

REGENTS Biology

Enzymes:

“Helper” Protein molecules

s1

Flow of energy through life

- Life is built on chemical reactions

s2

Nothing works without enzymes!

- How important are enzymes?
 - all chemical reactions in living organisms require enzymes to work**
 - building molecules
 - synthesis enzymes
 - breaking down molecules
 - digestive enzymes
 - enzymes speed up reactions

We can't live without enzymes!

s4

ENZYMES

- A specialized type of protein
- Function in our body: acts like a **catalyst** = substance that speeds up the rate of a chemical reaction but it is **not** used up in the reaction.

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Enzymes are proteins

- Each enzyme is the specific helper to a specific reaction
 - each enzyme needs to be the **right shape** for the job
 - enzymes are named for the reaction they help
 - sucrase breaks down sucrose
 - proteases breakdown proteins
 - lipases breakdown lipids
 - DNA polymerase builds DNA

Oh, I get it! They end in -ase

s6

Enzymes aren't used up

- Enzymes are not changed by the reaction
 - used only temporarily
 - re-used again for the same reaction with other molecules
 - very little enzyme needed to help in many reactions

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It's shape that matters!

- **Lock & Key model**
 - ♦ **shape of protein** allows enzyme & substrate to fit
 - ♦ **specific enzyme** for each **specific reaction**

Enzyme vocabulary s10

- **Enzyme**
 - ♦ helper molecule
- **Substrate**
 - ♦ molecule that enzymes work on
- **Enzyme-substrate complex**
 - ♦ enzyme & molecule temporarily joined
- **Active site**
 - ♦ part of enzyme that substrate molecule fits into

What affects enzyme action

- **Enzyme concentration**
 - ♦ More available to work
- **Correct protein structure**
 - ♦ correct order of amino acids
 - ♦ why? enzyme has to be right shape
- **Temperature**
 - ♦ why? enzyme has to be right shape
- **pH (acids & bases)**
 - ♦ why? enzyme has to be right shape

Enzyme concentration

- **Effect on rates of enzyme activity**
 - ♦ as **increase** amount of enzyme = **increases** how fast the reaction happens
 - more enzymes = more frequently they collide with substrate

Enzyme concentration

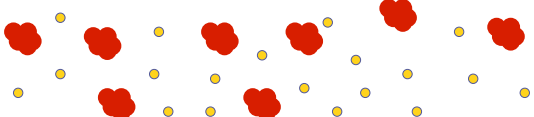
reaction rate ↑

amount of enzyme →

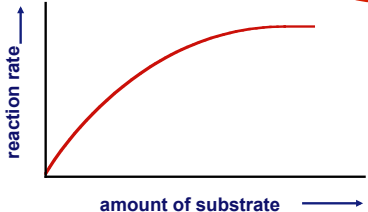
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Substrate concentration

- Effect on rates of enzyme activity
 - as **increase** amount of substrate = **increases** how fast the reaction happens
 - more substrate = more frequently they collide with enzyme



Substrate concentration



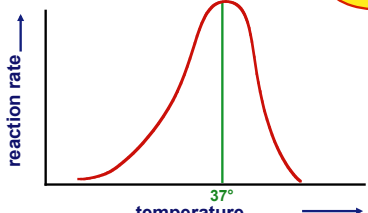
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Temperature

- Effect on rates of enzyme activity
 - Optimum temperature**
 - greatest number of collisions between enzyme & substrate
 - human enzymes = **35° - 40°C (body temp = 37°C)**
 - Raise temperature**
 - denature protein = unfold = lose shape**
 - Lower temperature T°**
 - molecules move slower
 - decrease collisions

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Temperature



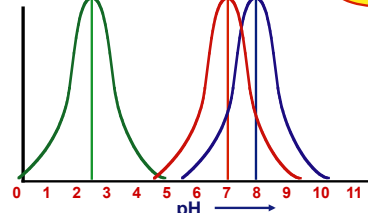
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pH

- Effect on rates of enzyme activity
 - pH changes protein shape**
 - most human enzymes = pH 6-8**
 - depends on where in body
 - pepsin (stomach) = pH 3
 - trypsin (small intestines) = pH 8

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pH



s21

