Lipids

Essential Question

Why are fats and oils important to cells?

Lipids

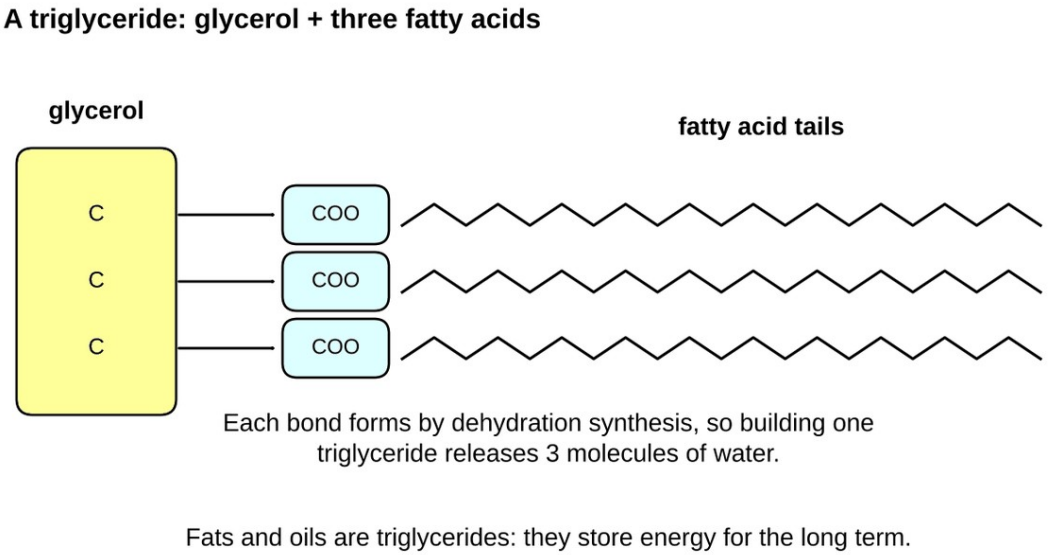
What Are Lipids?

- Lipids are mostly carbon and hydrogen
- They do not dissolve in water (nonpolar)
- Main groups: triglycerides, phospholipids, steroids
- Lipids are large molecules but not true polymers

Type of lipid	Structure	Main jobs
Triglyceride (fats and oils)	Glycerol + 3 fatty acids	Stores energy, insulates, cushions organs
Phospholipid	Glycerol + 2 fatty acids + a phosphate group	Forms cell membranes
Steroid	Four connected rings of carbon atoms	Hormones, cholesterol in membranes

Triglycerides

- Glycerol joined to three fatty acids
- Each bond forms by dehydration synthesis
- Fats and oils store energy
- Fat stores about 9 kcal per gram, carbohydrate about 4

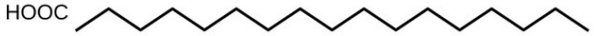


Saturated and Unsaturated Fatty Acids

- Saturated: no double bonds in the tail
- Unsaturated: one or more double bonds
- Double bonds bend the tail
- Straight tails pack together tightly

Saturated fatty acid

no double bonds: straight tail, packs tightly, solid at room temperature



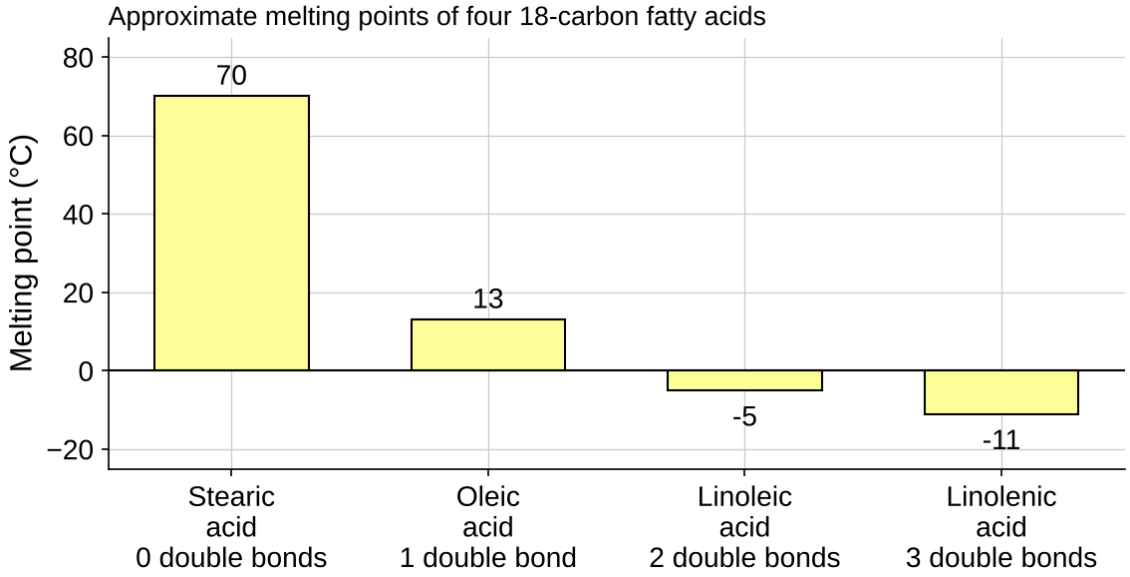
Unsaturated fatty acid

one or more double bonds: bent tail, packs loosely, liquid at room temperature



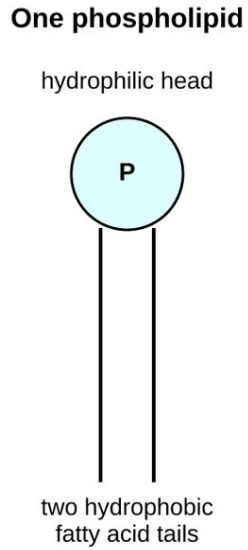
Double Bonds and Melting Point

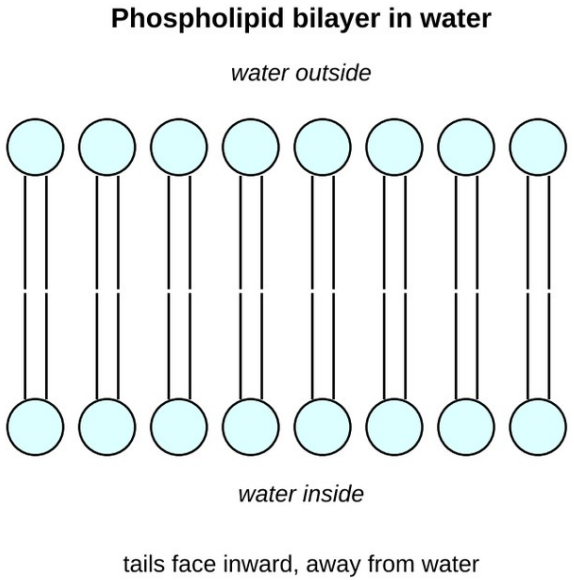
- The more double bonds, the lower the melting point
- Bent tails pack loosely and move apart more easily
- Room temperature is about 20 to 25°C
- Structure determines properties



Phospholipids and Membranes

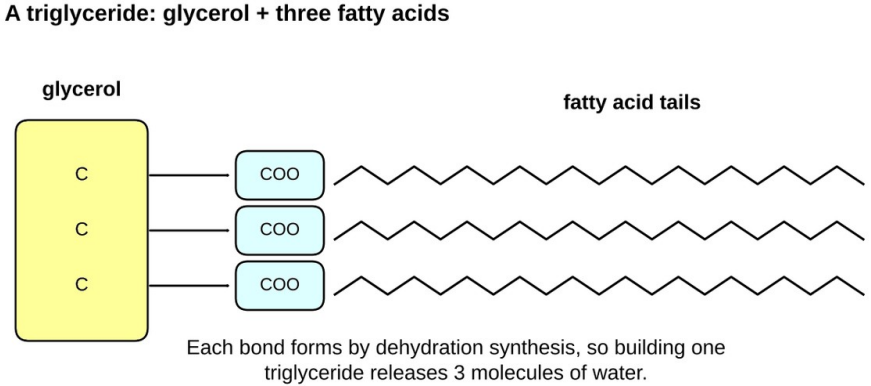
- Phospholipid: a phosphate head and two fatty acid tails
- The head is attracted to water (hydrophilic)
- The tails avoid water (hydrophobic)
- In water, phospholipids form a bilayer





Example: Energy in Fat

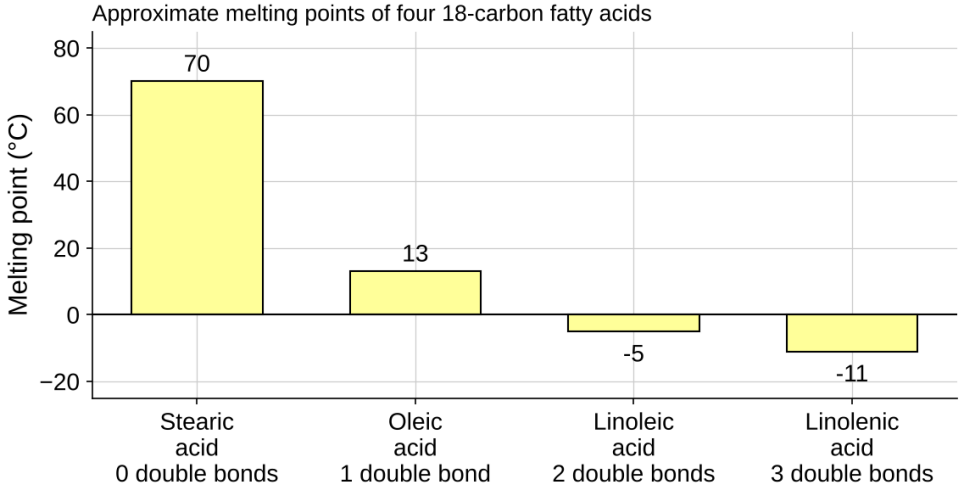
Fat provides about 9 kcal per gram, and carbohydrate provides about 4 kcal per gram. (a) How much energy is in 30 g of fat? (b) How many grams of carbohydrate hold the same amount of energy? (c) How many molecules of water are released when one triglyceride forms from glycerol and three fatty acids?



Fats and oils are triglycerides: they store energy for the long term.

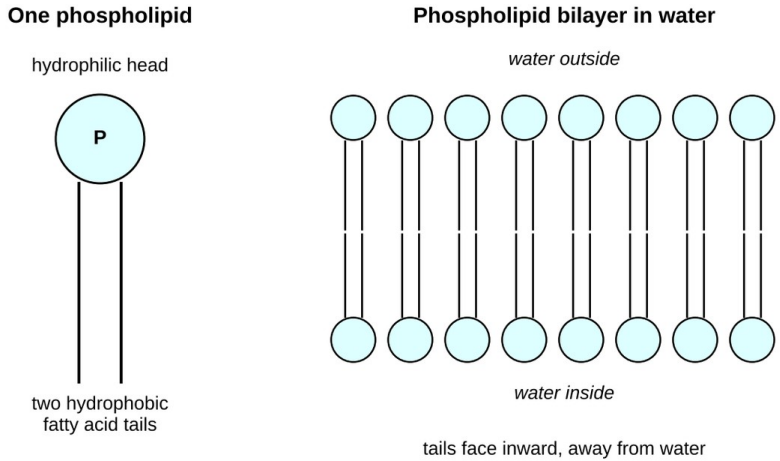
Example: Fatty Acids and Melting Point

Use the graph of melting points. (a) Which of the four fatty acids are liquid at room temperature (about 20°C)? (b) How much lower is the melting point of oleic acid than that of stearic acid? (c) Use the shape of the molecules to explain the pattern.



Example: Phospholipids in Water

A scientist places many phospholipid molecules in water and shakes the mixture. (a) Which part of a phospholipid is attracted to water? (b) Describe how the phospholipids arrange themselves. (c) Why is this arrangement useful for a cell?



Lipids

Big Ideas

- Lipids are nonpolar and do not dissolve in water
- A triglyceride is glycerol plus three fatty acids
- Fat stores about 9 kcal per gram
- Double bonds bend tails and lower the melting point
- Phospholipids form the bilayer of cell membranes