M.Sc I. Biochemistry Semester I Paper III Advanced Enzymology
Question Bank

Unit I (Kinetics I)

Q.1) Choose the correct alternative (each carry 1 mark)

1) The amino acid from following is
a) glutamate b) lysozyme c) papain d) ribonuclease
2) The rate of a reaction
a) increases with increase in temperature b) decreases with increase in temperature
c) does not depend on temperature d) depends on temperature
3) Enzyme kinetics is
a) study of substrate **b) study of rate of reaction**
c) study of initial velocity d) all of the above
4) In an enzymatic reaction, enzymes exist in
a) 2 forms b) 3 forms **c) 6 forms** d) 4 forms
5) Turnover number is also known as
a) Km **b) Kcat** c) Kcam d) Kcad
6) V_0 = Vmax occurs at
a) Low [s] **b) High [s]** c) Low Vo d) High Vo
7) The following statement is not true
a) The reaction for the formation of ES is irreversible
b) Turnover number is also known as catalytic constant
c) The reaction is in study state when rate of synthesis is equal to rate of degradation
d) Plateau is called Vmax
8) Maximum catalytic activity of enzymes is shown at
a. **Optimum temperature** b. Minimum temperature
c. Maximum temperature d. Accurate temperature
9) Maximum catalytic activity of enzymes is shown at
a. **Optimum** pH b. Minimum pH c. Maximum pH d. Accurate pH
10) No catalytic activity of enzymes is shown at
a. Optimum temperature b. **Minimum temperature**
c. Maximum temperature d. Accurate temperature

Q2) Fill in the blanks (each carry 1 mark)

1. The double reciprocal plot is also known as Lineweaver Burk plot.
2. The temperature at which the enzyme shows maximum catalytic activity is optimum temperature.
3. Michaelis & Menton are the scientists who discovered MM equation.
4. Vmax is the rate of reaction at which the enzyme show the highest turnover.
5. Km is the concentration of substrate at which half of the Vmax is attained.
6. The pH at which the enzyme shows maximum catalytic activity is optimum pH.
7. Complete the equation: V = Vmax{s}/ Km+s
8. The enzyme having another site other than active site is called allosteric enzyme.
9. The graph of LB plot passes through 2 number of quadrants.
10. The graph of effect of temperature on enzymatic reaction is bell shaped.

Q3) Answer in one sentence (each carry 1 mark)

1) Give M.M equation
Ans: V=vmax{s}/Km+s
2) Define optimum pH.

Ans: The most favourable pH at which the enzyme is most active
3) Define optimum temperature.
Ans: The most favourable at which the enzyme is most active
4) Define Km.
Ans: Km is the concentration of substrate at which half of the Vmax is attained.
5) Define Vmax.
Ans: Vmax is defined as the rate of the reaction at which the enzyme shows the highest turnover.
6) Define reciprocal plot.
Ans: A plot in which the units of both the ordinate and the abscissa are reciprocals of the value that have been determined.
7) Define substrate.
Ans: A substrate is defined as substance upon which the enzyme specifically act to convert in to product.
8) Define allosteric enzyme
Ans: Enzyme that contain another side other than active site at which modulators are attached.
9) Define coenzyme.
Ans: It is define as a substance that is essential for the activity of specific enzyme.
10) Define holoenzyme.
Ans: A holoenzyme = apoenzyme + coenzyme+ cofactor

Q4) Short answer questions (each carry 4 marks)

1) Describe the effect of temperature on the reaction rate.
2) Describe the effect of PH on the reaction rate.
3) Describe the effect enzyme concentration on the reaction rate.
4) Describe the effect of substrate concentration on the reaction rate.
5) Explain the limitations of M.M equation.
6) Describe double reciprocal plot.
7) Describe Eadie Hofstee plots.
8) Describe M.M equation for rapid state.
9) Describe steady state equation.
10) Describe single reciprocal plot.

Q5) Long answer question (each carry 8 marks)

1) Describe the effect of temperature and pH on the reaction rate.
2) Describe the effect of pH on the reaction rate and draw its graph.
3) Describe the effect enzyme concentration on the reaction rate and draw its graph.
4) Describe the effect of substrate concentration on the reaction rate and draw its graph.
5) Derive M.M equation and state its limitations.
6) Describe double reciprocal plot.
7) Describe Eadie Hofstee plots.
8) Explain M.M equation for rapid state with its curve.
9) Derive steady state equation.
10) Derive single reciprocal plot with respective graph.

Unit II (Kinetics II)

Q.1 Choose the correct alternative (each carry 1 marks)

1) The coenzyme is:
a) Often a metal b) Always a protein **c) Often a vitamin** d) Always an inorganic compound
2) The following is produced with combination of apoenzyme and coenzyme.
a) Holoenzyme b) Enzyme substrate complex
c) Prosthetic group d) Enzyme product complex
3) The example of competitive inhibition of an enzyme
a) Succinic dehydrogenase by malonic acid b) Cytochrome oxidase by cyanide
c) Hexokinase by glucose-6-phosphate d) Carbonic andydrose by carbon dioxide
4) Blocking of enzyme action by blocking its active site is called as
a) Allosteric inhibition b) Feedback inhibition
c) Competitive inhibition d) Non-competitive inhibition
5) Enzymes are made up of:
a) Fats **b) Proteins** c) Nucleic acid d) Vitamin
6) The following is the non protein component of the enzyme?
a) Cofactor b) Activator c) Coenzyme **d) All of these**
7) Zn^{2+} is an inorganic activator for enzyme.
a) Carbonic anhydrase b) Phosphtase **c) Chymotrypsin** d) Maltose
8) Mg^{2+} is an inorganic activator for enzyme.
a) Phosphatase b) Carbonic anhydrase c) Amylase d) Enterokinase
9) The following is an example of reversible inhibitor.
a) DIPF b) Penicillin c) Iodoacetamide **d) Protease inhibitor**
10) In mixed inhibition, the inhibitor binds this of enzyme
a) Active site **b) Allosteric site** c) Does not bind an enzyme d) Bind on substrate

Q2. Fill in the blanks (each carry 1 marks)

1) Enzyme which has two sites is called allosteric enzyme.
2) Inhibition of enzyme may also be reversed by removal of the inhibitor by the treatment with H_2S.
3) The non protein organic molecules and the prosthetic groups of enzyme are called coenzyme.
4) The coenzyme TPP is also called co-carboxylase.
5) The chief function of CoA is to carry acyl group.
6) When coenzyme is combined with apoenzyme, it is called as holoenzyme.
7) Apoenzyme is the protein part of holoenzyme.
8) The function of an enzyme is to change the rate of chemical reaction.
9) When inhibitor competes with the substrate the inhibition is called competitive inhibition.
10) Bisubstarte reactions can be classified into 2 main groups.

Q3.Answer in one sentence (each carry 1 marks)

1) Define inhibitor.
Ans: Any substance that negatively affects the enzymatic activity is called inhibitor.
2) Define enzymes.
Ans: Enzymes are the biocatalysts that alter the rate of reaction.
3) Define competitive inhibition.
Ans: An inhibitor competes with substrate for binding the active site is called competitive inhibitor.
4) Define coenzyme.
Ans: It is defined as organic compound that is essential for activity of specific enzyme.
5) Define cofactor.
Ans: It is defined as non organic compound that is essential for activity of specific enzyme.
6) Define Apoenzyme.

Ans: It is defined as protein part of enzyme that can combine with specific coenzyme and cofactors for catalytic activity.

7) Define enzyme specificity

Ans: The ability of an enzyme to react with one or substrate determines its specificity.

8) Define zymogen.

Ans: The inactive precursors of enzyme is called zymogen

9) Define allosteric enzyme.

Ans: The enzyme having another site other than active site is called allosteric enzyme.

10) Define inducer.

Ans: A substance that is responsible for the synthesis of a particular inducible enzyme is called inducer.

Q4) Short answer questions (each carry 4 marks)

1) Write a short note on coenzyme NAD.
2) Explain the role of FAD in metabolism.
3) Write a note on competitive inhibition.
4) Explain inhibition and its types.
5) Explain irreversible inhibition.
6) Explain Bisubstrate kinetics.
7) Explain activators kinetics.
8) Describe Haldane's relationship.
9) Explain in detail uncompetitive inhibition.
10) Explain in detail competitive inhibition.

Q5) Long answer question (each carry 8 marks)

1) Explain the role of metals in enzyme kinetics.
2) Explain the role of coenzyme in metabolism.
3) Describe the various types of enzyme inhibitors.
4) Explain in detail kinetics of competitive inhibition.
5) Explain in detail kinetics of non-competitive inhibition.
6) Explain in detail kinetics of uncompetitive inhibition.
7) Explain kinetics of Bisubstrate reaction.
8) Describe bisubstrate reactions.
9) Describe coenzymes.
10) Derive Haldane's equation and state its importance.

UNIT III (Mechanism of Enzyme action)

Q.1 Choose the correct alternative (each carry 1 marks)

1) The study of rates of chemical reaction that are catalyzes by enzymes is
a) First order reaction kinetics b) Zero order reaction kinetics
c) Chemical kinetics **d) Enzyme kinetics**

2) Lock and key model was proposed by
a) Henri b) Michaelis & Menton **c) Emil Fischer** d) Daniel Koshland

3) The substrate molecules bind to active site of the enzyme transforming into products through a series of steps. This phenomenon is known as
a) Enzyme kinetics **b) Enzymatic mechanism**
c) Chemical kinetics d) Zero order reaction kinetics

4) When the free energy occurs at standard condition it is termed as
a) Activation energy b) PKa **c) Standard free energy** d) Gibbs free energy

5) The disruption of interactions between substrate & solvent is referred as
a) Desolution b) Molecular orbital steering c) Protonation d) Deprotonation

6) The first step involved in chymotrypsin-mediated peptide bond hydrolysis is
a) Acylation b) Specific acid base catalysis
c) General acid base catalysis **d) Deacylation**

7) The covalent catalysis is aided by one of the following method? Nucleophilic catalysis
a) General acid base catalysis b) Specific acid base catalysis
c) Nucleophilic catalysis d) Substrate collision theory

8) Covalent catalysis involves substrate forming transient covalent bond with the residues present in the active site
a) Covalent catalysis b) Specific acid base catalysis
c) General acid base catalysis d) Lock and key model

9) Daniel Koshland proposed a model for enzymes reaction mechanisms which is termed as
a) Induced fit model b) Lock & key model
c) Henri kinetic model d) Michealis-Menten Kinetic model

10) The energy required to attain transition state is referred to as
a) Gibbs free energy **b) Activation energy**
c) Standard free energy change d) pH

Q2 Fill in the blanks (each carry 1 marks)

1) Succinate dehydrogenase is a mitochondrial marker enzyme.
2) In alcoholism, glutamyl transpeptidase enzyme is elevated.
3) The coenzyme is often a vitamin.
4) The enzyme minus its coenzyme known as apoenzyme.
5) The study of rates of chemical reactions that are catalysed by enzyme is referred to as enzyme kinetics.
6) Enzyme is polymers of amino acid.
7) Lock and key model was proposed by Emil Fisher in 1890.
8) In induced fit model only a specific substrate can bind and produce desirable reaction.
9) The induced fit model was proposed by Koshland in 1958.
10) Deacylation is the first step involved in chymotrypsin-mediated peptide bond hydrolysis.

Q3 Answer in one sentence (each carry 1 marks)

1) Induced fit model is given by
Ans: Koshland in 1958.
2) Lock and key model is given by.
Ans: Emil Fisher gave the Lock and key model.

3) Define enzyme?
Ans: Enzymes are biocatalyst which speed up the rate of reaction witout undergoing any change in its self.
4) Define active centre.
Ans:A region on an enzyme that bind to a protein or other substance during reaction.
5) Define chymotrypsin.
Ans:A digestive enzyme which breaks doen protein in the small intestine.
6) Define Ribonuclease.
Ans:Ribonuclease that catalyzes the degradation of RNA into smaller fragments.
7) Name any one physical metod used for active site determination.
Ans:Dialysis equilibrium method.
8) Define product.
Ans: The substance formed after ES complex dissociates is called product.
9) Define inducer.
Ans:A substance is responcible for the synthesis of particular inducible enzyme is called inducer.
10) Define zymogens.
Ans: They are inactive precursors of enzymes and usually contain many amino acids more than the active forms.

Q4) Short answer questions (each carry 4 marks)

1) Describe any one mechanism of enzyme action.
2) Explain orientation effect.
3) Explain acid base catalysis.
4) Explain Proximity effect.
5) Explain covalent catalysis.
6) Describe structure of Ribonuclease.
7) Describe structure of chymotrypsin.
8) Describe the chemistry of active centre.
9) Explain any one physical method for the determination of active site.
10) Explain any one chemical method for the determination of active site.

Q5) Long answer question (each carry 8 marks)

1) Describe mechanisms of enzyme action.
2) Explain strain and distortion effect.
3) Explain acid base catalysis and its types.
4) Explain Proximity and orientation effect.
5) Explain covalent catalysis and its applications.
6) Describe structure and functions of Ribonuclease.
7) Describe structure and functions of chymotrypsin.
8) Describe the chemistry of active centre and its role in inhibition.
9) Describe physical methods for the determination of active site.
10) Explain chemical methods for the determination of active site.

UNIT IV

Q.1 Choose the correct alternative (each carry 1 marks)

1) Which of the following is not a co-enzyme
A) NAD b) NADP c) FAD **d) Mn++**
2) Enzyme acts best at a particular temperature called
a) Catalytic temperature b) At normal body temperature
c) Optimum temperature d) None of the above
3) Which of the following statement is incorrect
a)Enzyme are protein in nature b)Enzyme are colloidal in nature
c)Enzyme are thermolabile **d)Enzyme are inorganic catalyst**
4) Which of the following is a multienzyme complex
a) Glyceraldehydes-3- phosphate (G3P) b) NAD+
c) FAD+ d) Pyruvate dehydrogenase
5) In certain metabolic pathway a number of enzyme are required this multienzyme complex occure enclosed in the
a) Membrance **b) Area with in ATP**
c) Microbodies d) Endo plasmic reticulum
6) The catalytic activity of an enzyme is restricted to its small partion called
a) Active site b) Passive site
c) Allosteric site d) All above
7) An enzyme function as
a) Organic catalysis b) inorganic catalysis
c) Inhibitors d) All of above
8) The predominant isoenzyme of LDH
a) LD-1 b) LD-2 c) LD-3 d) LD-5
9) The isoenzyme LDH5 is clactic dehydrogenase elevated in
a) Myocardial infaration b) Peptic ulcer
c) Liver disease d) Infectious disease
10) The CK isoenzyme present in cardiac muscle is
a) BB & MB b) MM & MB
c) BB only d) MB only

Q.2 Fill in the blanks (each carry 1 marks)

1) When CO2 is added to PEP the first stable product synthesises is oxaloacetate.
2) Isoenzymes are different molecular forms.
3) Isoenzymes are the result of gene duplication.
4) Pyrovate dehydregenase a multienzyme complex is required for the production of acetyl COA.
5) Bases catalyze the reaction by accepting a proton.
6) The CK isoenzyme present in cardiac muscle is BB only.
7) Enzyme acts best at a particular temperature called optimum tempreture.
8) Malate aspartate shuttle operates in heart and liver.
9) A large number of cellular enzyme are located in membranes are called as membrane bound enzyme.
10) The enzyme which forms the peptide bond is called as peptidyl transferase.

Q.3) Answer in one sentence (each carry 1 marks)

1) Give any two uses of multienzymes.
Ans:- It is used when the pancreas cannot make or does not release enough digestive enzymes into the gut to digest the good.

2) Define Multifunctional enzymes.
Ans:- Enzymes that perform multiple physiological functions.
3) Define membrane bound enzyme.
Ans:- Cellular enzymes that are located in membranes.
4) How enzymes control metabolic reaction?
Ans:- By lowering the activation energies of chemical reactions.
5) Give any two metabolic cyles that occur in the mitochondrial membrane.
Ans:- Beta oxidation and the citric acid cycle.
6) Give the importance of compartmentalization in enzyme regulation.
Ans:- Storing enzymes in specific compartments can keep them from doing damage or provide the right conditions for activity.
7) Define isoenzymes.
Ans:- Enzymes that occur in various metabolic forms and perform same functions.
8) State any two isoenzymes.
Ans:- Lactate dehygrogenase, Amylase
9) State any two importances of marker enzymes.
Ans:- Help in study of metabolism and cellular localization of pathway.
10) Give causes of high liver isoenzyme?
Ans:- Inflammation or damage to cells in the liver.

Q4) Short answer question (each carry 4 marks)

1) Describe multienzyme complexes.
2) State the applications of isoenzymes.
3) Describe the role of multienzyme complexes in metabolism.
4) Describe membrane bound enzymes.
5) Explain compartmentalization of substrate.
6) Explain in short shuttle system.
7) Draw the structure of PDH.
8) Describe lactate dehydrogenase.
9) Give the role of isoenzyme in clinical diagnosis.
10) Explain compartmentalization of enzyme.

Q.5) Long answer questions (each carry 8 marks)

1) Explain multienzyme complexes with an example.
2) Explain isoenzymes and give its applications.
3) Describe the multienzyme complexes and its significance in metabolic control.
4) Describe membrance bound enzyme in metabolic control.
5) Explain compartmentalization of enzyme and substrate.
6) Explain in detail shuttle system
7) Describe the structure of PDH
8) Describe isoenzyme with an example.
9) Explain the role of isoenzyme.
10) Explain mitochondrial membrane bound enzymes.

UNIT V

Q.1 Choose the correct alternative (each carry 1 marks)

1) The control and regulation of biological process involve some enzyme. They are known as
a) Allosteric substrate b) Reactants c) **Allosteric modulators** d) Inhibitions
2) Allosteric enzymes are
a) Smaller than simple enzyme b) Larger than simple enzyme
c) Smaller than complex enzyme **d) larger & more complex than simple enzyme**
3) Allosteric enzymes consist of several
a) Polypetide chains b) Inhibitors c) Temperature ranges d) Active sites
4) Enzymes that are involved in the feedback inhibition are known as
a) Apoenzymes b) Holoenzyme **c) Allosteric enzymes** d) Coenzymes
5) Enzymes are
a) Organic compounds produced by living organism b) Inorganic compounds
c) Organic as well as inorganic compounds d) All of these
6) The allosteric inhibition of enzymes
a) Causes the enzyme to work faster b) Binds to the active site
c) Participates in feedback regulation d) Denatures the enzyme
7) Allosteric enzymes possess
a) Three types of allosteric site b) Active site & 3 types of allosteric sites
c) Active site & 2 types of allosteric sites **d) Active site an allosteric sites**
8) The fastest enzyme is
a) Carbonic anhydrase b) Pepsin
c) DNA polymerase d) DNA gyrase
9) Enzymes that are involved in the control & regulation of biological process are
a) Allosteric enzyme b) Inhibitors c) Regulators d) Activators
10) Most industrial enzymes are obtained from
a) Plants b) Animal c) Insects **d) Microbes**

Q.2 Fill in the blanks (each carry 1 marks)

1) Enzymes are the **biological** catalyst, which increases the rate of the reaction.
2) Acetyl – COA carboxylase regulates the process of **Lipogenesis.**
3) Molecule that binds to allosteric sites is called **modulator.**
4) Binding to allosteric sites alter the activity of the enzyme, this is called **cooperative binding.**
5) A homotronic allosteric modulator is a substrate for its target **enzyme.**
6) Inhibitors are chemicals that **reduce** the rate of enzymatic reaction.
7) The process of increasing the amount or the activity of a protein is **enzyme induction.**
8) Hydrophilic hormone is **water-**soluble hormone.
9) Allosteric regulation of enzymes is crucial for the control of **cellular metabolism.**
10) Modulator binding site is called the **regulatory subunit.**

Q.3) Answer in one sentence (each carry 1 marks)

1) Define allosteric enzymes.
Ans:- Allosteric enzymes are enzymes that have an additional binding site for effecter molecules other than the active site.
2) State any two types of enzyme regulation.
Ans:- Allosteric regulation, genetic & covalent modification, & enzyme inhibition.
3) State the mechanism of allosteric regulation in enzyme activity.

Ans:- The allosteric inhibitors binds to an enzyme at a site other than the active site. The shape of the active site is altered so that the enzyme can no longer bind to its substrate.

4) Define product inhibition.

Ans:- Product inhibition is a type of enzyme inhibition where the product of an enzyme reaction inhibits.

5) Define feedback inhibition.

Ans:- Inhibition of an enzyme controlling an early stage of a series of biochemical reaction by the end product when it reaches a critical concentration.

6) Define enzyme induction.

Ans:- A process in which a molecule induces the expression of an enzyme.

7) Define enzyme repression.

Ans:- Enzyme repression is the mode by which the synthesis of an enzyme is prevented by repressor molecules.

8) Define allosteric regulation?

Ans:-Allosteric regulation (or allosteric control) is the regulation of an enzyme by binding an effector molecule at a site other than the enzymes active site.

9) State the importance of allosteric enzymes.

Ans:- Allosteric enzymes play a vital role in cellular regulation and they catalyse the reaction in metabolic pathways as well as control the rate of these pathways.

10) State the importance of enzyme regulation.

Ans:- Regulation of enzyme activity is vital because it coordinates different metabolic reactions. It also takes part in homeostasis.

Q 4) Short answer question (each carry 4 marks)

1) Explain Enzyme induction.
2) Explain concept of receptors.
3) Explain allosteric regulation.
4) Explain product inhibition.
5) Describe feedback control.
6) Describe nature of Allosteric enzymes.
7) Describe mode of action of allosteric enzymes.
8) Describe mode of hormonal action on enzymes.
9) Explain the sigmoidal kinetics of Allosteric enzymes.
10) Describe mode of hormonal action on enzyme.

Q 5) Long answer questions (each carry 8 marks)

1) Describe inhibitors and the mechanism of product inhibition.
2) Explain Enzyme induction & repression
3) Describe nature of allosteric enzymes & explain the feedback control.
4) Explain types of receptors.
5) Explain allosterism and discuss the nature of allosteric enzymes.
6) Explain the concept of receptors & antagonist.
7) Explain allosteric regulation & product inhibition.
8) Explain allosteric enzymes with example and mode of action of allosteric enzyme.
9) Explain allosterism with kinetics.
10) Explain the concept of agonist & antagonist.

Syllabus

Paper - III
(Advance Enzymology)

Unit I : Kinetics - I

a) Concept of steady state and rapid state Equilibrium kinetics.
b) Effect of temperature, pH, enzyme and substrate concentration on reaction rate.
c) Michaelis - Menton equation, single and double reciprocal plots.

Unit II : Kinetics - II

a) Enzyme inhibitor types, kinetics of enzyme inhibition.
b) Role of co-enzymes in metabolism, Role of metals in enzyme kinetics. Activator kinetics, Bisubstrate kinetics.
c) Kinetics for reversible enzyme catalysed reaction, Haldane's relationship.

Unit III: Mechanism of enzyme action -

a) Modes of enzyme catalysis - covalent, proximate or orientation effects, acid base etc.
b) Chemistry of active center, chemical modification studies by active site directed reagents, physical methods for determination of active site conformation.
c) Various theories of mechanism of enzyme action. Structure function relations of Ribonuclease and chymotrypsin.

Unit IV: Control of enzymes catalysed reaction - (Biological control)

a) Multienzyme complexes and their significance in metabolic control.
b) Membrane bound enzymes in metabolic control.
c) Compartmentalization of enzyme and substrate, the shuttle systems.
d) Isoenzymes

Unit V : Allosteric interactions and enzyme regulation

a) Allosterism, nature of allosteric enzymes ane sigmoidal kinetics, mode of action, allosteric regulation.
b) Product inhibition, feed back control, enzyme induction and repression.
c) Mode of hormonal action on enzymes, concept of receptors, agonists and antagonists.