

生物化学 I (2017年秋季学期, A 卷)

专业(班级): _____ 姓名: _____ 学号: _____

阅卷教师: _____

| 题号 | 一 | 二 | 三 | 四 | 五 | 合计 |
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| 分数 | | | | | | |



《中山大学授予学士学位工作细则》第六条：“考试作弊不授予学士学位”。

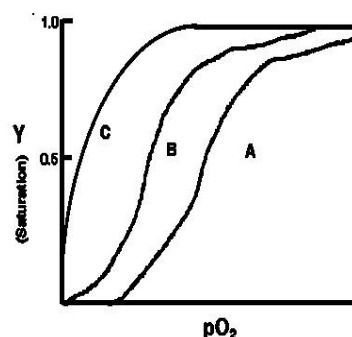
一、选择唯一正确答案 (每小题 1.5 分, 共 15 分)

- With regard to amino acids, which statement is **false**?
 A) Amino acids can act as proton donors and acceptors.
 B) All amino acids discovered in organism are L enantiomers.
 C) An L amino acid can be Dextrorotary.
 D) Non-standard amino acids can be found in the hydrolysis product of a protein.
- In a highly acidic solution, pH = 1.3, the dominant form of glycine is:
 A) $\text{NH}_2\text{-CH}_2\text{-COOH}$; B) $\text{NH}_3^+\text{-CH}_2\text{-COOH}$; C) $\text{NH}_2\text{-CH}_2\text{-CO}^-$; D) $\text{NH}_3^+\text{-CH}_2\text{-COO}^-$.
- In the isoelectric form of a tetrapeptide:
 A) The amino and carboxyl termini are not charged.
 B) Two internal amino acids of the tetrapeptide cannot have ionizable R groups.
 C) The total net charge is zero.
 D) Only the amino and carboxyl termini contribute charge.
- Which would elute first from a gel-exclusion chromatographic column?
 A) a negatively charged protein of MW=40,000
 B) a positively charged protein of MW=40,000
 C) a protein at its isoelectric point of MW=30,000
 D) a polysaccharide of MW=100,000
- In an aqueous solution, protein conformation is determined by two major factors. One is the formation of the maximum number of hydrogen bonds. The other is the:
 A) formation of the maximum number of hydrophilic interactions.
 B) maximization of ionic interactions.
 C) minimization of entropy by forming a water solvent shell around the protein.
 D) placement of all hydrophobic amino acid residues within the interior of the protein.
- You can destabilize a duplex DNA molecule in an aqueous solution by
 A) Decreasing the concentration of salt.

- B) Decreasing the concentration of organic solvents.
 C) Adjusting the pH to a value near 7.
 D) Adding a detergent.
7. With regard to DNA, which statement is **false**?
- A) Triple helix and tetraplex tend to appear at sites where replication, recombination or transcription is initiated or regulated.
 B) Hydrogen bonds are the only force to stabilize DNA structure.
 C) The absorbance of DNA at 260 nm will rise when it is denatured.
 D) Z-DNA tracts may play a role in the regulation of the expression of some genes or in genetic recombination.
8. Thr and/or Leu residues tend to disrupt an α helix when they occur next to each other in a protein because:
- A) of electrostatic repulsion between the Thr and/or Leu side chains.
 B) both amino acids are highly hydrophobic.
 C) the R group of neither amino acid can form a hydrogen bond.
 D) of steric hindrance between the bulky Thr and/or Leu side chains.
9. To calculate the turnover number of an enzyme you need to know the:
- A) initial velocity of the catalyzed reaction at $[S] \gg K_m$.
 B) K_m for the substrate.
 C) enzyme concentration.
 D) both A and C.
10. In glycoproteins, the carbohydrate moiety is always attached through the amino acid residues:
- A) tryptophan, aspartate, or cysteine; B) asparagine, serine, or threonine.
 C) glycine, alanine, or aspartate; D) aspartate or glutamate.

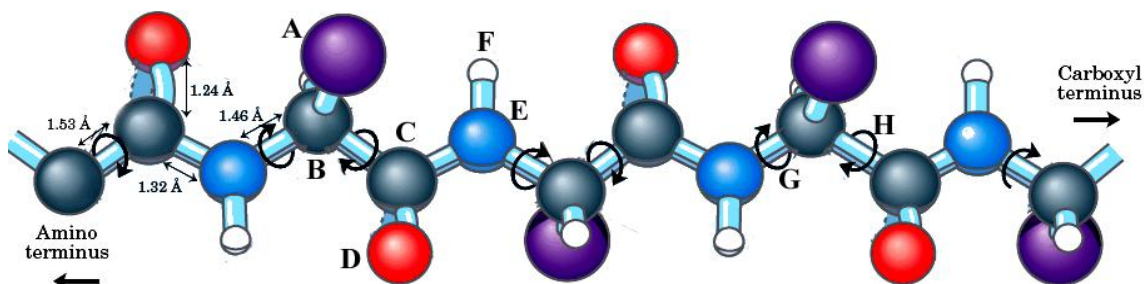
二、看图填空（每小题 5 分，共 25 分）

1. Consider this figure which shows oxygen binding to myoglobin or hemoglobin. For (1-7) indicate which (one or more) curve(s) fit the description (5points).



- (1)_____ Show(s) cooperative oxygen binding;
 (2)_____ Can be compared to the Bohr effect;
 (3)_____ Has the smallest P50;
 (4)_____ Correspond(s) to oxygen binding by isolated beta chains of Hb;
 (5)_____ Show(s) reversible oxygen binding;
 (6)_____ Correspond(s) to Hb with large amounts of BPG bound;
 (7)_____ Corresponds to an increase in CO_2

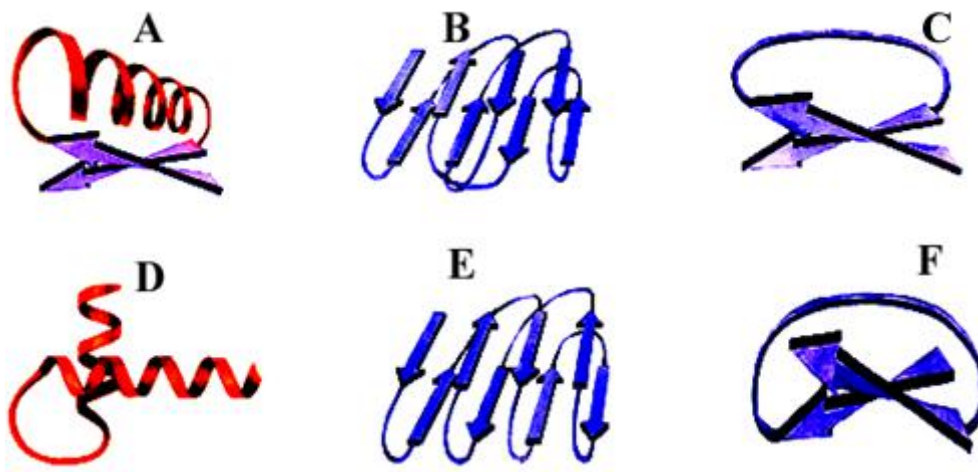
2. The following figure shows the model of peptides. The letters of A, B, C, D, E and F represent the atoms or side group of amino acids. The letters of G and H stand for the bond angle ψ or ϕ . Fill the blanks according to the figure (5points).



- (1) _____ = side group, _____ = alpha carbon atom, _____ = oxygen atom, _____ = nitrogen atom, _____ = hydrogen atom;
- (2) The conformation of the peptide is defined by the values of ψ (____) and ϕ (____);
- (3) The peptide bond between _____ and _____ has partial double-bond character;
- (4) The atoms (_____) form the peptide plane;
- (5) If the peptide is an alpha helix, indicate the H bond on the figure.

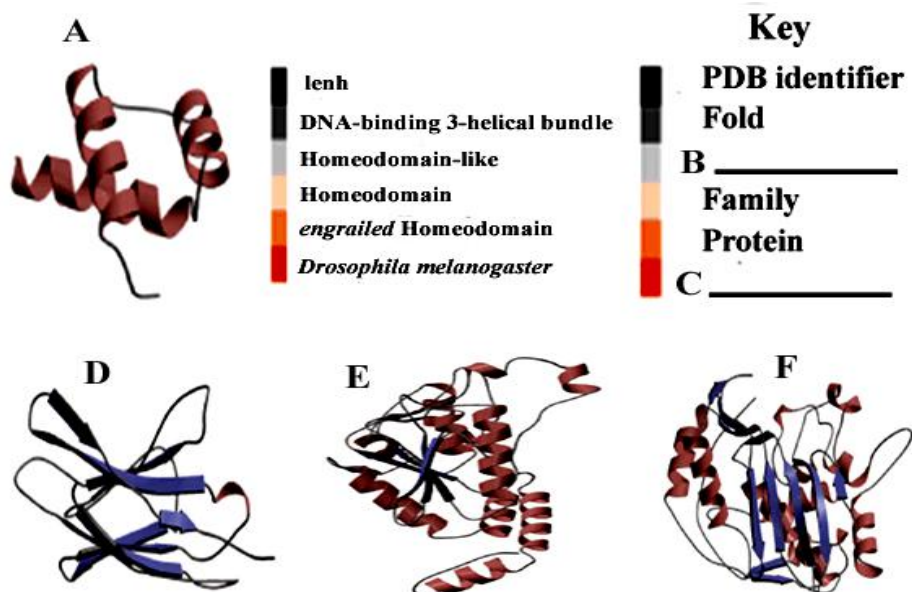
3. Supersecondary structure of proteins (5 points).

- (1) β - α - β Loop _____;
- (2) Greek Key _____;
- (3) α - α Corner _____;
- (4) Right-handed connection between β strands _____;
- (5) Not observed _____;
- (6) Very rare _____.

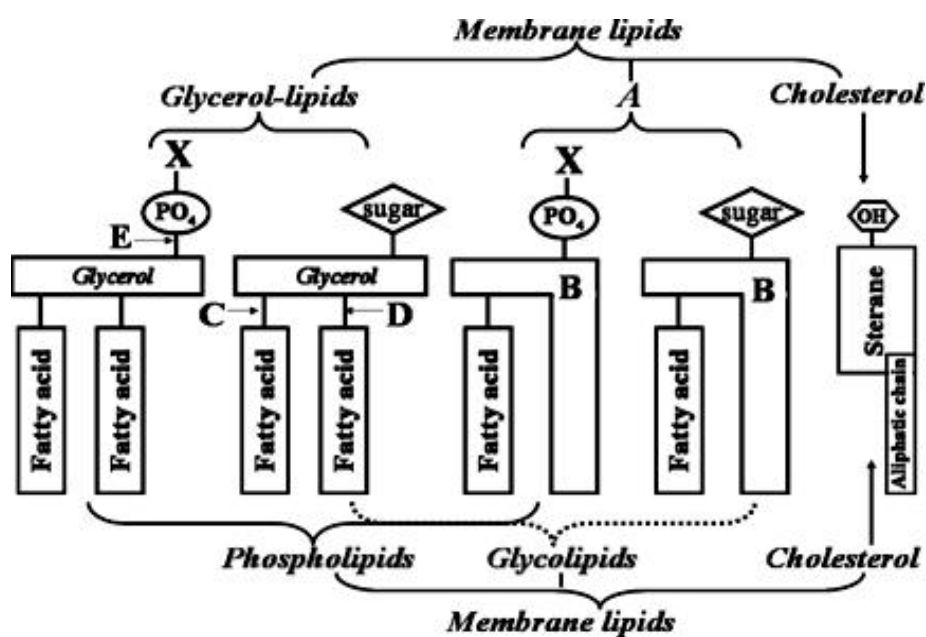


4. Protein classification (5 points).

- (1) All α _____; (2) All β _____; (3) α/β _____;
- (4) $\alpha+\beta$ _____; (5) Superfamily _____; (6) Species _____



5. Biomembrane lipids (5 points)



- (1) Sphingolipids _____; (2) Phospholipase A₁ _____
- (3) Phospholipase A₂ _____; (4) Phospholipase C _____
- (5) Sphingosine _____

三、关于酶的组题（答题要简洁，条理清晰，有针对性。如果你要回答的内容在前面已经给出，可以采用“参见……”的引用方式，以便节省答题时间）

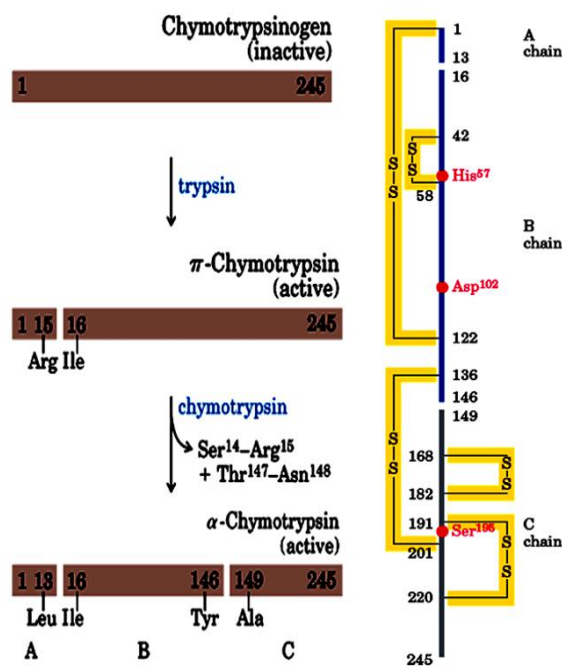
1. 酶为什么具有催化功能？（4分）
2. 为什么糜蛋白酶（Chymotrypsin）属于丝氨酸蛋白水解酶家族？你还知道那些丝氨酸蛋白水解酶以及蛋白水解酶家族？（4分）

3. 酶为什么具有最适催化温度和pH值？
(4分)

4. 糜蛋白酶的催化动力学曲线与肌红蛋白的氧合曲线类似；天冬氨酸转氨甲酰酶（ATCase）是一个变构酶，它的催化动力学曲线是否与血红蛋白的氧合曲线类似，为什么？（4分）

5. 糜蛋白酶的一级结构及其激活过程如图所示，这个激活顺序能否颠倒？给出理由（4分）

6. 对于人工酶（如环糊精）、核酶（RNA）、抗体酶、同工酶、以及具有催化功能的脂类分子集合体等具有明显区别的概念或对象，你能用什么基本原理将他们统一在“催化”的旗帜下？给出理由（4分）



四、关于膜的组题（答题要简洁，条理清晰，有针对性。如果你要回答的内容在前面已经给出，可以采用“参见……”的引用方式，以便节省答题时间）

1. 生物膜有哪些功能？（3分）
2. 膜蛋白有哪些存在方式？（3分）
3. 列举细胞膜的物质运输方式并分类（5分）
4. 离子通道和泵的区别是什么？它们的工作是如何相关的？举例说明（5分）

五、关于信号转导的组题（答题要简洁，条理清晰，有针对性。如果你要回答的内容在前面已经给出，可以采用“参见……”的引用方式，以便节省答题时间）

1. 生物信号（Biosignaling）有那些基本特征？（2分）
2. 描述 GTP-结合蛋白（G-蛋白）活化和失活的调节机制（4分）
3. 以 G-蛋白偶联受体为例，描述细胞信号转导的基本要素、途径和产生细胞应答的机制（8分）
4. 生物分子之间的相互作用是由其立体结构所决定的（Stereo-specific），请从小生物分子（small bio-molecules）的代谢和感觉系统（sensory systems）中各举一个例子说明（3分）
5. 举一个简单的例子，说明细胞信号转导异常与疾病发生的关系（3分）