

IB BIOLOGY · B1.1

Carbohydrates and lipids

Notes to fill in alongside the guide. Each numbered block matches a chapter of the guide, and of the lesson slides. Write in the gaps, answer the cues, annotate the figures, and sum up each section in your own words.

BY THE END YOU CAN

- ☐ Explain how carbon's four covalent bonds let it build chains, branches and rings B1.1.1
- ☐ Describe how condensation joins monomers into polymers and hydrolysis splits them, saying where the water goes B1.1.2, B1.1.3
- ☐ Tell pentoses from hexoses and alpha from beta glucose in ring diagrams, and link glucose's properties to its uses B1.1.4
- ☐ Explain how coiling, branching and size suit starch and glycogen to storing energy B1.1.5
- ☐ Explain how alternating beta glucose gives cellulose straight chains, bundled by hydrogen bonds B1.1.6
- ☐ Explain how glycoproteins let cells recognise each other, using the ABO blood groups B1.1.7
- ☐ 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
- ☐ Identify a steroid from its four rings and explain how oestradiol and testosterone cross the bilayer B1.1.13

01 Chains, branches and rings

B1.1.1

CUES

Predict: A drawing shows a carbon atom with a double bond to an oxygen, a single bond to another carbon and single bonds to two hydrogens. What is wrong with it?

What is meant by covalent bond?

What is meant by double bond?

What is meant by carbon compound?

NOTES

- 1 A _____ is a pair of electrons shared by two atoms, and the shared pair holds them together.
- 2 A carbon atom has four electrons in its outer shell to share, so it can make up to four covalent bonds: four single bonds, or a _____ plus two single bonds.
- 3 A _____ can have a _____, either unbranched, like the tail of a fatty acid, or branched; a single _____, like glucose; or several rings fused together, as in a steroid.
- 4 Carbon makes four bonds in total, and a _____ counts as two.

What is meant by chain?

What is meant by ring?

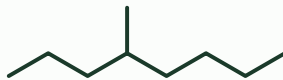
Your own notes

ANNOTATE THE FIGURE

Number the 5 steps on the figure and note what happens at each: 1 covalent bond; 2 four; 3 double bond; 4 chains; 5 rings.



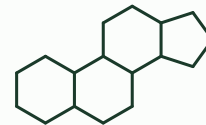
unbranched chain



branched chain



one ring



four fused rings

each corner and end is a carbon atom; hydrogens are left out

ANNOTATE THE FIGURE

Label each part and say what it does: kilo (k), $\times 1000$, centi (c), $\div 100$, milli (m), $\div 1000$, micro (μ), $\div 1\,000\,000$, nano (n), $\div 1\,000\,000\,000$.

kilo	k $\times 1000$		a food label
centi	c $\div 100$		a potato, about 10 cm
milli	m $\div 1000$		the tube's bore
micro	μ $\div 1\,000\,000$		starch grain and red blood cell
nano	n $\div 1\,000\,000\,000$		microfibril and glucose molecule

SPOT THE MISTAKE

What do students often get wrong about carbon compounds? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 01 in two or three sentences of your own.

02 Water out to build, water in to break

B1.1.2 B1.1.3

CUES

Predict: Ten glucose molecules are joined into one unbranched chain. How many water molecules were released?

What is meant by polymers?

What is meant by monomers?

What is meant by macromolecules?

What is meant by condensation reaction?

What is meant by polysaccharides?

What is meant by glycosidic bonds?

What is meant by hydrolysis?

NOTES

- 1 Many of life's large molecules are _____: long chains of similar small units called _____.
- 2 Very large molecules like these are _____.
- 3 Monomers are joined by a _____.
- 4 Three families of polymer are built this way. _____ are monosaccharides joined by _____.
- 5 _____ runs the other way: hydro means water and lysis means splitting.

Your own notes

ANNOTATE THE FIGURE

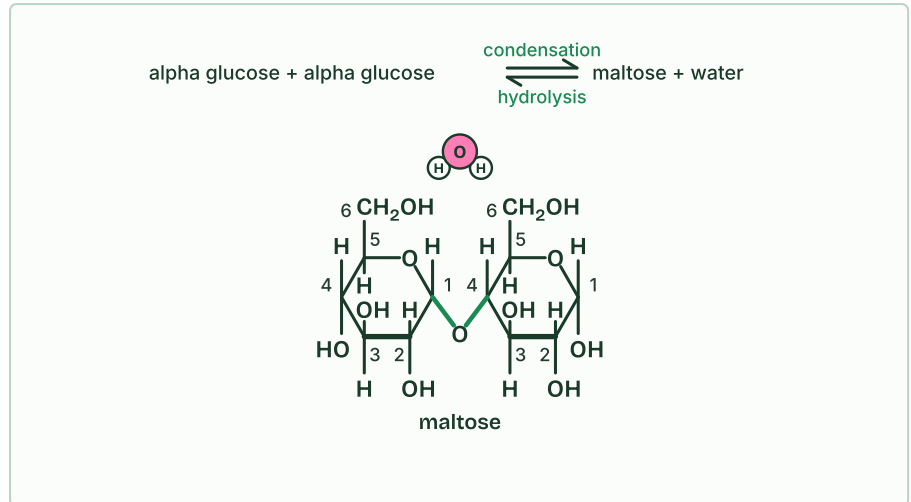
Number the 5 steps on the figure and note what happens at each: 1 monomers; 2 Condensation; 3 glycosidic bond; 4 polymer; 5 Hydrolysis.



water is split: its OH goes to one end and its H to the other

ANNOTATE THE FIGURE

Number the 4 steps on the figure and note what happens at each: 1 alpha glucose; 2 carbon 1, carbon 4; 3 water, 1,4 glycosidic bond, condensation; 4 hydrolysis.



SPOT THE MISTAKE

What do students often get wrong about condensation and hydrolysis?
Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 02 in two or three sentences of your own.

03 Glucose: small, soluble and stable

B1.1.4

CUES

Predict: Sugar C in the second figure has a five-sided ring. Is it a pentose or a hexose?

What is meant by monosaccharide?

What is meant by pentose?

What is meant by hexose?

What is meant by alpha (α) glucose?

What is meant by beta (β) glucose?

What is meant by isomers?

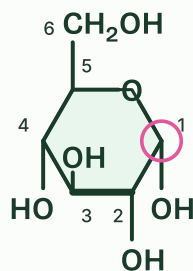
NOTES

- 1 A _____ is one sugar unit, the monomer of carbohydrates.
- 2 In cells most monosaccharides exist as rings. They are named by their number of carbon atoms: a _____ has five (ribose, deoxyribose) and a _____ has six (glucose, fructose).
- 3 Glucose comes in two forms with the same formula, $C_6H_{12}O_6$:
_____ and _____.
- 4 They are _____.

Your own notes

ANNOTATE THE FIGURE

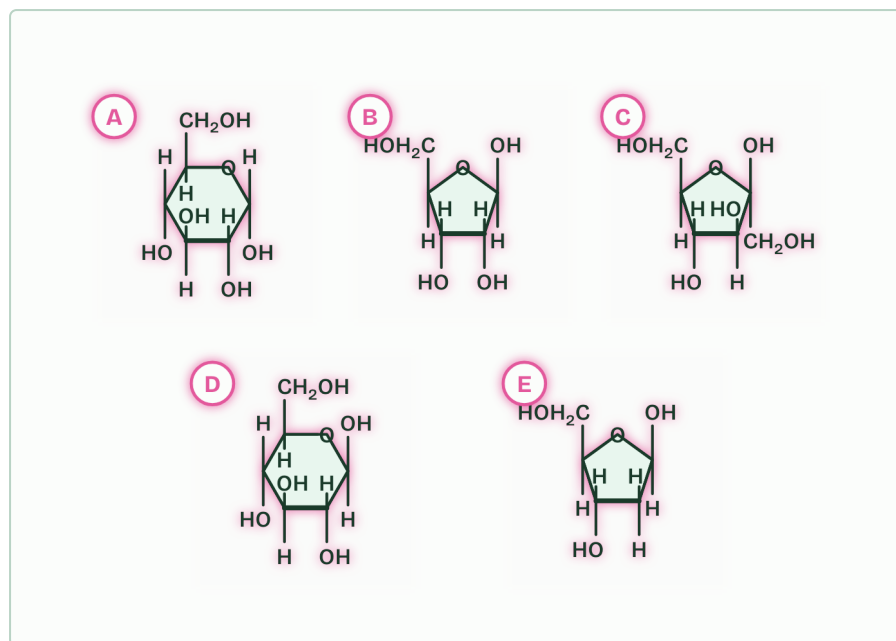
The figure shows it as α -glucose, β -glucose and Both. Note what changes each time.



$C_6H_{12}O_6$
the same atoms in every state
 α -glucose

ANNOTATE THE FIGURE

Label each part and say what it does: α -glucose, ribose, fructose, β -glucose, deoxyribose.



REMEMBER IT

ABBA: which way carbon 1's OH points

A Alpha	B Beta
A _____	B _____

REMEMBER IT

Why glucose is the sugar on the move

S Sweet	T Treats	S Stay	E Energetic
S _____	T _____	S _____	E _____

SPOT THE MISTAKE

What do students often get wrong about monosaccharides? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 03 in two or three sentences of your own.

04 Starch and glycogen: energy packed tight

B1.1.5

CUES

Predict: An amylose molecule and a glycogen molecule hold the same number of glucose units. A sprinter's muscles suddenly need glucose. Which store can release it faster?

What is meant by starch?

What is meant by glycogen?

What is meant by amylose?

What is meant by amylopectin?

What is meant by branches?

NOTES

- 1 Plants store energy as _____ and animals (and fungi) store it as _____.
- 2 Starch is a mixture of two polysaccharides. _____ is an unbranched chain that coils into a helix. _____ is a coiled chain with _____ coming off it.

Your own notes

ANNOTATE THE FIGURE

The figure shows it as Amylose, Amylopectin and Glycogen. Note what changes each time.

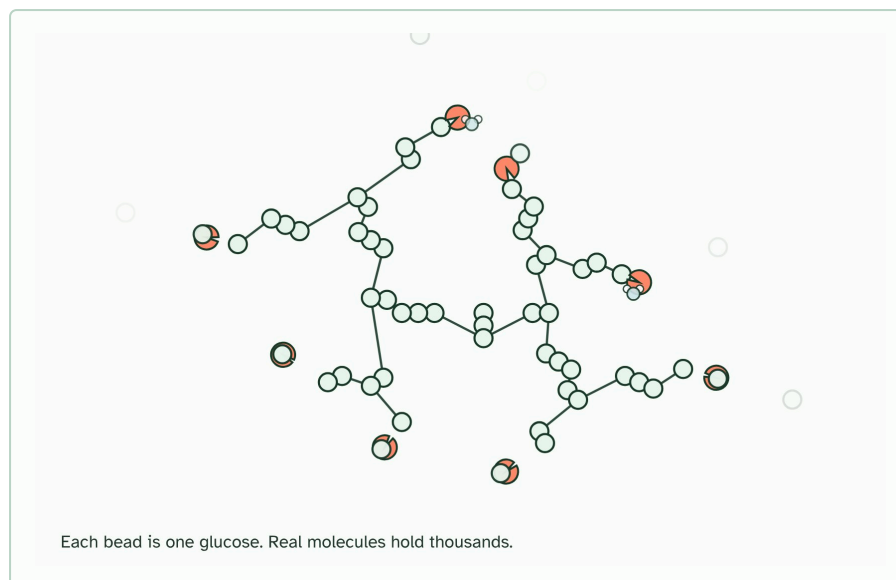
working ends: 1



○ one glucose unit ● a working end, where glucose goes on or comes off
real molecules: thousands of glucose units

ANNOTATE THE FIGURE

Annotate this still from the animation (Watch it happen: building and using a store): what is happening, and why?



SPOT THE MISTAKE

What do students often get wrong about starch and glycogen? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 04 in two or three sentences of your own.

05 Turn every other glucose over and the chain runs straight

B1.1.6

CUES

Predict: Cellulose chains lie side by side in bundles. What holds neighbouring chains together?

What is meant by cellulose?

What is meant by cell walls?

What is meant by hydrogen bonds?

What is meant by microfibrils?

What is meant by tensile strength?

NOTES

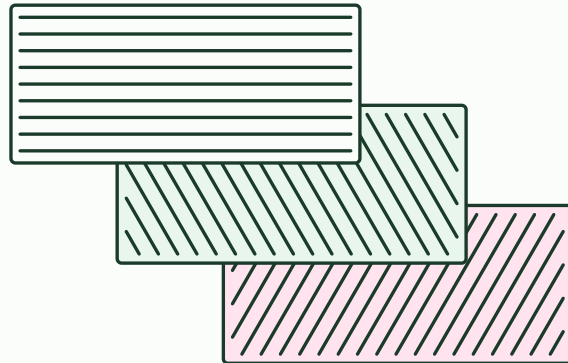
- 1 _____ is an unbranched polymer of β -glucose and the main material of plant _____. β -glucose does not join to itself the way α -glucose does.
- 2 Straight chains lie side by side, and OH groups on neighbouring chains form _____ that cross-link them into bundles called _____.
- 3 One hydrogen bond is weak, but there are thousands along every chain, and together they make a microfibril very strong when pulled: it has high _____.
- 4 Two _____ molecules. Their OH groups point opposite ways.
- 5 Turn one _____ and they can join: water leaves and a bond forms.
- 6 Every other unit is turned over, so the chain runs _____.

Your own notes

ANNOTATE THE FIGURE

Number the 6 steps on the figure and note what happens at each: 1 beta glucose; 2 over; 3 straight; 4 hydrogen bonds; 5 microfibrils; 6 cell wall.

cell wall, cut away

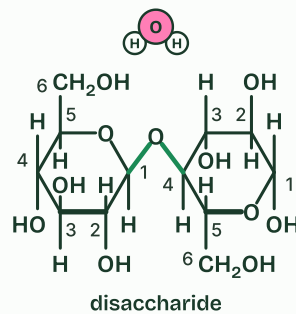


each layer: microfibrils side by side, all in one direction

ANNOTATE THE FIGURE

Number the 4 steps on the figure and note what happens at each: 1 beta glucose; 2 carbon 1, carbon 4; 3 water, 1,4 glycosidic bond, cellulose, condensation; 4 hydrolysis.

beta glucose + beta glucose $\xrightleftharpoons[\text{hydrolysis}]{\text{condensation}}$ disaccharide + water



SPOT THE MISTAKE

What do students often get wrong about cellulose? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 05 in two or three sentences of your own.

06 Sugar name tags on the cell surface

B1.1.7

CUES

Predict: What makes a group A red blood cell different from a group B one?

What is meant by glycoprotein?

What is meant by cell-cell recognition?

What is meant by antigens?

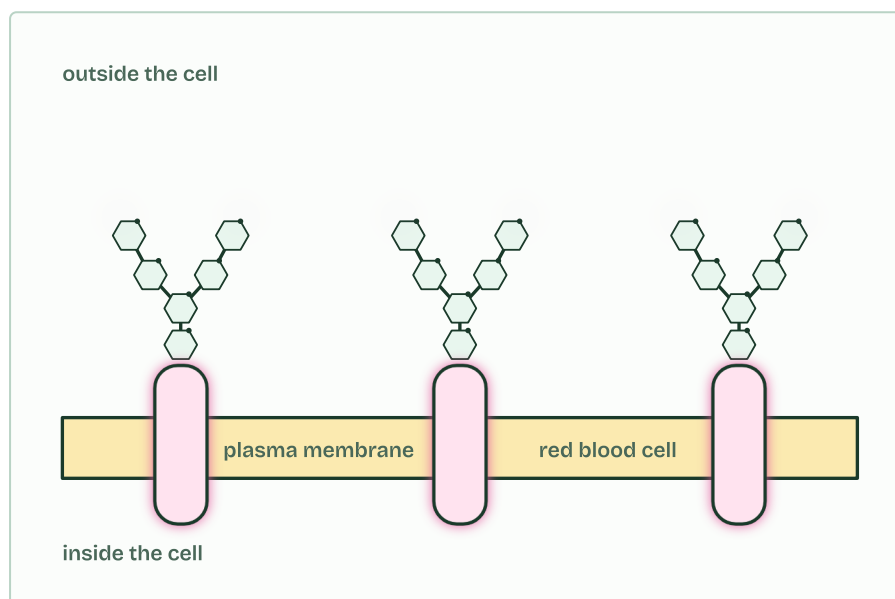
NOTES

- 1 A _____ is a protein with carbohydrate chains attached.
- 2 Carbohydrate chains can differ in which monosaccharides they contain, in the order of those sugars and in how the chain branches, so they can take a huge number of forms. That makes them good identity tags, and other cells read them: this is _____.
- 3 The A and B forms are _____.

Your own notes

ANNOTATE THE FIGURE

Label each part and say what it does: protein part, no A or B sugar, no A or B sugar, protein part, no A or B sugar, no A or B sugar, protein part, no A or B sugar, no A or B sugar.



SPOT THE MISTAKE

What do students often get wrong about glycoproteins? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 06 in two or three sentences of your own.

07 Lipids keep their distance from water

B1.1.8 B1.1.9

CUES

Predict: You have salted butter but need it unsalted. What could you do?

What is meant by lipids?

What is meant by non-polar solvents?

What is meant by fats?

What is meant by oils?

What is meant by waxes?

What is meant by hydrophobic?

What is meant by triglycerides?

What is meant by glycerol?

What is meant by fatty acids?

What is meant by carboxyl group?

What is meant by ester bond?

What is meant by phospholipid?

NOTES

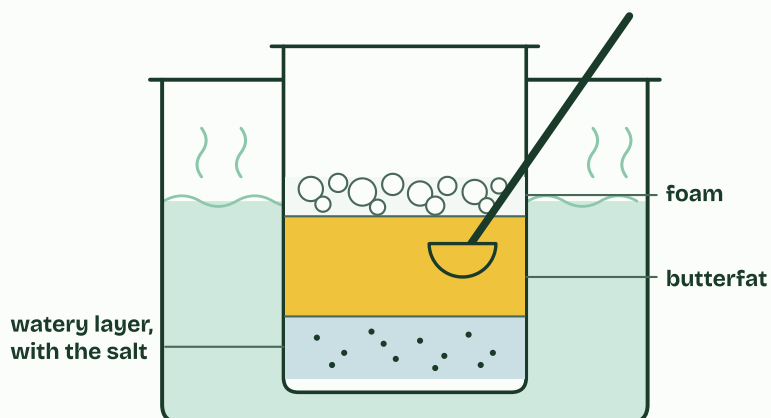
- 1 _____ are substances made by living things that dissolve in _____, such as hexane, but only sparingly in water.
- 2 Lipids include _____, _____, _____ and steroids.
- 3 Water molecules stay bonded to each other and push the lipid out into droplets or a separate layer: lipids are _____.
- 4 Fats and oils are mostly _____: one _____ (three carbons, each with an OH group) joined to three _____.
- 5 A fatty acid is a hydrocarbon chain with a _____, COOH, at one end.
- 6 Each one joins glycerol by condensation: the OH of the carboxyl group and the H of one of glycerol's OH groups leave as water, and an _____ forms.
- 7 A _____ is glycerol joined to two fatty acids and one _____, also by condensation.

Your own notes

What is meant by phosphate group?

ANNOTATE THE FIGURE

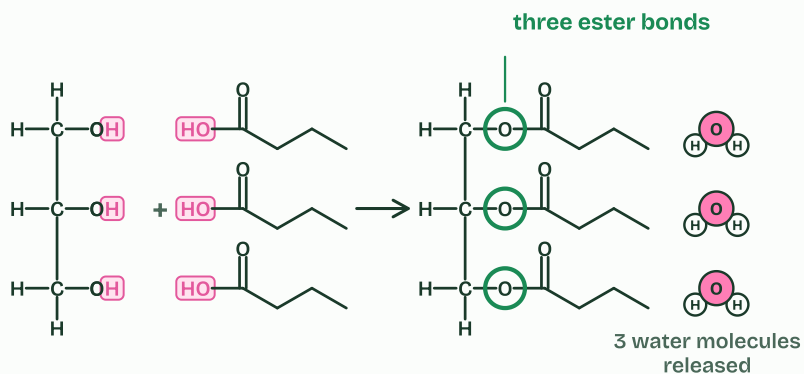
Number the 5 steps on the figure and note what happens at each.



after melting and standing: the fat, with the salt left behind in the water

ANNOTATE THE FIGURE

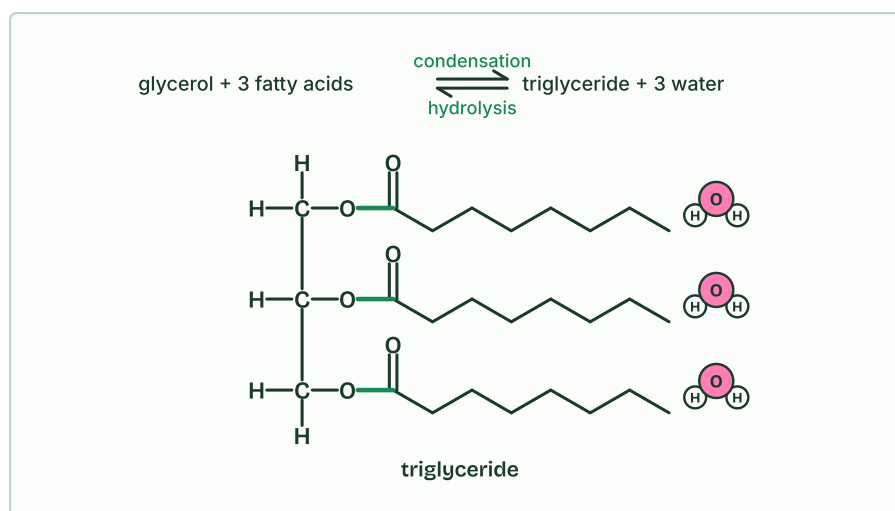
The figure shows it as Triglyceride and Phospholipid. Note what changes each time.



chains drawn short: most real fatty acids have 14 to 20 carbons

ANNOTATE THE FIGURE

Number the 4 steps on the figure and note what happens at each: 1 Glycerol, fatty acids; 2 carboxyl group, OH groups; 3 water, ester bonds, condensation, triglyceride; 4 hydrolysis.



SPOT THE MISTAKE

What do students often get wrong about lipids, triglycerides and phospholipids? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 07 in two or three sentences of your own.

08 Every double bond puts a kink in the tail

B1.1.10

CUES

Predict: 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?

What is meant by saturated?

What is meant by unsaturated?

What is meant by monounsaturated?

What is meant by polyunsaturated?

What is meant by cis?

What is meant by melting point?

What is meant by endotherm?

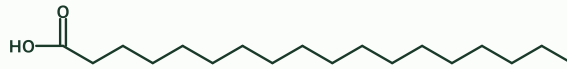
NOTES

- 1 A _____ fatty acid has none: each carbon holds as many hydrogen atoms as it can, so the chain is saturated with hydrogen.
- 2 An _____ fatty acid has at least one C=C. With one it is _____, and with two or more it is _____.
- 3 In natural fatty acids the double bonds are almost all _____: the chain continues on the same side at both ends of the double bond, so it bends there, by about 30°.
- 4 Kinks decide the _____.
- 5 An _____ keeps its body warm, about 37 °C in a mammal, so its fat can hold a far larger share of saturated fatty acids: often a third to a half, against about a tenth in plant oils.

Your own notes

ANNOTATE THE FIGURE

The figure shows it as Saturated, Monounsaturated and Polyunsaturated. Note what changes each time.



stearic acid

no C=C

packs closely
six copies



REMEMBER IT

Why unsaturated fats are oils

D Double	K Kinks	L Leave	L Liquids
D _____	K _____	L _____	L _____

SPOT THE MISTAKE

What do students often get wrong about saturated and unsaturated fatty acids? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 08 in two or three sentences of your own.

09 Fat: the lightest way to carry energy

B1.1.11

CUES

Predict: A seal and a cod swim in the same polar sea. Which needs a thick layer of fat to insulate it?

What is meant by adipose tissue?

What is meant by thermal insulation?

What is meant by endotherm?

What is meant by blubber?

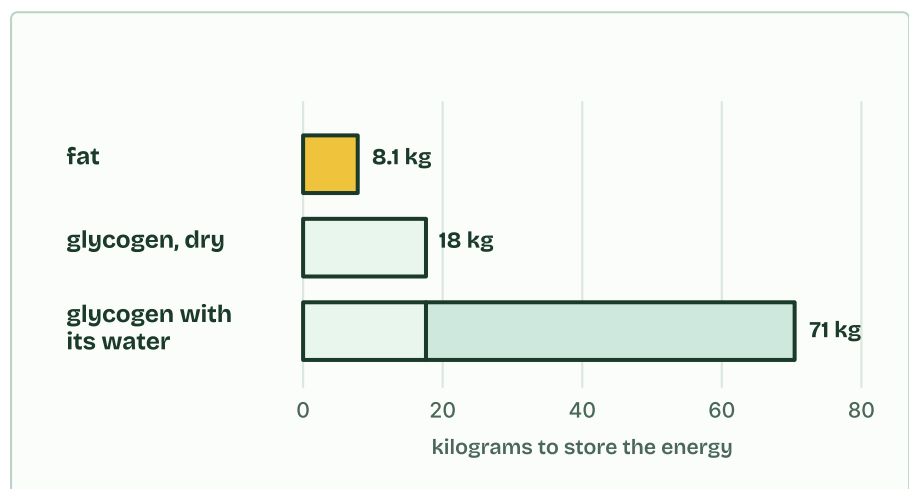
NOTES

- 1 _____ is made of cells that each hold a large droplet of triglyceride, under the skin and round organs.
- 2 Triglycerides also give _____.
- 3 An _____ loses heat to colder surroundings faster the bigger the difference, and far faster in water than in air (A1.1, the ringed seal).
- 4 So endotherms in cold habitats, above all in polar seas, have thick layers of fat called _____, and tropical mammals have thin ones.

Your own notes

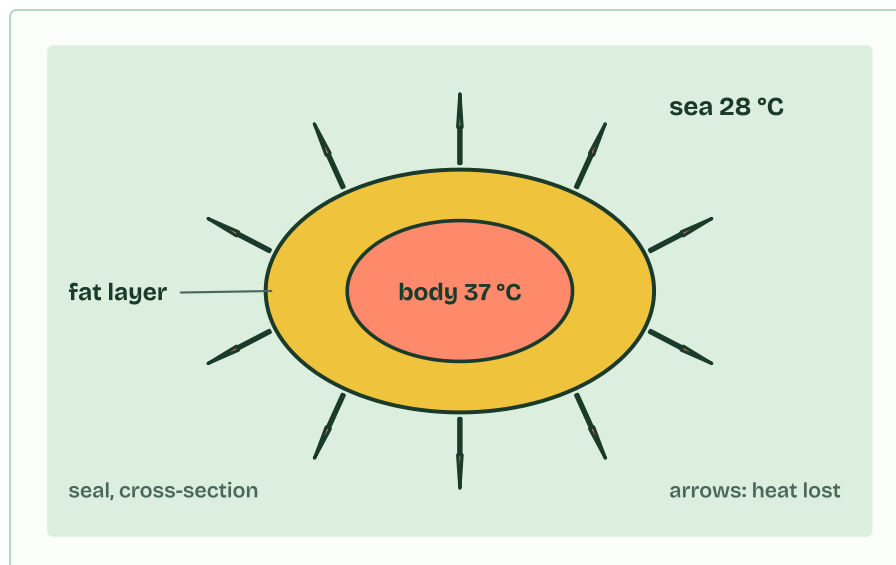
ANNOTATE THE FIGURE

Label the key parts and add a note on what it shows.



ANNOTATE THE FIGURE

The figure shows it as Tropical sea 28 °C, Temperate sea 12 °C and Polar sea -2 °C. Note what changes each time.



SPOT THE MISTAKE

What do students often get wrong about adipose tissue? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 09 in two or three sentences of your own.

10 Half loves water, half does not

B1.1.12

CUES

Predict: Phospholipids are stirred into a beaker of water, well below the surface. What do they form?

What is meant by amphipathic?

What is meant by hydrophilic head?

What is meant by hydrophobic tails?

What is meant by phospholipid bilayer?

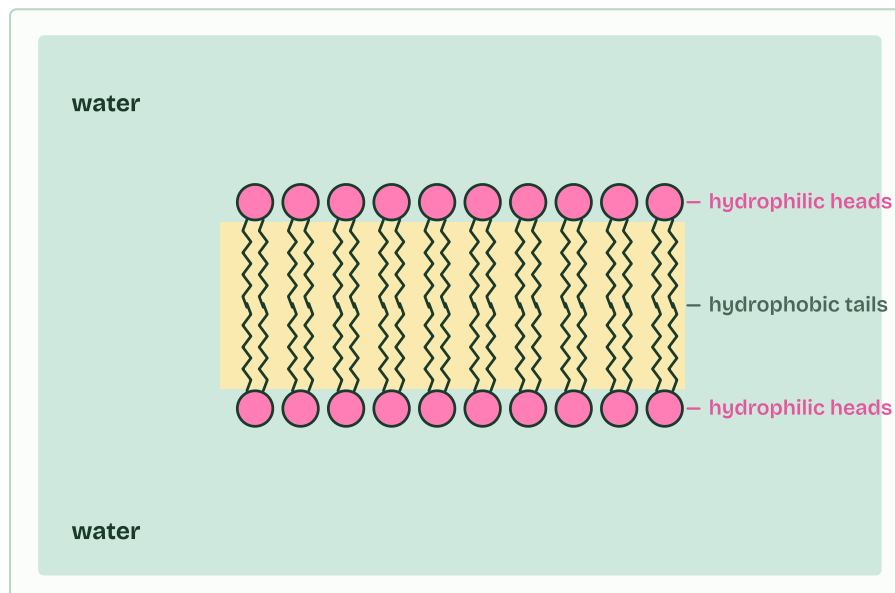
NOTES

- 1 A phospholipid is _____: one part of the molecule is attracted to water and another part is not.
- 2 The phosphate group carries a negative charge and attracts water, and with the glycerol it forms the _____.
- 3 The two fatty acid tails are non-polar, so they are the _____.
- 4 The result is two layers, with the tails pointing inwards and the heads facing the water on both sides: a _____.

Your own notes

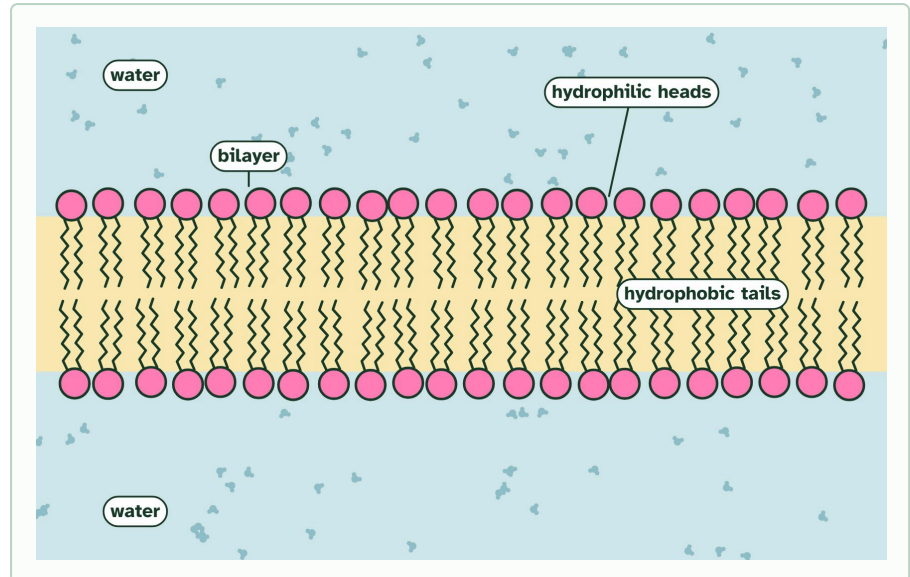
ANNOTATE THE FIGURE

Number the 4 steps on the figure and note what happens at each.



ANNOTATE THE FIGURE

Annotate this still from the animation (Watch it happen: a bilayer builds itself): what is happening, and why?



SPOT THE MISTAKE

What do students often get wrong about the phospholipid bilayer? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 10 in two or three sentences of your own.

11 Four rings, and straight through the membrane

B1.1.13

CUES

Predict: Testosterone crosses a membrane with no transport protein. Glucose cannot. Why?

What is meant by steroids?

What is meant by oestradiol?

What is meant by testosterone?

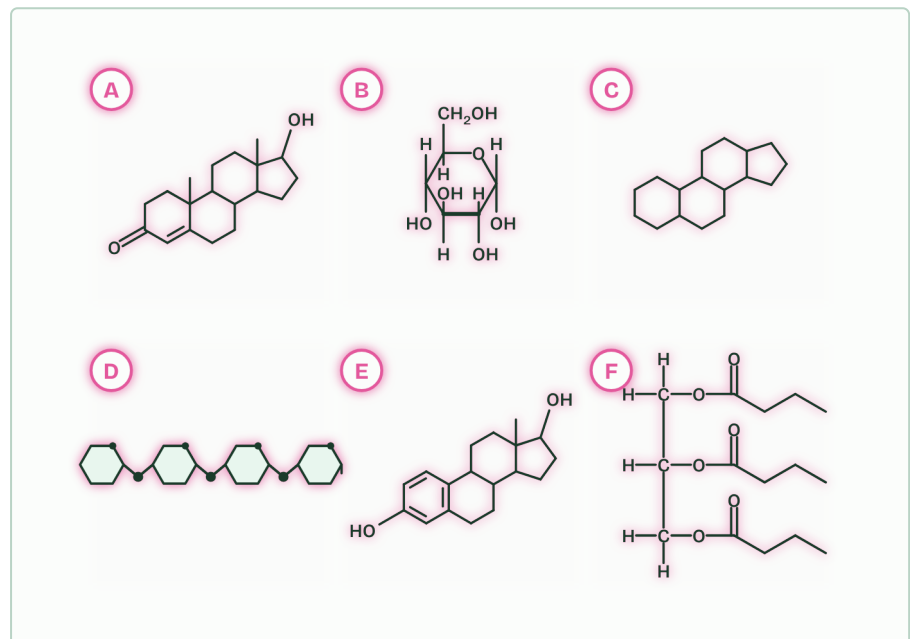
NOTES

- _____ are lipids built on four fused rings: three rings of six carbons and one of five, sharing edges.
- Cholesterol, which sits in animal cell membranes (B2.1), is a steroid, and so are the sex hormones _____ and _____.

Your own notes

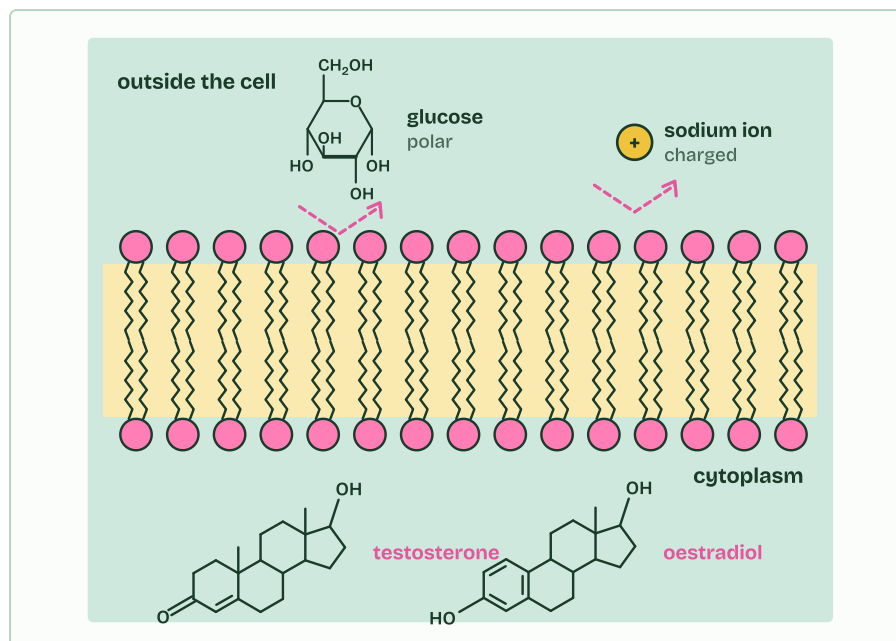
ANNOTATE THE FIGURE

Label each part and say what it does: testosterone, α -glucose, a steroid skeleton, part of an amylose chain, oestradiol, a triglyceride.



ANNOTATE THE FIGURE

Number the 5 steps on the figure and note what happens at each.



SPOT THE MISTAKE

What do students often get wrong about steroids? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 11 in two or three sentences of your own.



Check yourself

The check for this guide is online: a fresh paper of past-paper style questions from the exam bank on B1.1 each time, marked as you go, and saved to your Exam practice progress when you are signed in. Scan the code, or type the link.

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.