AP BIOLOGY · UNIT 1 · TOPIC 1.5

Lipids

Learning objective 1.5.A Describe the structure and function of lipids.

Name: Date: Period:

Use the tool **The Kink Test**. Work on the **The kink test** tab for Parts 1 to 3, then switch to **Predict the effect** for Part 4.

Part 1 · Predict, then check

All five of these fatty acids are drawn at the same scale, so only their shape differs. In the shorthand after each name, the first number is the number of carbons and the second is the number of C=C double bonds. Record the number of double bonds for each. Before you press any of them, predict whether each will be **solid or liquid** at room temperature (20 °C). Then press each one and record the state the tool reports.

Fatty acid	C=C double bonds	I predict	Actually at 20 °C
Palmitic acid (16:0)			
Stearic acid (18:0)			
Oleic acid (18:1)			
Linoleic acid (18:2)			
Alpha-linolenic acid (18:3)			

Part 2 · Hold the length constant

The four 18-carbon fatty acids all have the same chain length, so double bonds are the only thing that changes between them. Record the melting point the tool gives for each.

Fatty acid	Double bonds	Melting point (°C)	Solid or liquid at 20 °C
18:0			
18:1			
18:2			
18:3			

1. Based on the Part 2 table, describe the effect of increasing the number of C=C double bonds on the melting point of an 18-carbon fatty acid.

Part 3 · Why the kink matters

Look at the packing panel underneath each molecule, and compare 18:0 with 18:3. Both are drawn at the same scale, so the only difference is shape.

2. Describe the difference between a saturated and an unsaturated fatty acid in terms of the bonds between their carbon atoms.

3. Based on the packing panel, describe how the packing of 18:0 tails differs from the packing of 18:3 tails.

4. Explain why kinked fatty acid tails give a lower melting point than straight tails, based on how closely the tails pack and the energy needed to separate them.

Part 4 · Predict the effect

Switch to the **Predict the effect** tab and work the cards. Then answer questions 5 to 7 on your own. For each prediction, state the direction of the change and the reasoning behind it. For question 7, use the What lipids do panel on The kink test tab.

5. A food manufacturer adds hydrogen across the double bonds of a liquid vegetable oil, removing the double bonds. Predict the effect of this change on the melting point of the oil. Justify your prediction.

6. A plant moved to a colder climate activates an enzyme that adds double bonds to the fatty acids in its membranes.
(a) Predict the effect of this change on the fluidity of the membranes. Justify your prediction.

(b) Explain how this change helps the plant survive in the cold.

7. (a) Describe the function of phospholipids in an animal cell membrane.

(b) Describe the function of cholesterol in an animal cell membrane.

What the model simplifies

The packing panel shows three tails lying flat in two dimensions. Real fats pack in three dimensions and a real membrane is a bilayer two molecules thick, so this is a cross-section of the idea rather than a picture of a membrane.
Only the fatty acid tail is drawn. A triglyceride joins three of these to a glycerol backbone; a phospholipid joins two plus a phosphate head group.
Solid and liquid switch cleanly at the melting point. Real fats are mixtures of several fatty acids and soften over a range of temperatures instead of at a single one.
Every molecule is drawn at the same bond length, so shape is the only visual difference between them. Melting points are published physical constants.