Biochemistry 2007B 學號：_____ 姓名：_____ 代號：_____

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

1. 請寫出 Michaelis-Menten 公式，並說明此公式有那幾個是變數？那幾個是常數？

2. 推導 Michaelis-Menten 公式的最基本出發點是什麼？科學家是如何觀察到的？

3. K_m 的單位為何？這個數字及其大小有何意義？

4. **Chymotrypsin** 對下面的 peptide 有何反應？

   Glu-Arg-Leu-Gly-Lys-His-Ser-Trp

5. 如何計算一個酵素的 k_3？

6. 酵素活性區形成一個凹陷口袋，此種設計非常關鍵，請就以下各提示，說明口袋的重要特性：
   (a) 水分子
   (b) 離子鍵
   (c) 酸鹼催化 acid-base catalysis

7. 某酵素樣本 X 含 0.1 mg 蛋白質，活性分析 (總體積 1 mL) 是測量反應生成物 P 的產量；已知 1 mL 中若含有 1 μmole 生成物 P，則在 405 nm 有 0.1 吸光度。若你測得 X 在 10 min 增加 0.35 吸光，請問此酵素 X 之 比活性 若干？ (要寫出算式)

8. 沙林 (Sarin) 原本是一種 serine protease 抑制劑，為何可被用來作為殺人的神經毒氣？

9. 回答以下有關 chymotrypsino**gen** 的修飾問題：
   (a) 第一刀切在 R15-I16 之間，有何作用？
   (b) 後來又切了幾刀，去除兩個片段，有何作用？

10. 醣解作用是所有生物的最主要代謝路徑。在此過程中，葡萄糖以及上面的碳原子經歷一連串變化，因此得以產生能量，請說明其變化過程。

11. 許多蛋白質在轉譯之後，再以磷酸化做修飾。為何演化不在最早的時候，就以各種磷酸化的胺基酸 (如 P-Ser 或 P-Tyr 等) 來合成蛋白質？

12. 請以箭頭連結酵素及基質，從胰增糖素 **glucagon** 開始，把信號傳到目標細胞，細胞內如何啟動信息傳導，一直到肝醣降解成 Glc-1-P 為止。

13. 幾千年來人類就以各種繁殖手法，來改變動植物的遺傳形質，早就在進行基因改造。那麼，為何很多人對最近的基因改造生物如此排斥？

14. 為何 penicillin 可以作為抗生素？請說明其對微生物的作用機制。

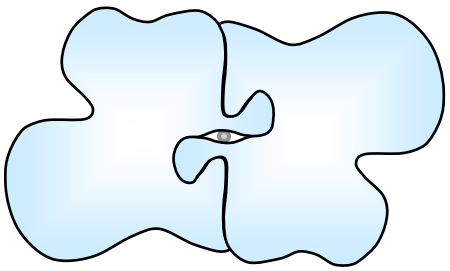
15. 說明 ATCase (aspartate transcarbamoylase) 如何以其上游及下游代謝物來調控酵素活性。

▼ 以下每題 10%：

16. 若用定點突變對 trypsin 分子上的胺基酸做改變如下，請預測對酵素催化的影響如何：
   (a) 活性區上的 Ser 195 改成 **Cys**
   (b) 活性區上的 His 57 改成 **Gly**
   (c) 專一性區上的 Asp 189 改成 **Glu**

17. 精要解釋以下名詞：
   (a) Mixed type inhibition
   (b) Ubiquitin
   (c) Cascade
   (d) RNAi
   (e) MALDI-TOF

18. 儘你所知，在下面 glycogen phosphorylase 的示意圖中，說明各種重要的構造或功能：



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

1. Write the Michaelis-Menten equation, and specify the constant and variable parameters in the equation.

2. What is the most beginning point for the deduction of Michaelis-Menten equation? Explain how scientists noticed this basic observation.

3. What is the unit for K_m? What is the significance of K_m and its value?

4. What would be the product(s) of the following peptide after being treated with **chymotrypsin**?

   Glu-Arg-Leu-Gly-Lys-His-Ser-Trp

5. How to calculate the constant k_3 of an enzyme?

6. The active site of an enzyme is generally shaped like a deep pocket, which is very critical to enzyme catalysis. Based on the following hints, please describe important effects of this catalytic pocket:
   (a) Water molecule
   (b) Ionic bonding
   (c) Acid-base catalysis

7. An enzyme preparation X contains 0.1 mg protein. The activity assay measures its product P in a total reaction mixture of 1 mL. One μmole P (in 1 mL solution) has an absorbance of 0.1 at 405 nm. If you measure the absorbance increase as 0.35 in 10 min in the reaction mixture, what is the **specific activity** of this enzyme preparation? (write down how you calculate)

8. Sarin is an inhibitor against serine proteases. Why it could be used as a nerve gas for killing people?

9. Answer following questions about chymotrypsino**gen**:
   (a) It is cut open firstly at R15-I16. What is the effect?
   (b) Then there are several cuts followed, and two small peptides are removed. What these actions effect?

10. Glycolysis is the most essential pathway for all living organism. The glucose molecule and the carbon atoms on it subject to a serial of conversion leading to the production of energy for the cell. Please describe the stages of this conversion.

11. Many proteins are modified by phosphorylation only after their translation. The evolution did not create the phophoamino acids (e.g. P-Ser or P-Tyr) for translating proteins with phosphate groups. Please explain why.

12. Starting from **glucagon** bound by its target cell, the message goes through the signal transduction pathway, and finally triggers the conversion of glycogen to Glc-6-P. Please write the whole network with enzymes and substrates linked by arrows.

13. For thousands of year, human civilization has manipulated the genetic traits for better breeders of livestock or plant culture. Then why so many people or groups in the modern society reject the genetic modified organism?

14. Penicillin is one of the antibiotics. Please explain its action mechanism on the microorganism.

15. Explain how the ATCase (aspartate transcarbamoylase) activity is controlled and regulated by its upstream or downstream metabolites.

▼ 16~18 (10% x 3)

16. The following amino acids are changed by site-directed mutagenesis, predict their effect to enzyme catalysis.
   (a) Active-site Ser 195 changed to **Cys**
   (b) Active-site His 57 changed to **Gly**
   (c) Specificity-site Asp 189 changed to **Glu**

17. Explain the following terms:
   (a) Mixed type inhibition
   (b) Ubiquitin
   (c) Cascade
   (d) RNAi
   (e) MALDI-TOF

18. In the following outline-sketch of glycogen phosphorylase, specify all structural features or functions you know.