

答案直接寫在考卷上，可寫在背面，有問題可加註說明，注意不能加紙。(每題 5%，第 16~18 題 10%)

- 請寫出符合以下條件之胺基酸英文全名：
例如 殘基最小：Glycine (答案可能一個以上)
 - 含有-SH 基：
 - 是一種神經傳導物質：
 - 可以被磷酸化：
 - 沒有光學異構物：
 - 側基含有四個碳但沒有氮原子：
- 假如 amino acid 的平均分子量為 128，則含有 100 個 amino acids 的蛋白質分子量有多少？
- 一段 double helix DNA 若含有 100 個鹼基對，請問此段 DNA 的長度有多少 nm？(要寫出算式)
- 何謂 sickle cell disease 其病因與蛋白質的序列有關？還是與構形有關？
- DNA 片段所含鹼基序列中，下列何者可能被限制酶切開？(回答 yes 或 no)
 - GGATCC-
 - GGAATCC-
 - AATT-
 - AATTAA-
 - AATTAATT-
- 有研究生以 Sanger 法決定 DNA 序列，當然也使用 dideoxy NTP 終止複製，作成各種不同長度的片段。但他發現所合成出來的 DNA 都很長，因而無法定出序列。請問他出了什麼錯誤？
- 有一段 peptide 序列如下，請問其立體構造有何特點？

-VIPAPIAPP-
- 原核細胞並無 intron，請想像 intron 是如何在真核細胞中演化出來的？
- Alpha helix 是蛋白質的二級構造之一，它對蛋白質的整體構造有何貢獻？
- DNA 也有一級、二級、三級構造，請分別敘述之，並說明氫鍵對這些構造有何影響。
- 請寫出 histidine (His) 的構造，其殘基上面有兩個氮原子，請問它們的化學性質有何差異？
- 請回答以下有關 isoleucine (Ile) 的問題：
 - 請畫出其分子式，寫出所有的氫原子。
 - Ile 分子上有幾個不對稱碳？請以 * 標出。
- 若你把某一醋酸 (acetic acid, $pK_a = 4.8$) 溶液的 pH 調到 5.8 時，請描述這個溶液中各種分子或離子的組成狀況。
- 若用定點突變對某酵素分子上的胺基酸做改變如下，請預測對酵素活性的影響程度：
 - 活性區上的 Ser 改成 Thr
 - 活性區附近的 Ala 改成 Pro
 - 活性區外面的 Cys 改成 Ser
- 請畫出下面 peptide 滴定曲線的大略圖形：

Gly-Gly-Gly-Gly-Gly
- 請畫出下面分子構造：
 - SDS
 - beta-mercaptoethanol
- 精要解釋以下名詞：
 - cDNA library (or bank)
 - Northern hybridization
 - Supersecondary structure (of protein)
 - Positive supercoil (of DNA)
 - Clathrate (水籠)
- 請說明以下學者的貢獻：
 - Pauling & Corey
 - Chargaff
 - Anfinsen
 - Rosalind Franklin
 - Leloir

Please write directly on this sheet. Use the reverse side if necessary. No extra pages. You can express your opinion about the questions. (1~15, 5% each; 16~18, 10% each)

1. Write the full name of amino acids as the description.
Example – Containing smallest side chain: Ans. Glycine
(Answer might contain more than one amino acid)
 - a) Containing –SH residue
 - b) A kind of neurotransmitter
 - c) Can be phosphorylated
 - d) No optical isomer
 - e) Containing 4 carbons in the side chain but no nitrogen
2. The average molecular mass for an amino acid is 128. Calculate the mass of a protein containing 100 amino acid residues.
3. If a double helix DNA contains 100 base pairs, what is its length in nm? (write your calculation please)
4. What is sickle cell disease? The cause of this disease is related to the sequence or conformation of a protein?
5. Which of the following DNA fragments can be cut open by restriction enzymes? (answer yes or no)
 - a) -GGATCC-
 - b) -GGAATTCC-
 - c) -AATT-
 - d) -AATTAA-
 - e) -AATTAATT-
6. A graduate student was sequencing a DNA by Sanger's method using dideoxy NTP for the determination of the DNA synthesis. Instead of obtaining DNA fragments with various lengths, he only got very long fragments, and could not sequence at all. Could you explain why?
7. Is there any contribution or effect to the final protein structure for the following peptide?
-VIPAPIAPP-
8. There is no intron in prokaryotic cells. Could you imagine how the intron was evolved in eukaryotic cell?
9. Alpha helix is one of the secondary protein structures. What is its contribution to the final protein structure?
10. DNA structures can also be regarded as primary, secondary and tertiary. Please describe these structures, and explain how hydrogen bonds contribute to stabilize them.
11. Draw the structure of histidine (His). There are two nitrogen atoms on its side chain. Please describe the difference of their chemical properties.
12. Answer following questions about isoleucine (Ile):
 - a) Draw the structure of Ile.
 - b) Please identify all unsymmetrical carbons by *.
13. If you adjust the pH of an acetic acid solution ($pK_a = 4.8$) to 5.8, what is the chemical composition of this solution.
14. If we change amino acids on an enzyme by site-directed mutagenesis, predict the effect to the activity of the enzyme.
 - a) Ser on the active site is changed to Thr
 - b) Ala near the active site is changed to Pro
 - c) Cys outside the active site is changed to Ser
15. Draw the roughly titration curve for the peptide:
Gly-Gly-Gly-Gly-Gly
16. Draw the molecular structures for the compounds:
 - a) SDS
 - b) beta-mercaptoethanol
17. Explain precisely the following terms:
 - a) cDNA library (or bank)
 - b) Northern hybridization
 - c) Supersecondary structure (of protein)
 - d) Positive supercoil (of DNA)
 - e) Clathrate (水籠)
18. Describe the contribution of the following scientists:
 - a) Pauling & Corey
 - b) Chargaff
 - c) Anfinsen
 - d) Rosalind Franklin
 - e) Leloir