

I. 單選題: (20%, 5% for each question)

1. ( ) Which of the following processes are never spontaneous: A reaction that occurs with (A) any size decrease in enthalpy and any size increase in entropy ; (B) a small increase in enthalpy and a large increase in entropy ; (C) a large decrease in enthalpy and a small decrease in entropy ; (D) any size increase in enthalpy and any size decrease in entropy.
2. ( ) Which one of the following is the largest force governing protein structure (A) disulfide bond ; (B) hydrophobic effect ; (C) ionic interaction ; (D) hydrogen bond.
3. ( ) The inhibition in which inhibitor is a substance that directly competes with a substrate for binding site reversibly is: (A) noncompetitive inhibition. ; (B) uncompetitive inhibition. ; (C) complete inhibition. ; (D) competitive inhibition.
4. ( ) An enzyme that transfers a phosphoryl group from ATP (or other nucleotides) to another substrate is a/an (A) phosphatase ; (B) kinase ; (C) phosphoglucose isomerase ; (D) ATPase.

II. 解釋名詞 : (10%, 5% for each term)

1. hydrophobic effect
2. chemiosmotic theory

III. 簡答題 : (20%, 10% for each question)

1. Many chemical reactions within living organisms have positive  $G^{\circ}$  values, i.e. that they can't proceed spontaneously under the physiological conditions. Under this circumstance, how do living organisms "force" these reactions to proceed as required? (10%)
2. A solution is made by mixing 50 ml of 2.0 M  $K_2HPO_4$  and 25 ml of 2.0 M  $KH_2PO_4$ . The solution is diluted to a final volume of 200 ml. What is the final pH of the solution? ( $pK = 6.82$  for  $KH_2PO_4$ ) (10%)

3. 在基因轉譯的時候，mRNA 和 tRNA 會互相配對，請依下圖回答問題  
 甲、 已知有一小段蛋白質其轉譯所得胺基酸序列由 N 端到 C 端為：

Met-Tyr-Asp-His-Phe-Trp

請寫出這段胺基酸序列未轉譯前，其對應的 mRNA 的由 5' 到 3' 的序列。(12%)

- 乙、 轉譯過程中，畫出該 mRNA 與一個 Asp-tRNA 配對互補時的相對位置，並指明它們密碼區與反密碼區由 5' 到 3' 的序列。(6%)

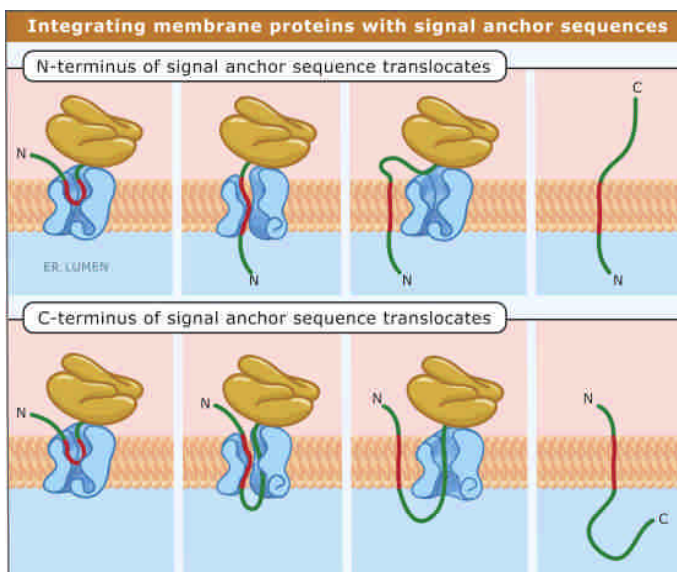
		2nd base in codon				
		U	C	A	G	
1st base in codon	U	Phe Phe Leu Leu	Ser Ser Ser Ser	Tyr Tyr STOP STOP	Cys Cys STOP Trp	U C A G
	C	Leu Leu Leu Leu	Pro Pro Pro Pro	His His Gln Gln	Arg Arg Arg Arg	U C A G
	A	Ile Ile Ile Met	Thr Thr Thr Thr	Asn Asn Lys Lys	Ser Ser Arg Arg	U C A G
	G	Val Val Val Val	Ala Ala Ala Ala	Asp Asp Glu Glu	Gly Gly Gly Gly	U C A G

4. 試比較 DNA 和 RNA 有那些不同。(8%)
5. 2008 年諾貝爾生物化學領域，是因研究 GFP (green fluorescent protein) 綠色螢光蛋白而得獎，請寫出你所知道 GFP 在生物化學應用上的重要性。(5%)

6. 利用下圖說明新轉譯的蛋白質，若此新轉譯蛋白質最後會成為細胞膜上的受體，而且是以 N 端接觸細胞外訊號配位子(ligand)，請問

甲、 此新蛋白質在轉譯時應該屬於下圖的 N-terminus 路徑還是 C-terminus 路徑？(4%)

乙、 寫出你判斷的理由。(4%)



7. 請說明有關「DNA 聚合酶連鎖反應 (PCR, polymerase chain reaction)」

甲、 其步驟之溫度、DNA 分子的狀態，溫度決定的根據。(6%)

乙、 引子的設計須考慮的條件。(5%)