Chapter-3 Enzymes

Very Short Answers Questions:

1. **How are prosthetic groups different from co-factors?**

A: Co-factors are non-proteinaceous part of holoenzyme that are essential for enzyme activity. They may be organic or inorganic.

Prosthetic groups are organic co-factors which tightly bound to the apoenzyme.

2. **What is meant by 'feedback' inhibition?**

A: If end product of a chain of enzyme catalyzed reactions inhibits the enzyme of the first reaction as part of homeostatic control of metabolism it is called 'Feedback inhibition'.

3. **Why are 'oxido reductases', so named?**

A: Oxidation invariably associated with reduction or vice versa in chemical reactions. Enzymes catalyzing these reactions are named as 'oxido-reductases'.

4. **Distinguish between apoenzyme and co-factor?**

A: Certain enzymes require non-protein constituents for their catalytic activity. The protein part of these enzymes are apoenzymes and non-protein constituent is called co-factor.

5. **What are competitive enzyme inhibitors? Mention one example?**

A: Competitive inhibitors closely resemble the substrate in their molecular structure. They compete for the active sites of enzymes.

E.g.: Inhibition of succinic dehydrogenase acting on succinic acid by melonate.

6. **What are non-competitive enzyme inhibitors? Mention one example?**

A: Non-competitive inhibitors do not have structural similarity with substrate. They attach to the enzyme at a point other than the active site forming enzyme-inhibitor complex.

E.g.: Copper, Mercury.

7. What do the four digits of an enzyme code indicate?

A: i) First digit of the code indicates the major class of the enzyme.

ii)Second and third digits indicate sub-class and sub-subclass respectively.

iii) Last digit is the serial number of the enzyme in that sub-subclass.

8. Who proposed 'Lock and Key hypothesis' and Induced fit hypothesis?

A. Lock and Key hypothesis—Emil Fischer.

Induced fit hypothesis --- K. Koshland.

9. Define Michaelis constant

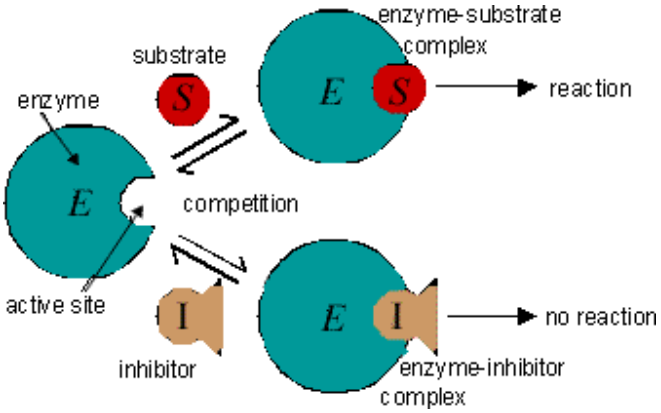
A: Michaelis-Menton constant (K_m) is substrate concentration required to cause half the maximal reaction rate. (K_m values represent approximate inverse measures of the affinity of the enzyme for a given substrate.).

Short Answers Questions:

1. Write briefly about enzyme inhibitors?

Ans: When the binding of the chemical shuts off enzyme activity , the process is called inhibition and the chemical is called as an inhibitor.

Inhibitors are **competitive ,non-competitive** and **feedback inhibition**.

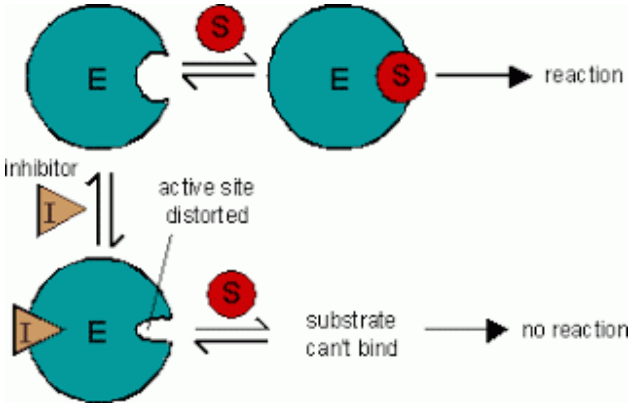


Competitive inhibitor: When the inhibitor closely resembles the substrate in its molecular structure and inhibits the activity of the enzyme, it is known as competitive inhibitor.

Due its close structural similarity with the substrate, the inhibitor competes with the substrate for the active sites of the enzymes. Consequently the substrate cannot bind to the enzyme as a result enzyme activity declines.

E.g. Inhibition of **succinic dehydrogenase by malonate** which closely resembles the substrate succinate in structure.

Non-competitive inhibition: In non-competitive inhibition the inhibitor has no structural similarity with the substrate and forms an enzyme inhibitor complex at a point other than its



active site, so that the globular structure of the enzyme is changed. As a result catalysis cannot take place.

E.g. **Metal ions copper, mercury, silver** etc

Feedback inhibition: In 'Feedback inhibition', the end product of a chain of enzyme catalysed reactions inhibit the enzyme of the first reaction as part of homeostatic control of metabolism.

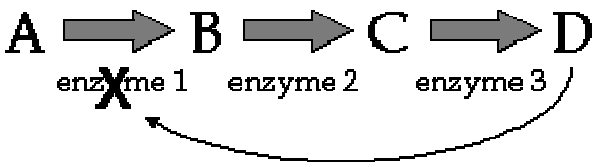
2. Explain different types of co-factors?

Ans: Co-factors are non-proteinaceous part of the complex enzymes .Protein part is called **apoenzyme**. Co-factors are essential for the activity of the enzymes.

Co-factors may be **inorganic metallic ions** or **organic molecules**. Organic co-factors are also called as co-enzymes.

Metallic co-factors: **Mg, Zn, Ca, Mo**, etc act as co-factors in the enzymes Hexokinase, Carbonic anhydrase, Nitrogenase respectively.

Co-enzymes which are **tightly bound** to the apoenzyme are called as **prosthetic groups** E.g. Heam in the activity of peroxidase and catalase.



3. Explain the mechanism of enzyme action?

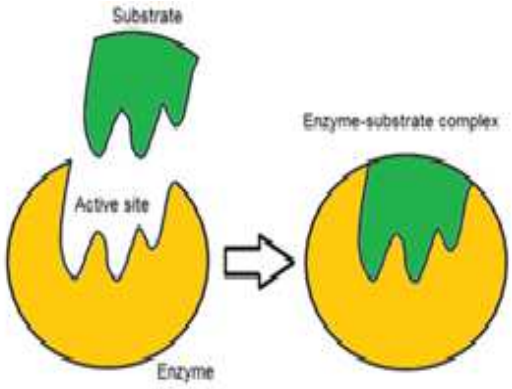
Ans: In all enzymatic reactions when an enzyme reacts with a substrate an intermediate enzyme substrate complex is going to form which dissociates into enzyme and product.

$$E + S \rightarrow [ES] \rightarrow [EP] \rightarrow E + P$$

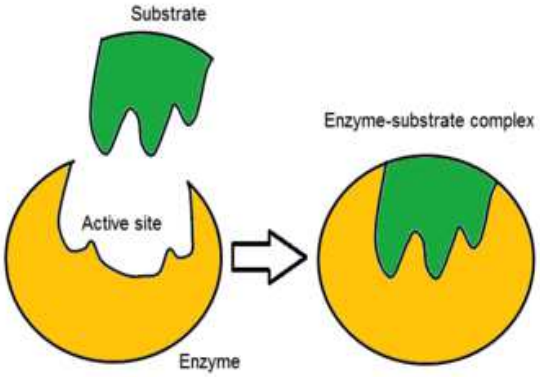
Formation of [ES] complex is essential for catalysis.

Formation of [ES] can be explained with 'Lock and Key' hypothesis by Emil Fisher and with 'Induced –Fit' hypothesis by Daniel E. Koshland.

It can be described in the following steps:



Lock and Key Model



Induced- fit model

1. First, the substrate binds to the active site of the enzyme , fitting into the active site.
2. The binding of the substrate induces the enzyme to alter its shape, fitting more tightly around the substrate.
3. The active site of the enzyme , now in close proximity with the substrate, breaks the chemical bonds of the substrate and the new enzyme- product complex is formed.
4. The enzyme releases the products of the reaction and the free enzyme is ready once again to bind to another molecule of the substrate and runs through the catalytic cycle once again.