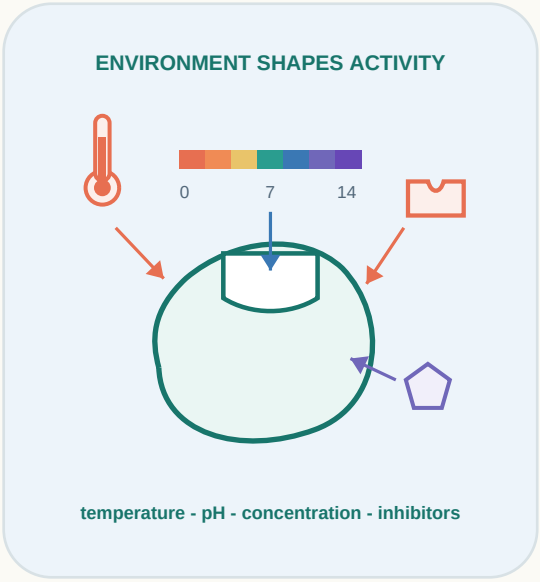
AP BIOLOGY | UNIT 3

TOPIC 3.2

Environmental Impacts on Enzyme Function

Temperature, pH, molecule concentrations, and inhibitors change enzyme activity by altering collisions, binding, or protein shape.



THE CORE CAUSAL CHAIN

CONDITION
temperature, pH, etc.

→

MOLECULES
collisions or bonds

→

ACTIVE SITE
binding changes

→

RATE
activity rises or falls

BY THE END, YOU SHOULD BE ABLE TO...

1. Explain temperature and pH effects on enzyme activity.
2. Interpret enzyme-rate graphs and identify an optimum.
3. Compare competitive and noncompetitive inhibition.

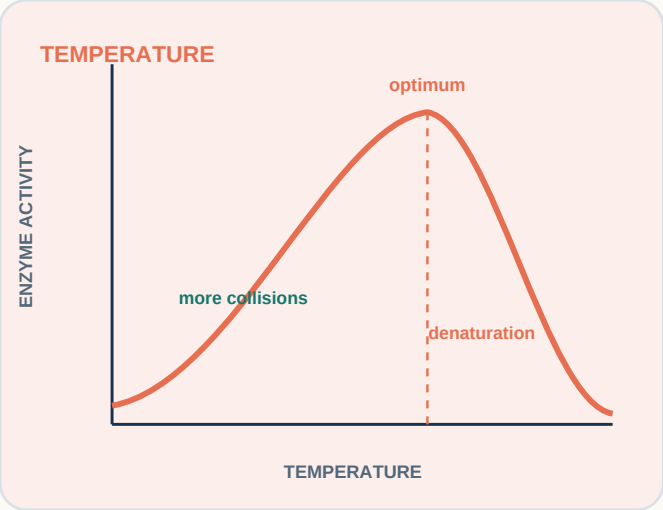
BIG IDEA

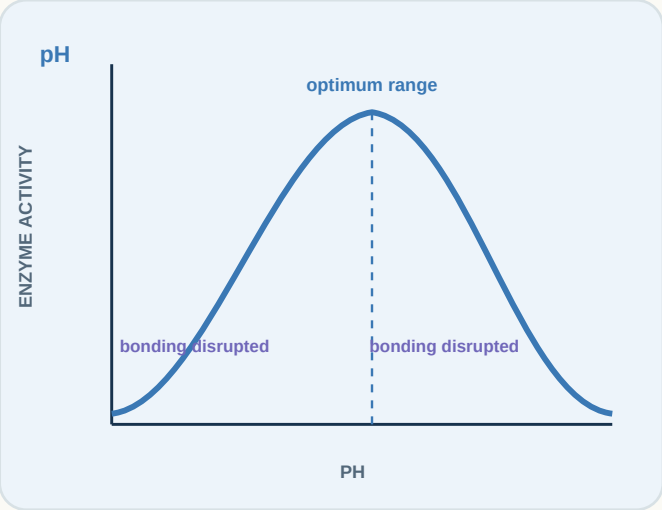
An environmental factor changes enzyme activity only through a mechanism: collision frequency, molecular binding, or the structure of the enzyme itself.

1 Temperature, pH, and enzyme shape

Moderate changes can alter collision frequency; larger changes can disrupt the interactions that maintain an enzyme's active-site structure.

ACTIVITY CURVES





FROM CONDITION TO MECHANISM

LOW TEMPERATURE	molecules move more slowly	→	fewer successful collisions; lower rate
HIGH TEMPERATURE	weak interactions in the protein are disrupted	→	active site changes; activity falls
EXTREME pH	charges and bonding interactions change	→	folding or substrate binding is disrupted

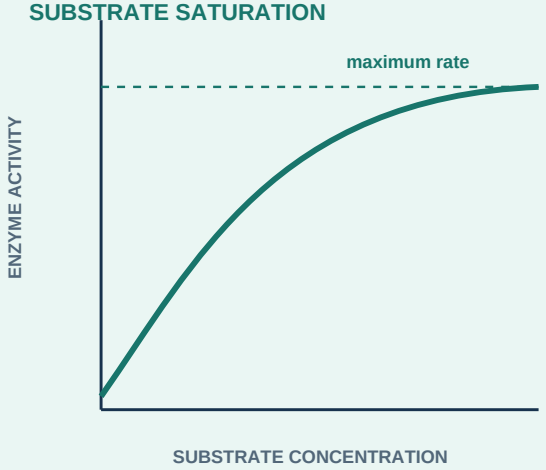
READ THE GRAPH CAREFULLY

An optimum is a maximum under the tested conditions. It is not proof that every enzyme works best at the same temperature or pH.

2 Concentration and inhibition

Reaction rate depends on how often active sites are occupied and whether other molecules block binding or alter catalytic structure.

SUBSTRATE SATURATION

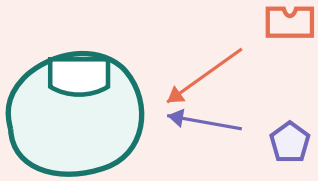


CONCENTRATION BALANCE

- **MORE SUBSTRATE**
  rate rises until active sites are saturated
- **MORE ENZYME**
  maximum possible rate can increase
- **MORE PRODUCT**
  net forward rate may slow as products accumulate

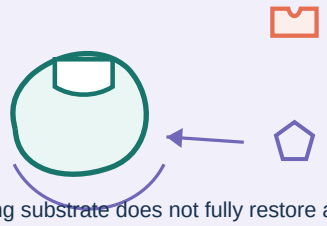
TWO WAYS TO INHIBIT

COMPETITIVE



More substrate can reduce the inhibitor's effect because binding is competitive.

NONCOMPETITIVE



Adding substrate does not fully restore activity because catalytic function is altered.

SIDE-BY-SIDE

	COMPETITIVE	NONCOMPETITIVE
BINDING SITE	active site	another site
MORE SUBSTRATE	can reduce inhibition	does not fully restore activity

DATA FIRST

Use the pattern in the data to identify an effect, then explain the molecular mechanism that could produce that pattern.