

Enzymes and metabolism · supported focus

International Baccalaureate · IB Diploma · Biology · HL

Scope and prerequisites

Supported HL focus. First assessment 2025; current subject brief acquired; full Biology guide not acquired. Remaining guide, assessment and practical requirements retain their recorded holds.

Prerequisites: read the stated quantities and units, use arithmetic and the model conditions below. Each lesson develops its own method before independent transfer.

These are original or explicitly fictional teaching examples, not actual measurements or completed assessed learner investigations.

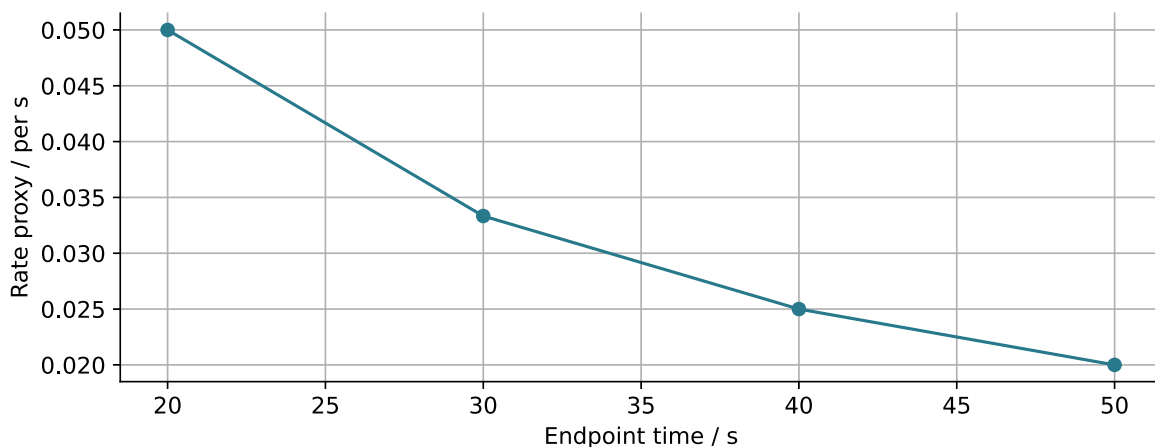
Enzyme rate and controlled measurements

■ What would explain this observation?

- An **enzyme** works quickly at one temperature and slowly at another. Heating can increase successful collisions, but excessive heat can change the active site.
- Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

■ Build the model

- An enzyme is a biological catalyst. The substrate binds at an active site whose shape and chemical properties support the reaction. A catalyst increases rate without being used up overall.
- enzyme: A biological catalyst; **denaturation** : A structural change that disrupts function.



■ Choose evidence that can test it

- Measure rate using product formed per unit time or a fixed endpoint. For an endpoint test, $1/\text{time}$ is a rate proxy if the same amount of product or substrate change defines the endpoint each time.
- For starch digestion, equilibrate enzyme and starch in a water bath, control pH with buffer, mix measured volumes, and test samples with iodine at fixed intervals. Use a clean spot for each test. Do not put iodine into the reaction mixture.

■ Work from known quantities

- State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution.
- Known: the endpoint is reached in 40 s. Use rate proxy = $1/\text{time}$. Rate proxy = $1/40 = 0.025$ per second. At 20 s the proxy is 0.050 per second, twice as large. This comparison is valid only if the same endpoint and starting concentrations are used.

Example:

A fixed endpoint takes 50 s. Calculate the rate proxy $1/\text{time}$. Use the same sequence: known quantities $\rightarrow$ model $\rightarrow$ relation $\rightarrow$ substitution $\rightarrow$ unit and interpretation.

■ Check the conclusion and its limits

- An optimum is specific to the enzyme and conditions. Low temperature usually slows the reaction; it does not necessarily denature the enzyme. Endpoint intervals limit precision.
- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Warn:

A low temperature always permanently denatures an enzyme. This claim is false: An optimum is specific to the enzyme and conditions. Low temperature usually slows the reaction; it does not necessarily denature the enzyme. Endpoint intervals limit precision.

Key:

Enzyme rate and controlled measurements: Measure rate using product formed per unit time or a fixed endpoint. For an endpoint test, $1/\text{time}$ is a rate proxy if the same amount of product or substrate change defines the endpoint each time.