

Amino acids and peptide bonds

60 minutes • B1.2.1, B1.2.2 and B1.2.4 • Chapters 1, 2

Drawing a generalised amino acid, joining two by condensation, and why chains of twenty kinds are endless

BY THE END, STUDENTS CAN

- ☐ Draw a generalised amino acid and name the four groups on its alpha carbon B1.2.1
- ☐ Explain how condensation joins amino acids with peptide bonds, write the word equation and draw a dipeptide B1.2.2
- ☐ Explain why the number of possible polypeptides is practically endless B1.2.4

TIMING

0-5	5 min	Do now: draw it from memory	
5-15	10 min	The five strokes	
15-30	15 min	Model it, then draw it	
30-40	10 min	Peptide bonds	
40-55	15 min	Your name in amino acids	
55-60	5 min	Exit	
	60 min	One lesson	

STARTER

5 min Do now: draw it from memory

Students draw an amino acid with no notes, label the two functional groups and say what the side chain is. Keep the drawings: they are checked against the figure in the next step.

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 Every amino acid is built on the same core

CHAPTER 01 IN THE SLIDES

Step through the figure (6 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. The **alpha carbon** makes four bonds.
2. An **amine group** goes on the left bond: a nitrogen with two hydrogens.
3. A **carboxyl group** goes on the right bond: a carbon with a double bond to one oxygen and a single bond to an OH.
4. One **hydrogen** atom goes on the bottom bond.
5. The last bond carries the **R group**. It stands for whatever side chain this amino acid has.
6. Three different amino acids: the same core in each, and only the **R group** differs.

Predict box: A student draws an alpha carbon bonded to -NH₂, -COOH, R and -OH. What is wrong with the drawing? Hands up or mini whiteboards first.

Answer B: The fourth group should be a single hydrogen atom, not -OH

Remember it: A Cat Has Rhythm (Amine group, Carboxyl group, Hydrogen, R group).

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. Two amino acids, **R₁** and **R₂**, with the carboxyl group of the first facing the amine group of the second.
2. The **OH** from the carboxyl group and one **H** from the amine group are lit: they will leave as **water**.
3. The carbon bonds to the nitrogen and the water drifts away. The new C-N bond is a **peptide bond**.
4. A **dipeptide**, drawn as an examiner wants it. It still has an amine group at one end and a carboxyl group at the other.

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. Two **amino acids**.
2. The OH of one's **carboxyl group** and an H of the other's **amine group** face each other.
3. They leave as **water**, and a **peptide bond** joins the carbon to the nitrogen: **condensation**, making a **dipeptide**.
4. Add water and the peptide bond splits again, the OH back to the carbon and the H to the nitrogen: **hydrolysis**.

Predict box: Two different amino acids, A and B, are joined by one peptide bond. How many different dipeptides could they make? Hands up or mini whiteboards first.

Answer C: Two: A's carboxyl to B's amine, or B's carboxyl to A's amine, and these are different molecules

THE LESSON

10 min **The five strokes**

Play [chapter 1](#)'s figure one step at a time, with students drawing along on paper. Turn over the A Cat Has Rhythm tiles. Pairs then check each other's drawing for the five things an examiner looks for: the alpha carbon, the amine group, the carboxyl group, the hydrogen and the R group, with every bond showing.

15 min **Model it, then draw it**

With model kits, pairs build two amino acids, take the OH and the H away as water, join the C to the N and then draw the dipeptide and write the word equation (activity below). Then they add a third amino acid.

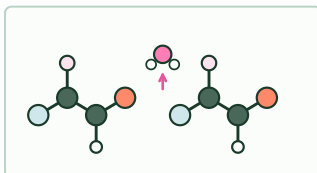
10 min **Peptide bonds**

[Chapter 2](#): the bond builder on the board, joining two different amino acids both ways round, then the predict box. Write the word equation once more, from memory.

15 min **Your name in amino acids**

Students spell a word in the one-letter code, draw it as a chain, mark the bonds and count the water released (activity below).

ACTIVITIES

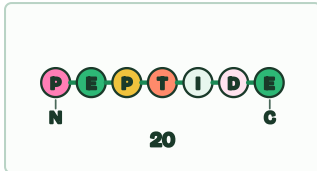


MODEL

Model it, then draw it

Pairs build two amino acids from a molecular model kit (two of the simplest, any two), take an -OH from one carboxyl group and an -H from the other amine group, join them as water, and connect the C to the N. Then they draw the dipeptide on paper and write the word equation. Last, they build a third amino acid and add it.

Needs: molecular model kits (or snatoms, as in A1.1), one per pair.



PUZZLE

Your name in amino acids

Each student spells a word or their name in the one-letter amino acid code (a table of the twenty letters on the board), draws it as a chain of beads, marks the peptide bonds, and marks the free amine group at one end and the free carboxyl group at the other. They count the bonds and the water released and work out how many sequences of that length could exist (20^n). The letters B, J, O, U, X and Z have no standard amino acid (O and U are codes for rare extra ones, not the twenty). Inside a chain only the two ends keep a free amine or carboxyl group, so label the alpha carbons and R groups on every amino acid, but the amine and carboxyl only at the ends. Then they type the word into Fold a protein, under [chapter 4](#), which counts its peptide bonds and the 20^n again, and watch the chain fold; a short word stays loose, and the element says it is too short to fold up.

Needs: a printed one-letter table.

PLENARY

5
min

Exit

How many different tripeptides are possible, and why? ($20 \times 20 \times 20 = 8,000$, because every position has twenty choices.)

WHAT STUDENTS GET WRONG

The peptide bond in the wrong place: between alpha carbons, through an oxygen, or to an R group. Ring the C-N between the C=O and the N-H.

Water from one amino acid. The OH comes from the carboxyl group of one and the H from the amine group of the other.

Twenty amino acids, so twenty proteins. The order makes the protein.

STRETCH AND SUPPORT

Support: give a traceable amino acid template, to trace and then to complete.

Support: use the four Remember it tiles as starters.

Support: cut the figures' captions up for students to put in order.

IN THE GUIDE

- 1** [Every amino acid is built on the same core](#)
- 2** [Peptide bonds join amino acids, and water leaves](#)
- 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 B1.2, built from its key terms and ready to print
- A [pub quiz](#) with rounds on B1.2, to present or run with no projector
- An [escape room](#) built from the [question bank](#) on B1.2

ALREADY ON THE SITE FOR B1.2

- Quiz: [Proteins \(HL\)](#)
- Revision map: [B1.2 Proteins](#), to fill in
- Exam questions: [B1.2 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.

- [B1.2 Proteins](#)

EXAM PRACTICE

Check yourself

Set it for homework: a fresh paper of exam-bank questions on B1.2 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=B1.2&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.