

FULL A-LEVEL BIOLOGY NOTES: ENZYMES (Uganda UNEB / Biological Science Style)

INTRODUCTION

Every living organism carries out thousands of chemical reactions every second. These reactions include digestion, respiration, photosynthesis, protein synthesis, tissue repair, excretion and growth. Without enzymes, these reactions would occur extremely slowly and life would not be possible under normal body conditions.

DEFINITION OF ENZYMES

Enzymes are biological catalysts produced by living cells which speed up chemical reactions without themselves being chemically changed or used up. Most enzymes are proteins made of amino acids folded into a complex three-dimensional structure.

WHY ENZYMES ARE IMPORTANT

The body depends on enzymes for all metabolic reactions. Digestion, respiration, movement, nerve transmission, blood clotting and tissue repair all depend on enzyme action. Without enzymes, food would not be broken down, ATP would not be produced and cells would die.

HOW ENZYMES WORK

Each enzyme possesses an active site. The substrate fits into this active site to form an enzyme-substrate complex. The enzyme lowers activation energy, allowing reactions to occur rapidly.

LOCK AND KEY HYPOTHESIS

According to the lock and key hypothesis, the active site has a fixed shape and only a substrate with a complementary shape can fit into it. This explains enzyme specificity.

INDUCED FIT HYPOTHESIS

Modern biology explains that the active site is flexible. When substrate approaches, the active site changes shape slightly to fit the substrate more effectively.

FACTORS AFFECTING ENZYME ACTIVITY

Enzyme activity is affected by temperature, pH, substrate concentration, enzyme concentration and inhibitors. These factors alter collision frequency or change enzyme structure.

TEMPERATURE

At low temperatures molecules move slowly and fewer collisions occur. As temperature increases, enzyme activity rises until the optimum temperature is reached. Beyond optimum temperature, enzymes become denatured because heat destroys weak bonds maintaining enzyme structure.

pH

Each enzyme works best at a particular pH. Extreme pH changes ionic and hydrogen bonds within the enzyme causing denaturation. Pepsin works best in acidic conditions while trypsin works best in alkaline conditions.

ENZYME INHIBITION

Competitive inhibitors compete with the substrate for the active site. Non-competitive inhibitors bind elsewhere and change the active site's shape. Many poisons and pollutants inhibit enzymes.

DIGESTIVE ENZYMES

Amylase breaks starch into maltose, proteases digest proteins into amino acids and lipase breaks fats into fatty acids and glycerol. Digestion depends entirely on enzymes.

ENZYMES IN RESPIRATION

Respiration is controlled by many enzymes. ATP synthase helps produce ATP which provides energy for active transport, muscle contraction and biosynthesis.

ENZYMES IN IMMUNITY

Lysozyme found in tears, mucus and saliva destroys bacterial cell walls. This protects the body against infections.

HOW POLLUTION AFFECTS ENZYMES

Pollutants and smoke damage respiratory tissues and inhibit enzymes such as lysozyme. As enzyme activity decreases, bacteria survive and respiratory infections increase.

ENZYMES IN WOUND HEALING

Collagenase breaks down damaged collagen during tissue repair. In diabetes, reduced enzyme activity slows tissue remodeling leading to delayed wound healing.

ENZYMES AND DISEASES

Many diseases result from absence, inhibition or malfunction of enzymes. Poisonous substances like cyanide inhibit respiratory enzymes preventing ATP production.

HOW TO ANSWER UNEB ENZYME QUESTIONS

Modern UNEB questions require explanation from the biological basis. Students should explain the normal role of the enzyme, how the enzyme becomes affected and the final effect on tissues, organs and the whole body.

COMMON ENZYMES AND THEIR FUNCTIONS

Enzyme	Substrate	Products	Function
Amylase	Starch	Maltose	Digestion of carbohydrates
Protease	Proteins	Amino acids	Protein digestion
Lipase	Fats	Fatty acids + glycerol	Fat digestion
Lysozyme	Bacterial wall	Destroyed bacteria	Body defense
Collagenase	Collagen	Smaller fragments	Tissue repair

END OF NOTES — Continue revising by connecting enzymes to immunity, respiration, diseases, tissue repair and metabolism.