Enzymes
Question:

• What are enzymes?
Enzymes

Answer:

1. Proteins: most enzymes are proteins, primarily tertiary and quaternary structures.

2. Catalyst: chemical agent that accelerates a reaction without being permanently changed in the process.
Enzymes

3. Selective: enzymes are specific for which they will catalyze (Specificity - depends upon 3D shape).

4. Recycled: enzymes are reusable.

5. “ase” endings: examples: sucrase, maltase, lactase
Question:

- How do enzymes work?
Enzymes

Answer:

- **Enzymes** speed up the cell’s chemical reactions by **lowering the free energy of activation**.
Enzymes

Progress of the reaction

- Reactants
- Products

Free energy of activation

- Without Enzyme
- With Enzyme

Free Energy

- Without Enzyme
- With Enzyme

Progress of the reaction
The **substance** (reactant) an **enzyme** acts on.
Active Site

- A **restricted region** of an **enzyme** molecule which **binds** to the **substrate**.
Induced Fit

- A **change** in the **configuration** of an enzyme’s **active site** (H and ionic bonds are involved).
- **Induced** by the **substrate**.
Enzymatic Reaction

\[
\text{substrate (sucrose)} + \text{enzyme (sucrase)} \rightarrow \text{enzyme-substrate complex} \rightarrow \text{products} + \text{sucrase}
\]

products: glucose and fructose
What Affects Enzyme Activity?

- Three factors:
  1. Environmental Conditions
  2. Cofactors and Coenzymes
  3. Enzyme Inhibitors
1. Environmental Conditions

- Enzymatic reactions are very specific. The following environmental conditions affect enzymatic reactions:

1. Temperature (extremes most dangerous):
   - high temps may denature the enzyme.

2. pH (most like 6 - 8 pH - neutral)

3. Ionic concentration (salt ions)
2. Cofactors and Coenzymes

- Inorganic substances *(zinc, iron)* and vitamins (respectively) are sometimes needed for proper enzymatic activity.

- **Example:**

  Iron must be present in the quaternary structure - hemoglobin in order for it to pick up oxygen.
3. Enzyme Inhibitors

- Two examples:
  a. **Competitive inhibitors**: are chemicals that resemble an enzyme’s normal substrate and compete with it for the active site.

![Diagram of enzyme and inhibitor interaction]

- Substrate
- Competitive inhibitor
- Enzyme
3. Enzyme Inhibitors

b. Noncompetitive inhibitors:
Inhibitors that do not enter the active site, but bind to another part of the enzyme causing the enzyme to change its shape, which in turn alters the active site.