

Why life needs enzymes

60 minutes • C1.1.1, C1.1.2, C1.1.3, C1.1.10 • Chapters 1, 2, 3

What enzymes are for, metabolism as a web, anabolic and catabolic, and the activation energy hill

BY THE END, STUDENTS CAN

- ☐ Explain why cells need catalysts, and what an enzyme's speed does for digestion, growth and keeping cool enough to live C1.1.1
- ☐ Describe metabolism as a web of linked reactions, and sort reactions into anabolic and catabolic with an example of each C1.1.2, C1.1.3
- ☐ Read an energy diagram and explain how an enzyme lowers the activation energy without changing the energy released C1.1.10

TIMING

0-6	6 min	Do now: how long without an enzyme?	
6-16	10 min	Why speed matters	
16-28	12 min	Build or break?	
28-42	14 min	Draw the hill	
42-54	12 min	Enzymes and their substrates	
54-60	6 min	Exit: label the diagram	
	60 min	One lesson	

STARTER

- 6 min** **Do now: how long without an enzyme?**
- Put [chapter 1](#)'s predict box on the board and take a vote with fingers, 1 to 4. Leave the votes up, then play [chapter 1](#)'s figure: the same bond in starch, broken two ways. Students call out the gap between the two clocks.

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.

01 Seconds, not millions of years

CHAPTER 01 IN THE SLIDES

Step through the figure (3 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

- The same bond in starch, broken two ways.
- With water alone at room temperature, half the bonds take **millions of years** to break.
- Amylase breaks each one in about **a thousandth of a second**, at body temperature.

Predict box: With no enzyme at all, how long would water at room temperature take to break half the bonds between the glucose units in starch? Hands up or mini whiteboards first.

Answer C: About five million years

02 A web of reactions, an enzyme for each

CHAPTER 02 IN THE SLIDES

Step through the figure (3 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. One reaction, one enzyme.
2. The product of one reaction is the substrate of the **next**.
3. Thousands of linked reactions make **metabolism**. Switch off one enzyme and one step stops.

Show the figure: Six reactions in a cell or an organism. Is a bigger molecule being made, or a big one being taken apart?

Play the animation, Build glycogen, then break it down. It loops; pause it on each moment below and ask what is happening (in the lesson slides it is a video).

1. Glucose units join one at a time; a **water** molecule leaves at each link.
2. Amylose **coils** into a helix: a lot of glucose in a small space.
3. Amylopectin and glycogen **branch**, so they have many ends.
4. Enzymes take glucose off the **ends**, using a water molecule each time.

Predict box: A liver cell makes thousands of different enzymes. Why so many? Hands up or mini whiteboards first.

Answer A: Each enzyme catalyses one kind of reaction

Remember it: Add Cut (Anabolic, Catabolic).

03 A lower hill to climb

CHAPTER 03 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. A substrate, before it reacts.
2. Breaking its bonds needs energy first: the **activation energy**.
3. Making new bonds releases energy. Here more comes out than went in.
4. With an **enzyme**, the hill is lower. Start and end do not move.
5. A building reaction ends higher than it starts. An enzyme lowers its hill too.

Predict box: An enzyme lowers the activation energy of a reaction that releases energy. What happens to the energy released overall? Hands up or mini whiteboards first.

Answer D: Nothing: the start and end levels stay put

THE LESSON

10 min Why speed matters

Pairs list what would go wrong in a body with no enzymes. Take three answers and land on digestion in the hours food spends in the gut, copying all the DNA before a cell divides, and working at 37 °C. Then chapter 1's points: a catalyst is not used up, and heat is not an option for a cell.

12 min Build or break?

Chapter 2: step through the figure, from one reaction to a web. Then Build or break? in pairs, with the card sort below, and the chapter's own sorter on the board for the two cards the class argued over most. Finish with the Add and Cut tiles.

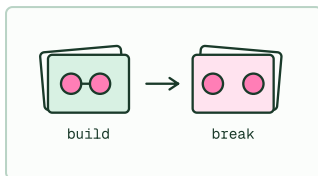
14 min Draw the hill

Mini whiteboards, alongside chapter 3's figure, one step at a time. Stop before step 4 and take the predict: what happens to the energy released overall? Students redraw the diagram with the lower hill and check the start and end levels against the figure.

12 min Enzymes and their substrates

The card match below, in groups. Then ask which of the seven reactions are anabolic, and which of the enzymes would have to be present in a liver cell.

ACTIVITIES

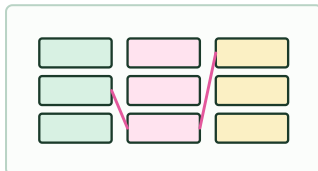


CARD SORT

Build or break?

Twelve cards, two headings: anabolic and catabolic. The six reactions of [chapter 2](#)'s sorter, plus DNA replication, making a phospholipid from glycerol and fatty acids, lipid digestion in the small intestine, breaking glycogen down to glucose in the liver, starch made in a potato, and protein broken down to amino acids in a cell. Each card is placed with the reaction type written under it: condensation, hydrolysis, oxidation or photosynthesis.

Needs: printed card sets, one per pair.

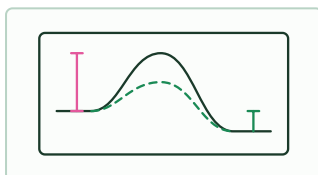


CARD GAME

Enzymes and their substrates

Triples to match, in three colours: amylase, starch, maltose; lipase, triglycerides, fatty acids and glycerol; pepsin, proteins, shorter peptides; catalase, hydrogen peroxide, water and oxygen; lactase, lactose, glucose and galactose; sucrase, sucrose, glucose and fructose; DNA polymerase, nucleotides, a DNA strand. Then ask: which are anabolic? Link the names to [chapter 2](#) and to the specificity of [chapter 6](#).

Needs: triples of cards in three colours.



DRAWING

Draw the hill

Students draw an energy diagram on a mini whiteboard for a reaction that releases energy, with and without an enzyme. They label the two activation energies and the energy released overall, then draw a second diagram for a reaction that takes energy in. Check each step against [chapter 3](#)'s figure.

Needs: mini whiteboards and pens.

PLENARY

6
min

Exit: label the diagram

On a sketch of an energy diagram, students label the activation energy with and without an enzyme, and the energy released overall.

WHAT STUDENTS GET WRONG

Enzymes are used up. They come out unchanged and work again.

Enzymes make reactions happen that otherwise could not. They speed up reactions that are possible but slow.

An enzyme changes the energy released. It lowers only the activation energy.

Breaking bonds releases energy. Breaking takes energy in; making bonds releases it.

All catabolism is hydrolysis. Respiration is an oxidation.

STRETCH AND SUPPORT

Support: the figures' captions as cut-up cards to put in order; the dotted key terms as a glossary; a writing frame for "explain the effect of temperature" (rise, optimum, fall, each with its reason).

Stretch: some enzymes speed reactions up more than a million million times. Why might the slowest reactions without enzymes be the ones cells most need enzymes for?

IN THE GUIDE

- 1 [Seconds, not millions of years](#)
- 2 [A web of reactions, an enzyme for each](#)
- 3 [A lower hill to climb](#)
- 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 standard 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=SL&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.