

Light into sugar

60 minutes • C1.3.1, C1.3.2, C1.3.3 and C1.3.5 • Chapters 1, 2, 4

Where the energy and the atoms of glucose come from, why the oxygen is from water, and why leaves absorb red and blue light

BY THE END, STUDENTS CAN

- ☐ Explain how photosynthesis turns light energy into the chemical energy of carbon compounds, and why ecosystems depend on it C1.3.1
- ☐ Write the word equation, say where each atom of glucose comes from, and explain why the oxygen given off comes from water C1.3.2, C1.3.3
- ☐ Explain why pigments absorb only some wavelengths, and read and sketch an absorption spectrum with wavelengths and colours C1.3.5

TIMING

0-6	6 min	Do now: sketch the equation	
6-14	8 min	Where the energy comes from	
14-28	14 min	Where the atoms go	
28-38	10 min	Two processes compared	
38-54	16 min	Why leaves are green	
54-60	6 min	Exit	
	60 min	One lesson	

STARTER

- 6 min** **Do now: sketch the equation**
- Students draw photosynthesis as a picture with its inputs, outputs and conditions, from memory (activity below), then share it with a partner.

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 Sunlight in, chemical energy out

CHAPTER 01 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.

- Light energy** from the Sun reaches a leaf.
- Photosynthesis turns it into **chemical energy** in the bonds of sugar.
- The cow lives on that energy, and stores some of it in milk.
- You release it in **respiration**, as ATP, and every step loses some as **heat**.

Predict box: The chemical energy in a slice of cheese: where did it first come from? Hands up or mini whiteboards first.

Answer B: Light caught by the grass it ate

02 Carbon from the air, hydrogen from water

CHAPTER 02 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. What goes in: **carbon dioxide** from the air, **water** from the soil.
2. Light energy **splits water**. The oxygen leaves as a by-product.
3. The **hydrogen** is added to carbon dioxide, building **glucose**.
4. carbon dioxide + water → glucose + oxygen. The bars show where each atom came from: green, carbon dioxide; pink, water.

Show the figure: Six atoms or molecules and two bins. Which molecule going in had the atom at all, and what tells you?

Play the animation, From light to sugar. It loops; pause it on each moment below and ask what is happening (in the lesson slides it is a video).

1. Into a **leaf**, a **palisade cell**, a **chloroplast** and the **thylakoids** where its pigments sit.
2. Chlorophyll absorbs **red** and **blue** light and reflects **green**.
3. Energy absorbed by chlorophyll **splits water**. The **oxygen** is given off as a by-product.
4. **Carbon dioxide** diffuses in from the air.
5. Hydrogen from water is added to carbon dioxide, building **glucose**, which can be stored as **starch**.
6. **carbon dioxide + water → glucose + oxygen**

Predict box: Where does the oxygen gas a leaf gives off come from? Hands up or mini whiteboards first.

Answer D: From the water it splits

04 Why some colours and not others

CHAPTER 04 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. **White light** is every colour together.
2. Chlorophyll absorbs **blue** and **red** and reflects most **green**.
3. An **absorption spectrum**: how much of each wavelength a pigment absorbs. These are for pigments dissolved in a solvent.
4. **Accessory pigments** absorb where chlorophyll a absorbs least.

Show the figure: Sketch chlorophyll's absorption spectrum: seven handles, one for each colour band. Chlorophyll a is the pigment to draw.

Predict box: Why does chlorophyll absorb red and blue light but very little green? Hands up or mini whiteboards first.

Answer D: Red and blue photons match jumps its electrons can make

Remember it: Richard Of York Gave Battle In Vain (Red, Orange, Yellow, Green, Blue, Indigo, Violet).

THE LESSON

8
min

Where the energy comes from

Chapter 1: the predict (the cheese) as a vote, then the figure. Pairs draw the Energy flowchart (below).

14
min

Where the atoms go

Chapter 2: the predict, then the figure step by step. Then Where does each atom go? (the card sort below, or the chapter's sorter on the board). Then play the photosynthesis film, SL, whole: "Light in, water split, oxygen out, sugar made."

10
min

Two processes compared

The Venn below: respiration, met in C1.2, against photosynthesis.

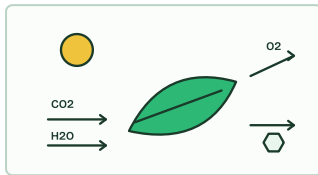
16

min

Why leaves are green

Chapter 4: the predict. Students sketch the spectrum on paper (Draw the spectrum, below), then set chapter 4's handles on the board. Play the figure, then turn over the Richard Of York tiles.

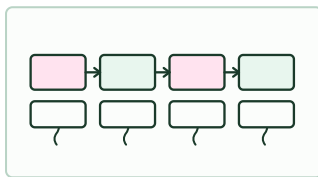
ACTIVITIES

**DO NOW**

Sketch the equation

Students draw photosynthesis as a picture: what goes in, what comes out, where, and what it needs. Shared with a partner, then compared with chapter 2's figure.

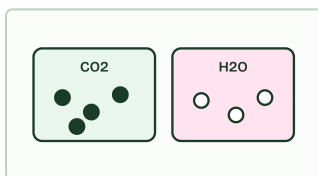
Needs: mini whiteboards.

**PAIRS**

Energy flowchart

Eight cards (Sun, light energy, leaf, chemical energy in glucose, a rabbit, chemical energy in ATP, muscle contraction, heat) laid as a flowchart (chapter 1). Then pairs add where heat leaves at every step.

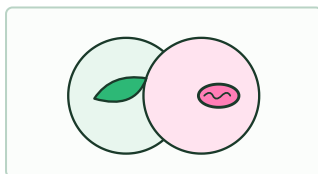
Needs: card sets.

**CARD SORT**

Where does each atom go?

Ten small cards (each a coloured atom: the carbon, hydrogen and oxygen atoms of glucose, the oxygen gas, the carbon in starch, the hydrogen in a fat, the oxygen atoms in the carbon dioxide, and so on) sorted onto two mats, "from carbon dioxide" and "from water" (chapter 2). The class then hears the heavy-oxygen story.

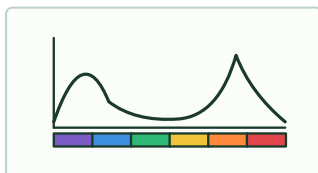
Needs: card sets and two mats per pair.

**VENN**

Two processes compared

A two-circle Venn: photosynthesis and respiration. Where it happens, inputs, outputs, energy in or out, and which organisms. At least three things go in the overlap (ATP made, membranes, enzymes, both in plant cells).

Needs: an A4 Venn sheet.

**SKETCH**

Draw the spectrum

On axes with wavelengths and a coloured strip of the visible spectrum, students sketch chlorophyll's absorption spectrum in pencil, then chlorophyll b's in another colour, and check against chapter 4's figure.

Needs: printed axes and coloured pencils.

PLENARY

6

min

Exit

Label where each atom of glucose came from, and say in one sentence why a leaf looks green.

WHAT STUDENTS GET WRONG

The oxygen comes from carbon dioxide. It comes from water ([chapter 2](#)).

Plants get their mass from the soil. Most of it is carbon and oxygen from the air.

Plants photosynthesise by day and respire by night. They respire all the time.

Leaves are green because chlorophyll makes green light. Green is what is not absorbed.

Light splits water directly. Chlorophyll absorbs the light, and its energy is used to split the water; light falling on water does not split it.

STRETCH AND SUPPORT

Support: chapter captions as cut-up cards to put in order; the dotted key terms as a glossary; a writing frame for "explain the effect of light intensity" (rise, why, plateau, why).

Stretch: if all the oxygen given off comes from water, the equation needs 12 water molecules in and 6 out. Write that equation and say why.

IN THE GUIDE

- 1** [Sunlight in, chemical energy out](#)
- 2** [Carbon from the air, hydrogen from water](#)
- 4** [Why some colours and not others](#)
- 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 C1.3, built from its key terms and ready to print
- A [pub quiz](#) with rounds on C1.3, to present or run with no projector
- An [escape room built from the question bank](#) on C1.3

ALREADY ON THE SITE FOR C1.3

- [Quiz: Photosynthesis](#)
- [Quiz: Photosynthesis \(HL\)](#)
- Revision map: [C1.3 Photosynthesis](#), to fill in
- Exam questions: [C1.3 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.
- [C1.3 Photosynthesis \(SL\)](#)
 - [C1.3 Photosynthesis \(HL\)](#)

EXAM PRACTICE

Check yourself

Set it for homework: a fresh paper of exam-bank questions on C1.3 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=C1.3&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.