

Lipids

60 minutes • B1.1.8 to B1.1.12 • Chapters 7, 8, 9, 10

Why lipids avoid water, how fats and phospholipids are built, and how fats store and insulate

BY THE END, STUDENTS CAN

- ☐ Explain why lipids are hydrophobic, and how condensation builds triglycerides and phospholipids B1.1.8, B1.1.9
- ☐ Compare saturated, monounsaturated and polyunsaturated fatty acids and explain their melting points B1.1.10
- ☐ Explain why triglycerides suit long-term energy storage and insulation, and compare them with carbohydrates as stores B1.1.11
- ☐ Explain how amphipathic phospholipids form a bilayer in water B1.1.12

TIMING

0-8	8 min	Do now: the salted butter puzzle	
8-15	7 min	Oil and solvents	
15-25	10 min	Make a fat, make a phospholipid	
25-40	15 min	Fats from the fridge	
40-50	10 min	Store and insulate	
50-60	10 min	Half loves water	
	60 min	One lesson	

STARTER

8
min

Do now: the salted butter puzzle

The [chapter 7](#) predict box. Then start melting the butter (the demo below) and leave it to settle.

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.

07 Lipids keep their distance from water

CHAPTER 07 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. Shake oil with **water**,
2. and it separates and floats: it does not dissolve.
3. In a **non-polar solvent** such as hexane, it dissolves.
4. Butter is mostly fat, with some water and, in salted butter, salt.
5. Melted, the **fat** separates from the watery layer, and the salt stays dissolved in the water.

Switch the figure through Triglyceride and Phospholipid, and have the class say what will change before each.

Predict box: You have salted butter but need it unsalted. What could you do? Hands up or mini whiteboards first.

Answer B: Melt it, leave it to settle, then pour the fat off the water

08 Every double bond puts a kink in the tail

CHAPTER 08 IN THE SLIDES

Switch the figure through Saturated, Monounsaturated and Polyunsaturated, and have the class say what will change before each.

Predict box: Olive oil's fatty acids are mostly monounsaturated, and ordinary sunflower oil's are mostly polyunsaturated. Both are liquid at room temperature. You put a bottle of each in the fridge at 5 °C. Which turns cloudy and thick? Hands up or mini whiteboards first.

Answer B: Olive oil: fewer double bonds per chain, so a higher melting point

Remember it: Double Kinks Leave Liquids (C=C double bond, Kinked chain, Loose packing, Lower melting point).

09 Fat: the lightest way to carry energy

CHAPTER 09 IN THE SLIDES

Show the figure: Assumes 10 000 kJ a day, 37 kJ g⁻¹ for fat, 17 kJ g⁻¹ for glycogen, and 3 g of water stored with every gram of glycogen.

Switch the figure through Tropical sea 28 °C, Temperate sea 12 °C and Polar sea -2 °C, and have the class say what will change before each.

Predict box: A seal and a cod swim in the same polar sea. Which needs a thick layer of fat to insulate it? Hands up or mini whiteboards first.

Answer A: The seal: its body stays near 37 °C, much warmer than the water

10 Half loves water, half does not

CHAPTER 10 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. One molecule, two natures: **amphipathic**.
2. Mixed into water,
3. the tails turn away from water and the heads face it,
4. forming a **bilayer**, with water on both sides.

Play the animation, Watch it happen: a bilayer builds itself. It loops; pause it on each moment below and ask what is happening (in the lesson slides it is a video).

1. Phospholipids stirred into water point every which way.
2. The tails cannot form hydrogen bonds with water, so water crowds the **tails** together.
3. No enzyme placed them and no energy was spent: **water** arranged them.

Predict box: Phospholipids are stirred into a beaker of water, well below the surface. What do they form? Hands up or mini whiteboards first.

Answer C: A double layer: tails inside, heads facing the water on both sides

THE LESSON

7 Oil and solvents

min

The demo below, then [chapter 7's](#) first figure. Come back to the settled butter.

10 Make a fat, make a phospholipid

min

The paper model below. Count the waters: three for a triglyceride and three for a phospholipid. The lipid bond builder on the board.

15 Fats from the fridge

min

The practical below. Then turn over the Double Kinks Leave Liquids tiles and set the [chapter 8](#) predict box.

10 Store and insulate

min

[Chapter 9's](#) figures. Think, pair, share on the guiding question "How do carbohydrates and lipids compare as energy stores?", building [chapter 9's](#) table on the board. Then the [chapter 9](#) predict box.

ACTIVITIES



DEMO

The salted butter puzzle

Melt about 50 g of salted butter in a small beaker standing in hot water and leave it to settle for 10 minutes: foam on top, clear golden fat, a cloudy watery layer below. Ladle off the fat. Ask where the salt went, and how to show it without tasting (no tasting in a lab): evaporate a drop of each layer on a watch glass and look for crystals.

Needs: salted butter, a beaker, a pan or beaker of hot water, a ladle, watch glasses.



DEMO

Oil and solvents

Two tubes: a few drops of vegetable oil shaken with water, which gives two layers, and with hexane in a fume cupboard, which gives one clear layer.

Needs: oil, water, hexane (fume cupboard, no flames), stoppered tubes.



MODEL

Make a fat, make a phospholipid

Paper pieces: a glycerol strip with three OH tabs, three fatty acid strips with COOH ends, one pink phosphate circle and small water cut-outs. Students cut off an H and an OH for each join and stick them together as water. They count three for a triglyceride and three for a phospholipid. The [biomolecules lab](#) has the same task on screen.

Needs: printed pieces, scissors, glue.



PRACTICAL

Fats from the fridge

Small samples of butter, lard, coconut oil, olive oil, sunflower oil and a margarine, straight from the fridge, in labelled dishes. Warm each in a gloved hand, or float the dishes on a tray of warm water, and record the order in which they soften and melt. Then read each label and rank the fats by their saturated, monounsaturated and polyunsaturated content. Does the order fit? Which one does not (coconut oil), and why ([chapter 8](#), [the dry lab](#))? Safety: **no nut oils** (allergy: use rapeseed instead), no tasting, wash hands. Margarine is a blend of plant oils made spreadable by processing: use its label.

Needs: the fats, small dishes, gloves, a tray of warm water, a thermometer, labels or photos of labels.

PLENARY

10
min

Half loves water

[Chapter 10's](#) figure and predict box. Students draw and label a bilayer section with the hydrophilic and hydrophobic regions and the word amphipathic.

WHAT STUDENTS GET WRONG

Lipids as polymers. A triglyceride is one glycerol and three fatty acids.

"Melting breaks the double bonds." Melting separates whole molecules.

"Saturated with fat." Saturated with hydrogen.

"Fat has more energy because its molecules are bigger." It is per gram: more C–H, less oxygen, and no water stored with it.

"Carbohydrates are always short-term stores." Plants keep starch for months.

"Cells build the bilayer with enzymes." Water arranges it.

STRETCH AND SUPPORT

Support: the tiles as a starter in each lesson (ABBA, Sweet Treats Stay Energetic, Double Kinks Leave Liquids).

Support: a writing frame for "explain why oils are liquid", built on the four tiles in order.

Support: the key terms (tap the dotted words) as a glossary, and the bond builder's tap mode on a tablet.

Stretch: why do lipids release more energy per gram than carbohydrates? Compare the oxygen in glucose and in a fatty acid chain (the linking question on oxidation and reduction).

Stretch: why might fat in the lower legs of an Arctic mammal be more unsaturated than fat near its body?

Stretch: design a fair test of the fridge fats using a water bath and a thermometer instead of hands.

IN THE GUIDE

- 7 [Lipids keep their distance from water](#)
- 8 [Every double bond puts a kink in the tail](#)
- 9 [Fat: the lightest way to carry energy](#)
- 10 [Half loves water, half does not](#)
- All [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 B1.1, built from its key terms and ready to print
- A [pub quiz](#) with rounds on B1.1, to present or run with no projector
- An [escape room built from the question bank](#) on B1.1

ALREADY ON THE SITE FOR B1.1

- Quiz: [Biological Molecules](#)
- Revision map: [B1.1 Carbohydrates and lipids](#), to fill in
- Exam questions: [B1.1 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.
- [B1.1 Carbohydrates](#)
 - [B1.1b Lipids](#)



EXAM PRACTICE

Check yourself

Set it for homework: a fresh paper of exam-bank questions on B1.1 each time, marked as students go and saved to their Exam practice when they are signed in.

biologybybradford.com/exam-maker/sit?topics=B1.1&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.