關於 18 題至 20 題

- (A) 2-Mercaptoethanol
 (B) Dansyl chloride
 (C) Performic acid
 (D) Sodium dodecyl sulfate
 (E) Phenylisothiocyanate

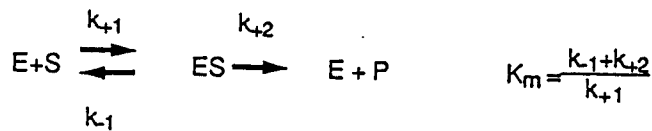
18. 可用來依序分解 polypeptides .

19. 氧化 protein 之 disulfide bonds .

20. 為一種 detergent , 用於跑 gel electrophoresis 時測定 proteins 之 molecular weight .

二、吾人想由酵母細胞分離純化某種水溶性酵素，並探討此酵素之反應特性。

1. 寫出任意三種破壞細胞之方法。(5%)
 2. 此酵素之競爭性抑制之反應模式如下所示：(15%)



- (a) 以假穩態法(quasi-steady state)求此酵素之反應速率式。
 (b) 假設沒有抑制劑存在之反應速率 V_0 及有 $5 \times 10^{-3} M$ 之抑制劑存在之反應速率 V_i 如下表所示：請由下表之實驗數據以 Lineweaver-Burk plot 求 K_m 及 K_i 。

S (Mx10 ³)	1.25	1.00	0.75	0.50
V ₀ (任何單位)	151	138	118	93
V _i (任何單位)	83.9	72.4	58.8	41.9

三、吾人欲利用基因工程生產人體之 insulin ; host 為 *E.coli* , vector 植有 tac promoter :

1. 簡述選殖此基因之主要步驟。(10%)
2. 簡述決定 insulin 基因之鹼基序列之 Sanger Method 之原理。(10%)
3. 簡述 lactose 誘導基因表現之原理。(10%)
4. 假設 host cell 為營養要求株，以 nonsense mutation 取得；而在基因重組菌培養中，有 revertant 之出現，請寫出此現象最有可能發生之原因並說明其機制。(10%)