

Stopping enzymes HL

60 minutes • C1.1.15 to C1.1.17 • Chapters 12, 13, 14

Competitive inhibition and statins, feedback inhibition of the isoleucine pathway, and penicillin

BY THE END, STUDENTS CAN

- ☐ Explain how statins inhibit an enzyme competitively, and contrast competitive and non-competitive inhibition on a graph C1.1.15
- ☐ Explain how isoleucine controls its own pathway by feedback inhibition C1.1.16
- ☐ Explain how penicillin inhibits transpeptidase for good, and how a changed transpeptidase makes bacteria resistant C1.1.17

TIMING

0-6	6 min	Do now: Sketch, then check	
6-18	12 min	Chapter 12: statins	
18-30	12 min	Chapter 13: the pathway valve	
30-40	10 min	Chapter 14: a trap that springs once	
40-55	15 min	Plan an 8-mark answer	
55-60	5 min	Exit	
	60 min	One lesson	

STARTER

6 Do now: Sketch, then check

min The higher level version, below: three lines on one graph. Students draw their prediction before [chapter 12](#).

ON THE BOARD, FROM THE GUIDE

Open the guide on the projector at each chapter (the links work in this PDF). Every figure plays from its own buttons, and the lesson's slides have the same figures, step by step, in the order of this plan.

12 [A look-alike in the active site](#)

CHAPTER 12 IN THE SLIDES

Step through the figure (4 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. HMG-CoA reductase: an early step on the way to **cholesterol**.
2. Part of a **statin** looks like the substrate and binds the active site.
3. It binds and leaves: **competitive** and **reversible**.
4. Less cholesterol is made, and blood cholesterol falls.

Switch the figure through No inhibitor, Competitive, Non-competitive and All three, and have the class say what will change before each.

Step through the figure (2 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. Relenza: a competitive inhibitor designed to fit a virus's enzyme.
2. Cyanide: a poison that takes the place where oxygen binds.

Play the animation, Add an inhibitor. It loops; pause it on each moment below and ask what is happening (in the lesson slides it is a video).

1. Molecules move at **random**, and most collisions miss the active site.
2. A **successful collision**: it binds and reacts, and the enzyme is unchanged.
3. Plenty of substrate outcompetes it, so the rate climbs back near its **maximum**.

Predict box: Two samples of an enzyme: one with a competitive inhibitor, one with a non-competitive inhibitor. You add far more substrate to both. In which does the inhibitor's effect fade? Hands up or mini whiteboards first.

Answer D: The competitive one: substrate wins the site back

13 The end product shuts the gate

CHAPTER 13 IN THE SLIDES

Switch the figure through Slow, Normal and Fast, and have the class say what will change before each.

Predict box: Isoleucine inhibits the first enzyme of its five-step pathway, not the last. Why the first? Hands up or mini whiteboards first.

Answer B: So no threonine is spent on intermediates nobody needs

14 A trap that springs once

CHAPTER 14 IN THE SLIDES

Step through the figure (5 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. **Transpeptidase** cross-links the wall's sugar chains.
2. Penicillin looks like the peptide the enzyme joins.
3. The enzyme starts to act on it, and is trapped by a **covalent bond**: irreversible.
4. Without cross-links, the wall gives way and the cell bursts.
5. A changed transpeptidase binds penicillin poorly: **resistance**.

Predict box: A strain of bacteria keeps building strong walls in penicillin. Its transpeptidase still makes cross-links. What has most likely changed? Hands up or mini whiteboards first.

Answer C: Its transpeptidase's active site binds penicillin poorly

Remember it: Copycat Nudge Mousetrap (Competitive, Non-competitive, Mechanism-based).

THE LESSON

12

min

Chapter 12: statins

Chapter 12: the statins figure, the predict, then the graph's states against their sketches. Then the collisions film with each inhibitor.

12

min

Chapter 13: the pathway valve

Chapter 13: the predict, then the Pathway valve. Set Fast, then Slow, then untick the allosteric site. Ask what would happen to a bacterium with that mutation.

10

min

Chapter 14: a trap that springs once

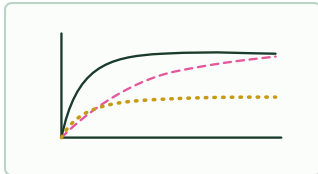
Chapter 14: the predict, then the figure. Finish with Copycat, Nudge, Mousetrap.

15

min

Plan an 8-mark answer

The writing task below: plan in keywords, then write.



DRAWING

Sketch, then check

Lesson 2: students sketch the three graphs of [chapter 7](#) from memory, then play the figure and correct their sketches in another colour.

Lesson 5: on one set of axes, draw rate against substrate concentration with no inhibitor, then a line for something competing for the active site, then one for something changing the active site's shape. Check against [chapter 12's](#) graph.

Needs: mini whiteboards, two colours of pen.



WRITING · HL

Plan an 8-mark answer

"Three molecules stop three enzymes: a statin, isoleucine and penicillin. Compare how each one does it, and say which can be undone. [8]" Plan in keywords first (competitive: binds the active site, resembles the substrate, reversible, more substrate overcomes it, statins; non-competitive: allosteric site, shape change, reversible, more substrate does not help; mechanism-based: covalent, irreversible, penicillin and transpeptidase; feedback with isoleucine; a sketch graph), then write. Peer mark against the points the class agrees.

Needs: lined paper.

PLENARY

5
min

Exit

Why can more substrate overcome a statin but not penicillin?

WHAT STUDENTS GET WRONG

All inhibitors block the active site. Non-competitive ones bind elsewhere.

More substrate overcomes any inhibitor. Only a competitive one.

Feedback inhibits the last enzyme. It inhibits the first, at the start of the pathway.

Penicillin is a competitive inhibitor. It binds covalently, for good.

Bacteria become resistant because penicillin changes them. The changed transpeptidase arose by mutation; penicillin selects it.

STRETCH AND SUPPORT

Stretch: methanol poisoning can be treated with ethanol, which competes with methanol for the active site of the same liver enzyme. Explain why a large dose of ethanol is needed, and has to be kept up, using [chapter 12's](#) graph.

Stretch: why might the isoleucine pathway's first enzyme respond to isoleucine in a switch-like way rather than gradually, and what would that give the cell? (Beyond the guide; for discussion only.)

Stretch: make a Tarsia puzzle on C1.1 better than the site's own, in the Tarsia builder.

IN THE GUIDE

- 12** [A look-alike in the active site](#)
- 13** [The end product shuts the gate](#)
- 14** [A trap that springs once](#)
- A11** [The whole guide, with the figures that play](#)
- PPTX** [This lesson's slides, in the order of this plan](#)

PRACTISE AND REVISE

BUILD FOR YOUR CLASS

- [Tarsia puzzle, dominoes and picture reveal](#) on C1.1, built from its key terms and ready to print
- A [pub quiz](#) with rounds on C1.1, to present or run with no projector
- An [escape room built from the question bank](#) on C1.1

ALREADY ON THE SITE FOR C1.1

- Lesson: [Enzymes & Metabolism HL \(HL\)](#)
- Lab: [The Enzyme in Your Spit](#)
- Summary doodle: [Enzymes & Metabolism](#)
- Quiz: [Enzymes](#)
- Quiz: [Enzymes & Metabolism \(HL\)](#)
- Revision map: [C1.1 Enzymes and metabolism](#), to fill in
- Exam questions: [C1.1 in the exam maker](#), a paper with its markscheme

CARD SETS ON SPLYCR

- Open a set to host it as a class game, or make a copy to edit.
- [C1.1 Enzymes and Metabolism](#)

EXAM PRACTICE

Check yourself

Set it for homework: a fresh paper of exam-bank questions on C1.1 at higher level each time, marked as students go and saved to their Exam practice when they are signed in.

biologybybradford.com/exam-maker/sit?topics=C1.1&level=HL&paper=quiz&marks=15&src=ep



How this was made. The course structure, the activities and the teaching choices come from my own classroom, my presentations and my years of teaching IB and AP Biology. I use Claude, an AI, to help write and build the interactive guides, lesson plans, slides and practice questions, and to draw the diagrams and code the interactives. I direct the work and review it against the IB and AP specifications before it goes live.