The Open University of Sri Lanka

B. Sc. Degree Programme - 2016/2017

Faculty of Natural Sciences

Department of Chemistry

CMU3126 – Biochemistry

CONTINUOUS ASSESSMENT TEST I

Ques No.	Max.	Marks
1	30	
2	30	
3	40	
Total	100	

Date: October 8th, 2017   Time: 4.00 p.m. – 5.00 p.m.

1. The kinetics of an enzyme catalyzed reaction can be understood by the Michaelis-Menten equation.

    i) Give the Michaelis-Menten equation and define all the terms in the equation.

    (10 marks)

    ii) The plot for Michalis-Menten equation is a hyperbolic curve. Explain why the curve plateaus off at high substrate concentrations.

    (5 marks)

    iii) Explain the Steady State Approximation.

    (5 marks)

Reg. No. ☐☐☐☐☐☐ 0071

iv) Draw a graph of concentration Vs Time indicating the change in concentration of reactants (E and S), intermediates (ES) and products (P) in an enzyme catalyzed reaction.

(10 marks)

(Total 30 marks)

2. Oxygen binding to hemoglobin (Hb) is a classic example for Allosteric effects in biological compounds.

    i) What is allosteric regulation?

(5 marks)

    ii) What are the characteristic effects of allosteric enzymes?

(10 marks)

    iii) Can hemoglobin act as an enzyme? Explain your answer.

(5 marks)

    iv) Explain heterotopic effect using hemoglobin as an example.

(5 marks)

v) What is the significance of heterotrophic modulation of hemoglobin.

(5 marks)
(Total 30 marks)

3. Citric acid cycle metabolizes different catabolic products in our body.
   i) What is the entry compound of citric acid cycle?

(5 marks)

   ii) What is the importance of citric acid cycle in the body?

(10 marks)

   iii) Fill in the blanks in the following reaction, step 3 of the citric acid cycle.

$$H_2C-COO^-$$
$$H-\overset{|}{C}-COO^-$$
$$H-\overset{|}{C}-COO^-$$
$$\overset{|}{OH}$$
D-Isocitrate

+ [____] ⇌ [____] $\Delta G= -8.4$ kJ/ mol

$$H_2C-COO^-$$
$$H-\overset{|}{C}-H$$
$$O=\overset{|}{C}-COO^-$$

+ [____] + [____]

(10 marks)

   iv) Fumarate undergoes a stereo-specific hydration of the C=C double bond, catalyzed by fumarate hydratase. Explain why fumarate hydratase is considered as a stereo-specific enzyme.

(5 marks)

   v) Explain the function of complex I of the electron transport chain.

(10 marks)
(Total 30 marks)

****

1. i) $V = \dfrac{V_{max}\,[S]}{k_m + [S]}$

V = Velocity of reaction

V_{max} = Maximum velocity of reaction

K_m = Michaelis constant

[S] = Substrate concentration

ii) Enzyme is saturated at high concentration of substrate

iii) [ES] does not change when the enzyme is saturated.

or

Change in the rate of change of the enzyme substrate complex at the steady state is very small compared to the rate of change of substrates or products.

iv)
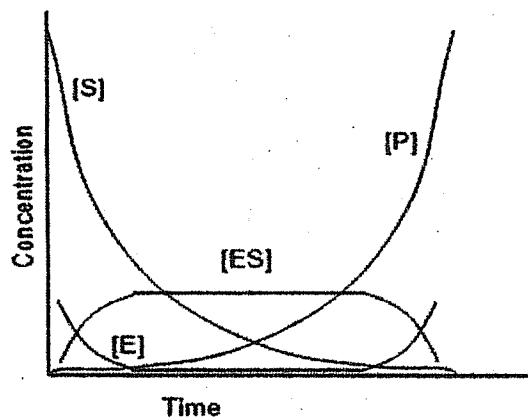
2. i) These regulators bind to the enzyme at a specific site (allosteric site) which is not the active site. It induces a conformational change which alters the affinity of the enzyme to substrate changing the rate of reaction.

ii)
   a) Have a quaternary structure
   b) Binding to a site other than active site
   c) Show cooperative effects
   d) Do not exhibit Michaelis- Menten kinetics, but show sigmoidal curves

iii) No.

It doesn't catalyse any reaction

iv) Hb has sites other than O_2 binding site. eg: CO_2 can bind to such site (CO_2/ H^+/ Cl^-/ BPG). Then the affinity of Hb to O_2 is decreased and release O_2
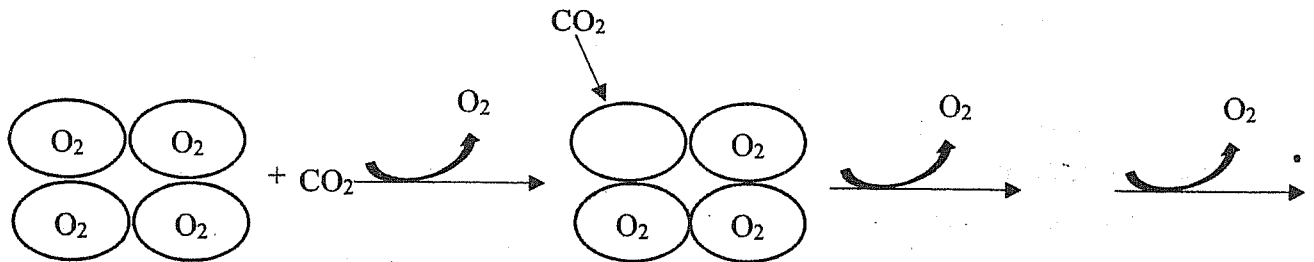
v) Rapidly metabolizing tissues need O_2. They have a low pH due to high $[H^+]$ and $[CO_2]$.
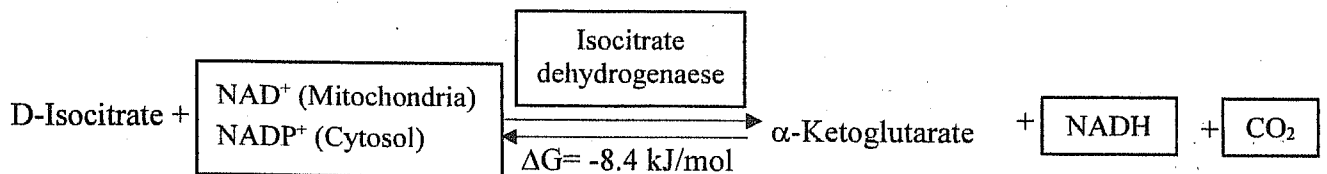   So they release O_2.

                Or

When $[CO_2]$ is high in cells/tissues it releases O_2. So Increase the O_2 transporting efficiency.

3) i) Acetyl CoA

   ii) Provide NADH, $FADH_2$, an energy provider GTP
       Important intermediates for biosynthetic process.

   iii)

   iv) It will only hydrate Fumarate, only single directional. It can't use D-malate as a substrate in the reverse reaction.

   v) NADH dehydrogenase
   • NADH $\longrightarrow$ $NAD^+ + H^+$
   • Transfer $4H^+$ from matrix to membrane
   • Pass e^n to convert FMN$\longrightarrow$ $FMNH_2$
   • E^n travels through Fe-s proteins finally to Q (ubiquinone)