درجات الاختبار الفصلي الأول – مقرر 431 كلن – علم الأنزيمات الإكلينيكية – شعبة رقم **(682)**

رقم الطالب	الدرجة (10)
430103437	3.5
431102518	4
433100055	8
433100299	9
433100708	7.5
433100834	10
433101074	5
433101274	10
433103514	10
433104847	7
433105562	6.5

درجات الاختبار الفصلي الأول – مقرر 431 كلن – علم الأنزيمات الإكلينيكية – شعبة رقم **(53201)**

رقم الطالب	الدرجة (10)
432100158	7.5
432103067	8
433100005	8
433100236	5.5
433100385	6
433100520	7.5
433100616	9.5
433101063	9.5
433101150	10
433102945	6
433103422	7.5
433103502	9
433103726	8
433105301	4
433107465	6.5

King Saud University
CLS Department
CLS 431

CLS 431 – 1st midterm exam – 12 Nov 2015

Model Answer

Question 1 (6 marks): Choose the best answer from the options underneath each question below:

1- Which of the following statements is true about enzymes or their function:

A. Enzymes do not alter the overall change in free energy for a reaction

B. Are -mostly- proteins whose three-dimensional form is key to their function

C. Enzymes speed up reactions by lowering activation energy

D. All of the above

2- The vitamin riboflavin is part of the _____ molecule

A. pyrophosphatase

B. catalase

C. FAD

D. NAD

3- Proteolytic cleavage of peptide bonds in zymogens will

A. Inhibit the enzyme

B. Activate the enzyme

C. Denature the enzyme

D. Decrease the optimal pH of the enzyme

4- The optimal temperature for human enzymes that are actively involved in metabolism is

A 25°C

B 30°C

C 60°C

D 37°C

5- Vitamins are important in metabolism because they are

A. Inorganic cofactors

B. Coenzymes

C. Long term regulators

D. Zymogens

6- The rate of enzyme synthesis (transcription/translation from genes to protein) will control

A. The enzyme activity

B. The enzyme concentration

C. The enzyme allostery

D. The enzyme inhibition

Question 2 (4 marks):

a) From what you have learned in enzyme classification, right the major EC class to which each of the following enzymes belongs:

Enzyme	Class
Lactate dehydrogenase (LDH)	**Oxidoreductases**
Alanine transaminase (ALT)	**Transferases**
Creatine kinase (CK)	**Transferases**
Amylase (AMY)	**Hydrolases**

Question 3 (6 marks): Differentiate between the following terms:

a) Lock-and-key theory vs. induced-fit theory

- Both are models that describe how an enzyme may bind to its substrate to form an ES complex.
- The lock-and-key theory requires an exact fit between the substrate and the enzyme considering the active site of the enzyme a rigid entity.
- However, the induced-fit model assumes that the active site is more flexible, and that it can undergo conformational changes to accommodate the substrate for ES complex formation.
- After the recognition of the 3D structure of enzymes, data reveal that substrate binding causes some movement of peptide bonds, apparently supporting the induced-fit model

b) Active site vs. allosteric site

- The active site is a groove or pocket on the enzyme surface that is lined with amino acids, whose side chains bind the substrate (e.g. glucose) and aid in its chemical transformation to products.
- The allosteric site is an alternative binding site on the enzyme, where effectors (activators or inhibitors) may alter the affinity of the enzyme for its substrate and possibly change its catalytic activity through many conformational changes at the allosteric site.
- ES complex formation takes place at the active site, whereas allostery plays a crucial role in many biological processes (e.g. regulation of metabolism, cell signalling, etc)

c) K_m vs K_{cat}

- K_m is the "kinetic activator constant"; derived from rate constants. It is the concentration that the enzyme needs to reach $V_{max}/2$.
- K_{cat} is the turnover number; the number of substrate molecules converted to product per enzyme molecule per unit of time, when E is saturated with substrate.
- K_m is a measure of the constant of the dissociation of E from S, while K_{cat} is a measure of the maximal molecular activity of the enzyme.

Question 4 (6 marks):

a) List 3 common mechanisms of enzymatic catalysis

1- Proximity-orientation effects
2- Acid-base catalysis (most common)
3- Covalent catalysis (may offer alternative pathways for the reaction, with lower activation energy requirements)
4- Electrostatic (metal ion) catalysis

b) List 3 common mechanisms of enzyme regulation

1- Availability of cofactors or coenzymes
2- Allosteric regulation (stimulation or inhibition)
3- Regulation of gene transcription and thus subsequent enzyme synthesis (upregulation or down regulation)
4- Covalent modifications (e.g. proteolytic zymogens)