Building and breaking

60 minutes • 1.3.A • Chapters 1, 2, 3 • The dry lab

The four classes of macromolecule, dehydration synthesis and hydrolysis, with a paper clip model and the amylase dry lab

BY THE END, STUDENTS CAN

- [ ] Name the monomer, the polymer and the bond for carbohydrates, proteins and nucleic acids, and say why lipids are not polymers 1.3.A
- [ ] Describe dehydration synthesis: the H and OH that leave as water and the covalent bond that forms 1.3.A
- [ ] Describe hydrolysis, and explain digestion and rebuilding as catabolism and anabolism 1.3.A

TIMING

0–5	5 min	**Do now: what is in your lunch?**	
5–13	8 min	**Four classes**	
13–28	15 min	**Paper clip polymers**	
28–35	7 min	**Watch it, both ways**	
35–53	18 min	**Starter to sugar**	
53–60	7 min	**Exit**	
	60 min	**One lesson**	

STARTER

5 min

Do now: what is in your lunch?

Students list five foods and guess, for each, whether it is mostly carbohydrate, fat or protein. Keep the lists for lesson 2's food tests.

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 Big molecules from small parts

CHAPTER 01 IN THE SLIDES

Tap the parts of the figure in turn: Carbohydrates, Proteins, Nucleic acids and Lipids.

> **Predict box:** A student says DNA, starch, a protein and a fat are all polymers. Which one breaks the rule, and why? Hands up or mini whiteboards first.
>
> **Answer B: The fat, because it is one glycerol joined to three fatty acids, not a long chain of similar units repeated**

> **Remember it:** Sugar Protein Gene (Polysaccharide, Polypeptide, Nucleic acid).

02 Take water out to build

CHAPTER 02 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. Two **monomers**. Each has an H at one end and an OH at the other.
2. An enzyme brings them together: the OH of one and the H of the other are about to leave.
3. They leave as a molecule of **water**, and a **covalent bond** now joins the monomers: dehydration synthesis.
4. Repeat it and a chain grows, a **polymer**: one water released for every bond.
5. **Hydrolysis** runs it backward: a water molecule is split, its H to one monomer and its OH to the other, and the bond breaks.

> **Predict box:** Ten glucose molecules are joined into one unbranched chain. How many water molecules were released? Hands up or mini whiteboards first.
>
> **Answer C: 9**

03 Put water back to break

CHAPTER 03 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. Starch from a meal reaches the small intestine: a chain of glucose units too big to cross into the blood.
2. Enzymes split it by **hydrolysis**, one water molecule into every bond.
3. What is left is **monomers**, glucose small enough to be absorbed. Breaking down like this is **catabolism**.
4. In the liver the same glucose is joined into glycogen by **dehydration synthesis**, releasing water: building up, **anabolism**.

Show the figure: Every 30 seconds a drop of the mixture goes into iodine. Blue-black means starch is still there; when a drop stays orange-brown, the starch is gone.

> **Predict box:** A starch molecule of 300 glucose units, in one unbranched chain, is digested completely to glucose. How many water molecules does that use? Hands up or mini whiteboards first.
>
> **Answer B: 299**

> **Remember it:** Dehydrate Hydrolyze (Water out, Water in).

THE LESSON

8 min

Four classes

Chapter 1's tap figure on the board. Students copy a table of class, monomer, polymer and bond, filling it in as you tap. Then chapter 1's predict box: which one is not a polymer?

15 min

Paper clip polymers

The model activity below: pairs build a chain by dehydration synthesis, paying a water token for every bond, then digest it by hydrolysis. Chapter 2's and chapter 3's predict boxes (10 glucose, then 300) are the checks.

7 min

Watch it, both ways

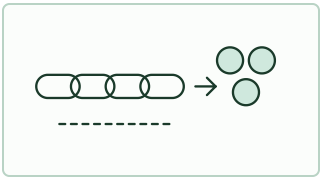
Chapter 2's figure a step at a time, then chapter 3's: digestion in the gut, rebuilding in the liver. Students label each as anabolism or catabolism.

18 min

Starch to sugar

The amylase dry lab in pairs: the control first, then four amounts of enzyme, three runs each. Students predict before each change and graph the mean rate. Where you have the kit, run 1% amylase and the boiled control for real on a spotting tile.

ACTIVITIES

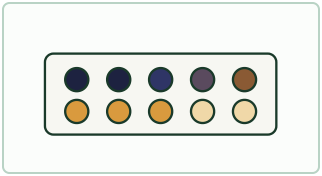


MODEL

Paper clip polymers

Each paper clip is a monomer and each small card a water molecule, marked H on one half and OH on the other. To join two clips, a pair tears a card in half and puts the halves in the "released" pile; to split a bond, they take a whole card from the "used" pile. Build a chain of ten, count the water, then hydrolyze it back to clips. Colored clips make a protein instead: the order of colors is its sequence.

Needs: 10 paper clips per pair (some in four colors), 20 small cards per pair.



DRY LAB

Starch to sugar

The amylase dry lab under chapter 3: starch and amylase in a water bath, a drop onto iodine every 30 seconds. Students time how long the starch lasts with the boiled control and four amounts of enzyme, and graph the rate. For real: 5 mL of 1% starch and 1 mL of 1% amylase at 37 °C, drops onto iodine on a spotting tile, with a boiled amylase tube beside it.

Needs: phones or laptops. For the real version: 1% starch, 1% amylase, iodine solution, spotting tiles, droppers, a 37 °C water bath, timers, eye protection.

PLENARY

7 min

Exit

On paper: "Describe what happens to a water molecule when a polysaccharide is hydrolyzed" (2 marks). Then the doubling predict box under the dry lab.

WHAT STUDENTS GET WRONG

"Fats are polymers." They are large and built by dehydration synthesis, but not chains of repeating monomers.

"Hydrolysis adds water to a molecule." It splits water: the H goes to one new end and the OH to the other. Chapter 2's figure, step 5, shows both.

"A chain of n units releases n waters." It releases n − 1, one per bond. The paper clip model makes them count.

STRETCH AND SUPPORT

Stretch: a protein of 150 amino acids is digested completely. How many water molecules are used, and how many peptide bonds broken?

Stretch: in the amylase dry lab, explain why the rate stops doubling with the enzyme once there is very little starch left.

Support: a table of class, monomer, polymer and bond, half filled in, to complete from chapter 1's figure.

For revision: students can drill this unit's key terms on Cramly.

IN THE GUIDE

1 Big molecules from small parts
2 Take water out to build
3 Put water back to break
Lab Dry lab: Test the food
All The whole guide, with the figures that play
PPTX This lesson's slides, in the order of this plan

EXAM PRACTICE

Check yourself

Set it for homework: a fresh paper of exam-bank questions on 1.3 and 1.4 each time, marked as students go and saved to their Exam practice when they are signed in.

biologybybradford.com/exam-maker/sit?program=ap&units=U1&ced=1.3,1.4&paper=quiz&marks=15&src=ep

PRACTISE AND REVISE

BUILD FOR YOUR CLASS

- Tarsia puzzle, dominoes and picture reveal on Unit 1, built from its key terms and ready to print
- A pub quiz with rounds on Unit 1, to present or run with no projector
- The Frozen Lake Station escape room, or an escape room built from the question bank on Unit 1

ALREADY ON THE SITE FOR UNIT 1

- Lesson: Macromolecules & Carbohydrates
- Quiz: Macromolecules & Carbohydrates
- Exam questions: Unit 1 in the exam maker, a paper with scoring guidelines

CARD SETS ON SPLYCR

Open a set to host it as a class game, or make a copy to edit.

- Unit 1: Chemistry of Life (part 1)
- Unit 1: Chemistry of Life (part 2)

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.