

Pathways, places and heat HL

60 minutes • C1.1.11 to C1.1.14 • Chapters 9, 10, 11

Enzymes inside and outside cells, linear and cyclical pathways, heat from metabolism, and the allosteric site

BY THE END, STUDENTS CAN

- ☐ Compare enzymes at work inside cells and outside them, and linear pathways with cycles C1.1.11, C1.1.13
- ☐ Explain why metabolism always releases heat, and how mammals and birds use it C1.1.12
- ☐ Explain how a molecule binding an allosteric site stops an enzyme, and why the binding can be undone C1.1.14

TIMING

0-5	5 min	Do now: Inside or outside?	
5-20	15 min	Chapter 9: chains and cycles	
20-32	12 min	Chapter 10: warm from the inside	
32-45	13 min	Chapter 11: a second site	
45-55	10 min	Timed written question	
55-60	5 min	Exit	
60 min		One lesson	

STARTER

- 5 min** **Do now: Inside or outside?**
- The card sort below, as a first look: students place each process inside or outside a cell on an A3 outline. Come back to it at the end of [chapter 9](#).

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.

09 Chains, cycles, inside and out

CHAPTER 09 IN THE SLIDES

Tap the parts of the figure in turn: The gut contents, Duct from the pancreas, Inside a cell, The cell's own membrane and An organelle inside the cell.

Play the animation, Three pathways on one map. It loops; pause it on each moment below and ask what is happening (in the lesson slides it is a video).

- Glycolysis**, in the cytoplasm: glucose is changed a step at a time, each step by its own enzyme.
- A **linear** pathway: what goes in at one end leaves at the other as something else, pyruvate.
- Back where it started: the last step remakes the molecule the first step needs. A **cycle**.

Predict box: Glycolysis runs in the cytoplasm, the Krebs cycle inside mitochondria, and protein digestion in your stomach. Which are intracellular? Hands up or mini whiteboards first.

Answer D: Glycolysis and the Krebs cycle: both inside cells

10 Warm from the inside

CHAPTER 10 IN THE SLIDES

Switch the figure through Energy from glucose and Body against air temperature, and have the class say what will change before each.

Predict box: A mouse and a lizard of the same mass sit at 20 °C for a day. Which needs more food, and why? Hands up or mini whiteboards first.

Answer C: The mouse: heat from respiration keeps it at 37 °C

11 A second site

CHAPTER 11 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. An active site, and a second site elsewhere: the **allosteric site**.
2. Only a specific molecule fits the allosteric site.
3. Binding changes the enzyme's shape, and with it the **active site**.
4. The binding is **reversible**: the inhibitor leaves, the enzyme works again.

Predict box: An allosteric inhibitor binds nowhere near the active site. How can it stop the enzyme? Hands up or mini whiteboards first.

Answer A: Binding changes the enzyme's shape, active site included

THE LESSON

15 Chapter 9: chains and cycles

min

Chapter 9: the predict, then the figure, tapping each part of the gut wall. Then the metabolism map on the board: run each pathway and ask whether its starting molecule comes back round. Teach the mnemonic: "Glycolysis goes; Krebs and Calvin come round."

12 Chapter 10: warm from the inside

min

Chapter 10: the predict (mouse or lizard), then both states of the figure. Ask: why does a bird need a warm body?

13 Chapter 11: a second site

min

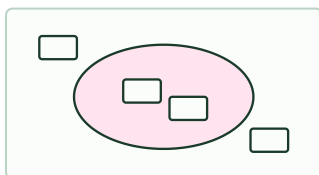
Chapter 11: the predict, then the figure. Students add an allosteric site to the plasticine enzyme from lesson 2 and show the active site changing shape.

10 Timed written question

min

A short written question on C1.1.1 to C1.1.13 from the exam maker, timed and marked.

ACTIVITIES



CARD SORT · HL

Inside or outside?

Cards: glycolysis, the Krebs cycle, the Calvin cycle, DNA replication, protein synthesis, starch digestion in the mouth, protein digestion in the stomach, lipid digestion in the small intestine, and lysozyme breaking bacterial walls in tears. Sort them onto a drawing of a cell with its outside marked. Then ask which are linear and which cyclical.

Needs: the cards and an A3 cell outline per group.

PLENARY

5 Exit

min

One difference between a linear and a cyclical pathway, with an example of each.

WHAT STUDENTS GET WRONG

Intracellular means in the cytoplasm. It means anywhere inside the cell, an organelle included.

Heat from respiration is waste with no use. Mammals and birds depend on it.

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

STRETCH AND SUPPORT

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

IN THE GUIDE

- 9 [Chains, cycles, inside and out](#)
- 10 [Warm from the inside](#)
- 11 [A second site](#)
- 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.