Triglycerides

Subject & topics: Biology | Biochemistry | Lipids **Stage & difficulty:** A Level C1

Part A

Triglyceride formation

A triglyceride is a particular type of lipid formed by a condensation reaction between one [ ] molecule and [ ] [ ] molecules. During condensation, the carboxyl groups of the [ ] molecules react with the hydroxyl groups of the [ ] molecule to form [ ] bonds. Therefore, this condensation reaction is also called [ ] reaction.

Items:

a phosphorylation | ester | fatty acid | an esterification | glycine | glycerol | phosphate | three | four | two

Part B

Condensation consequences

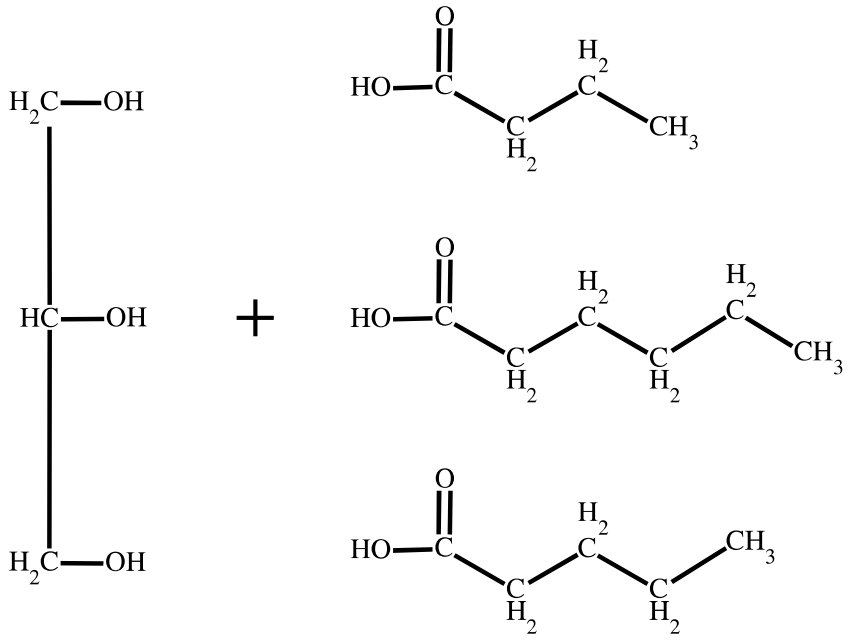
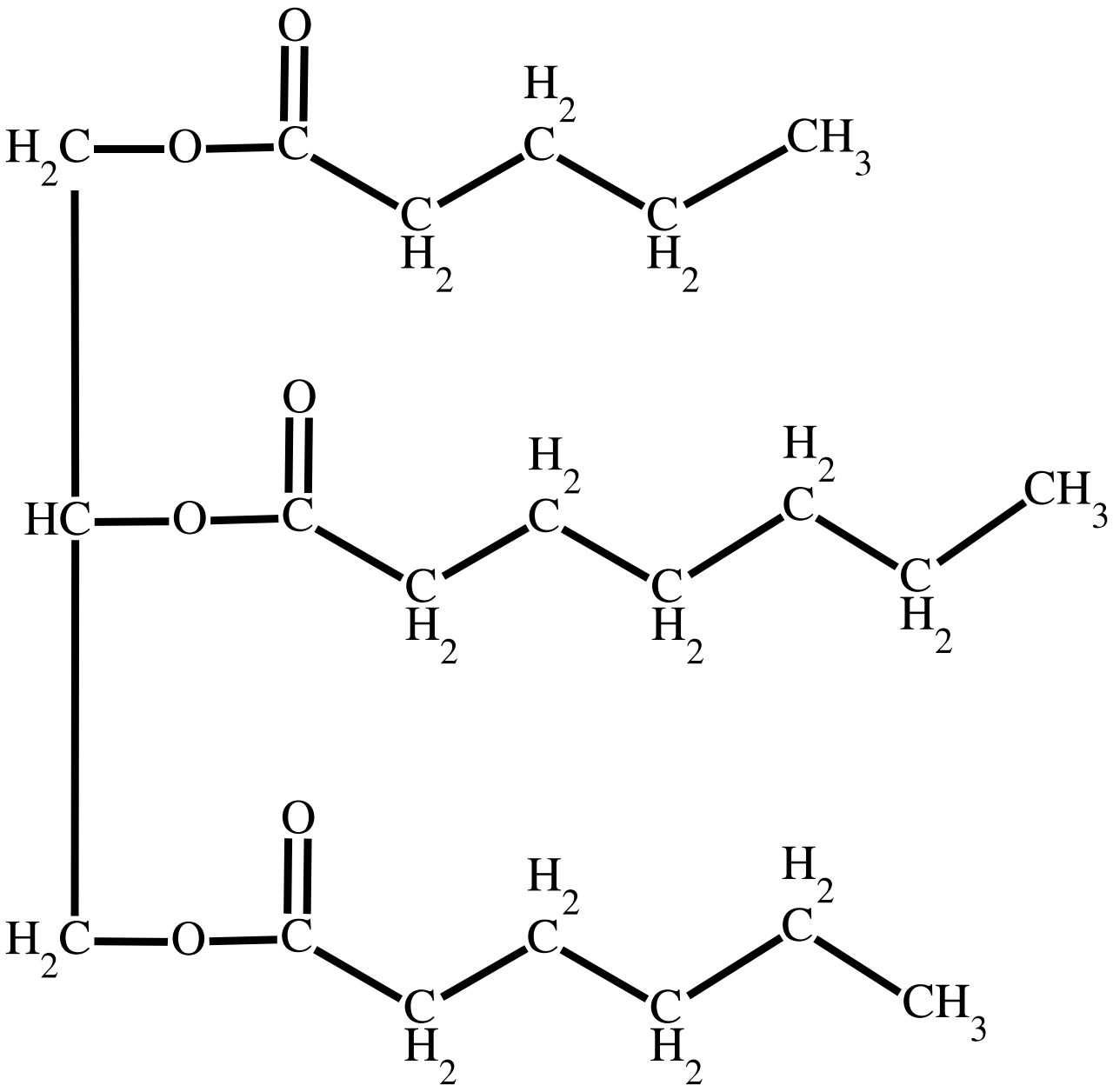
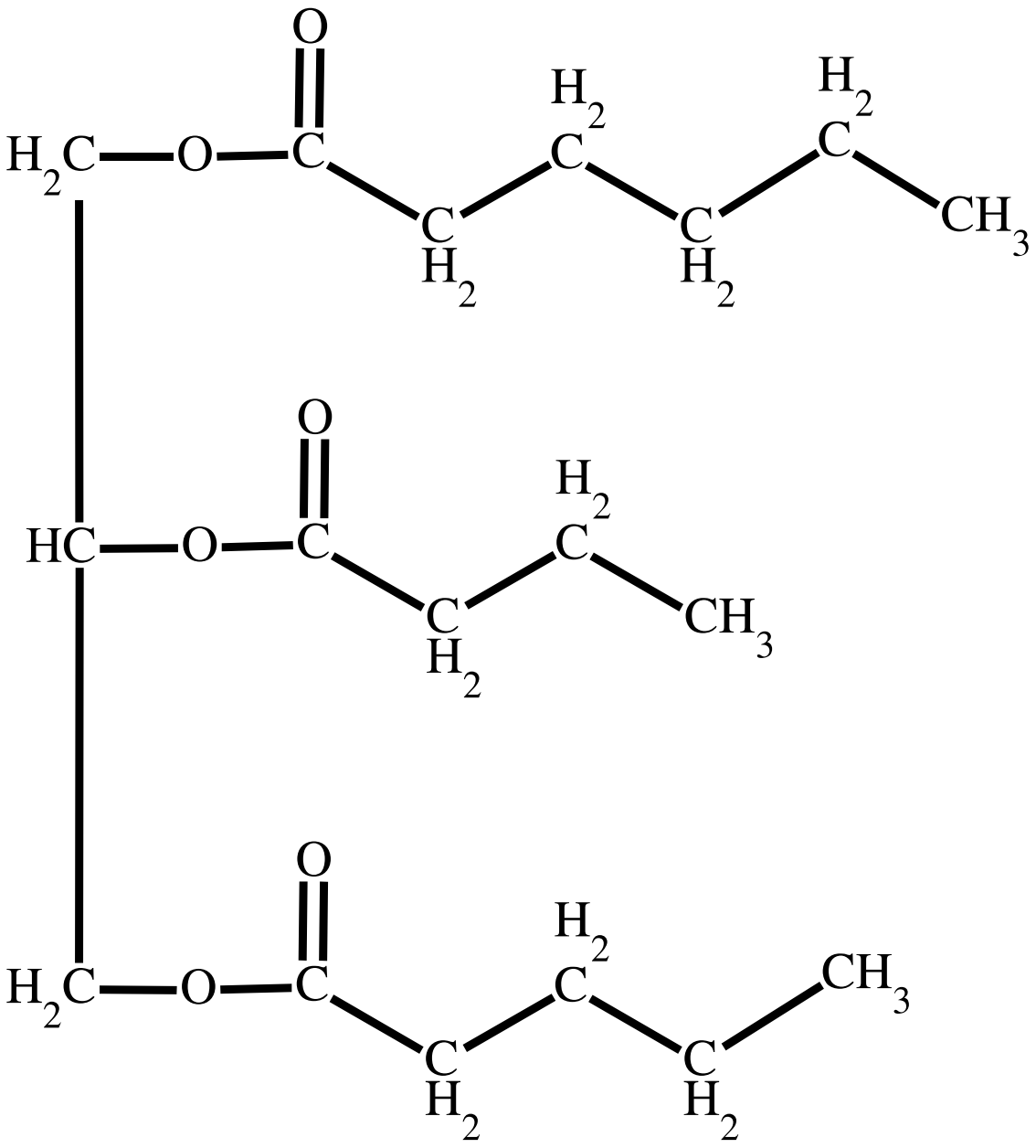


Figure 1: A condensation reaction between one glycerol molecule and three fatty acids.

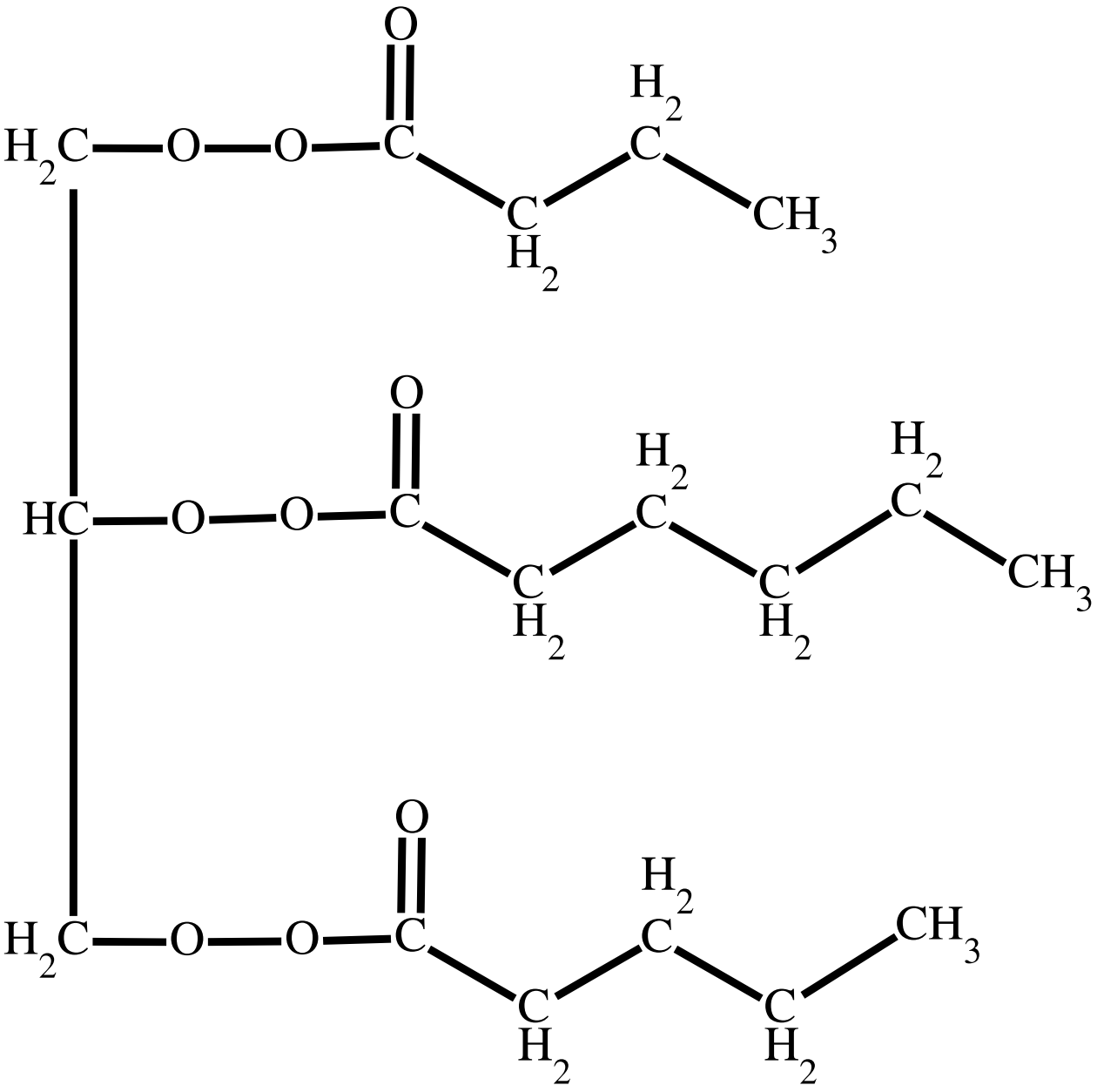
Which of the images below represent triglycerides that could be formed in the condensation reaction shown in Figure 1? Select all that apply.



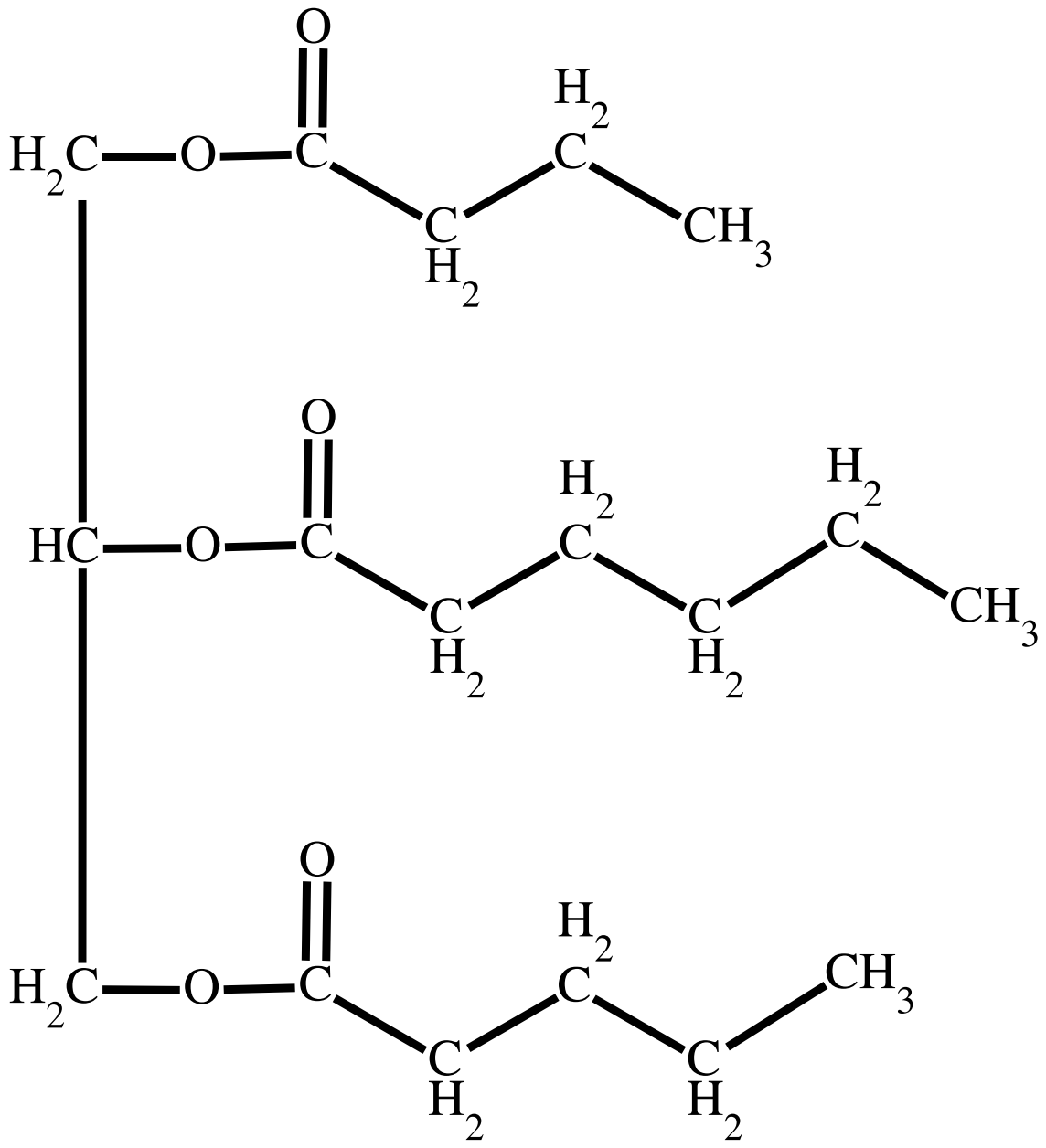
A



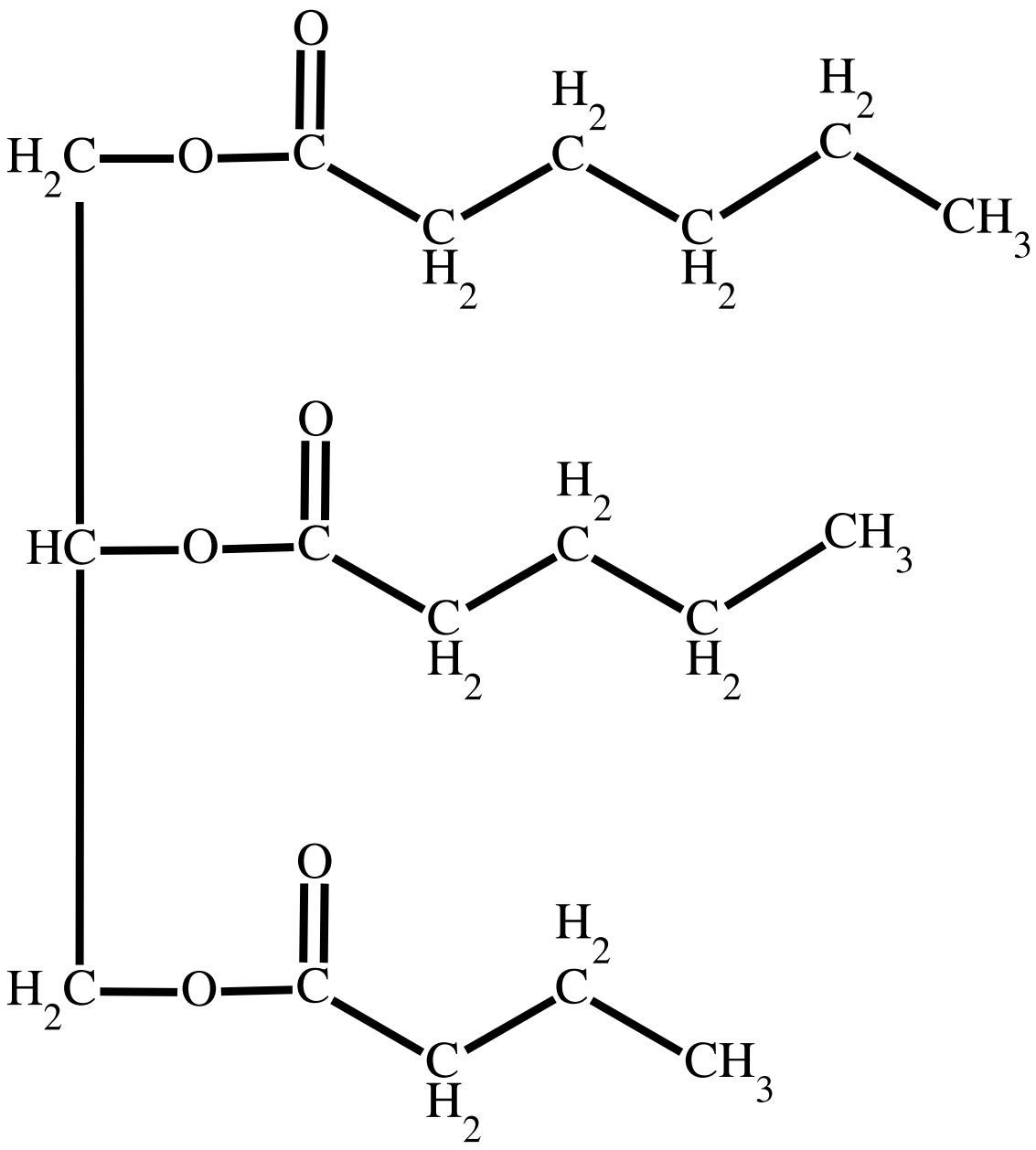
B



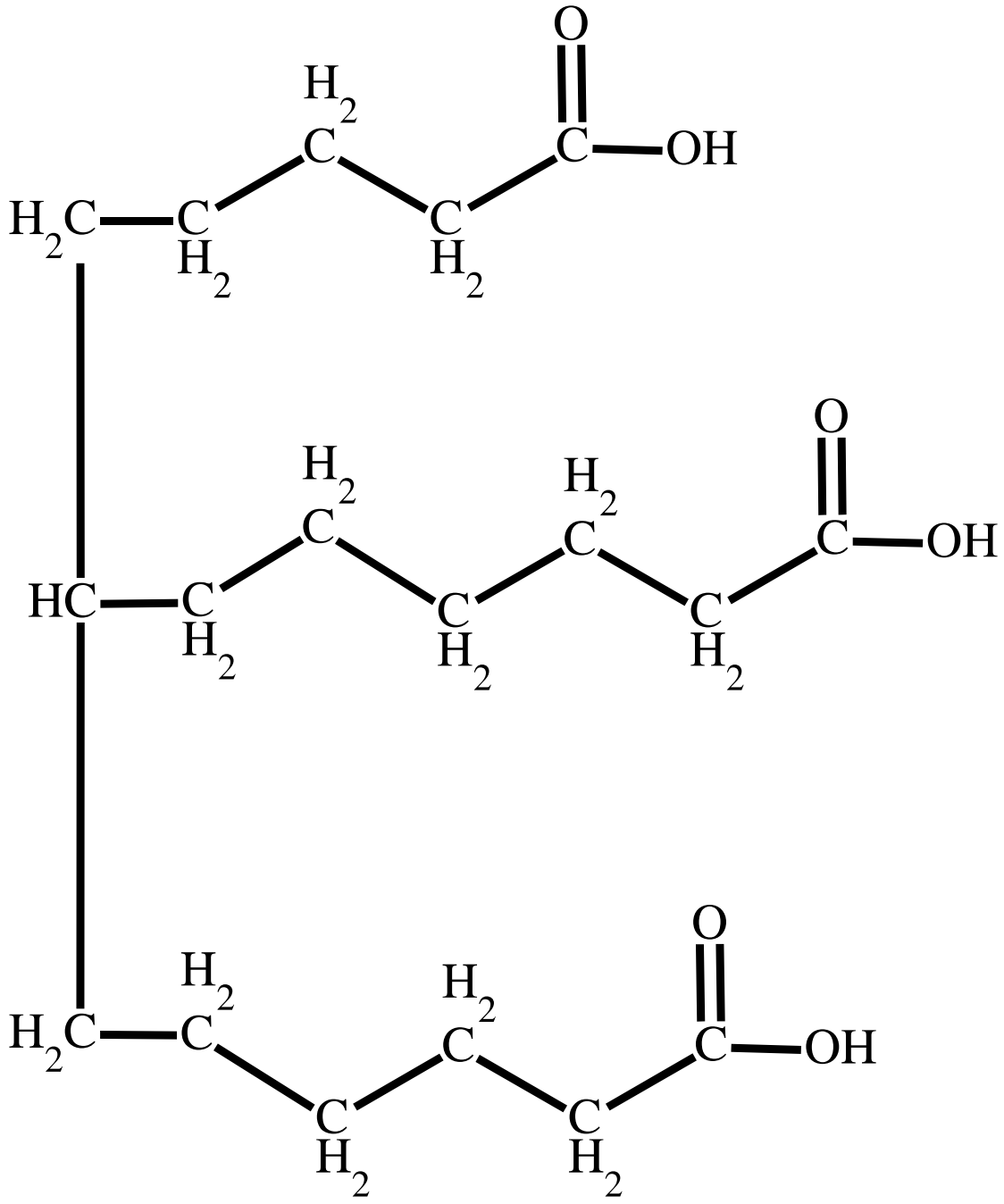
c



D



E



F

- [ ] A
- [ ] B
- [ ] C
- [ ] D
- [ ] E
- [ ] F

Part C

Triglyceride functions

Which of the following are functions of triglycerides? Select all that apply.

- [ ] act as biological catalysts
- [ ] energy storage
- [ ] insulation & protection
- [ ] precursor for steroid hormones
- [ ] primary component of cell membranes

Phospholipids

Subject & topics: Biology | Biochemistry | Lipids **Stage & difficulty:** A Level C1

Part A

Phospholipid structure

A phospholipid is a particular type of lipid that contains one [ ] molecule, [ ], [ ], and one phosphate group. It is, therefore, very similar in structure to a triglyceride, except that one of the [ ] have been replaced by a [ ].

Items:

phosphate group | two | glycerol | three | fatty acids | four

Part B

Phospholipid possibilities

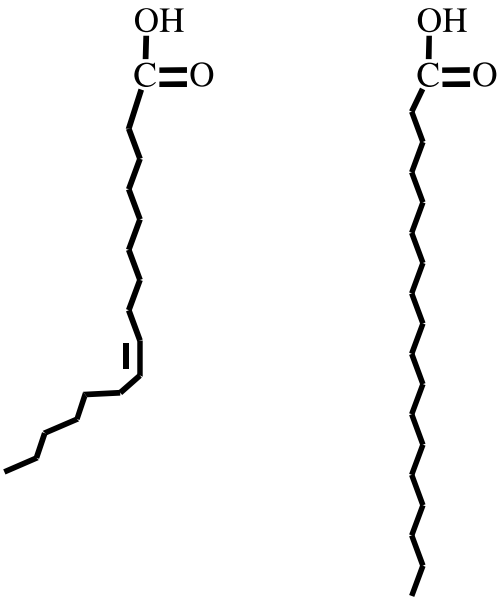
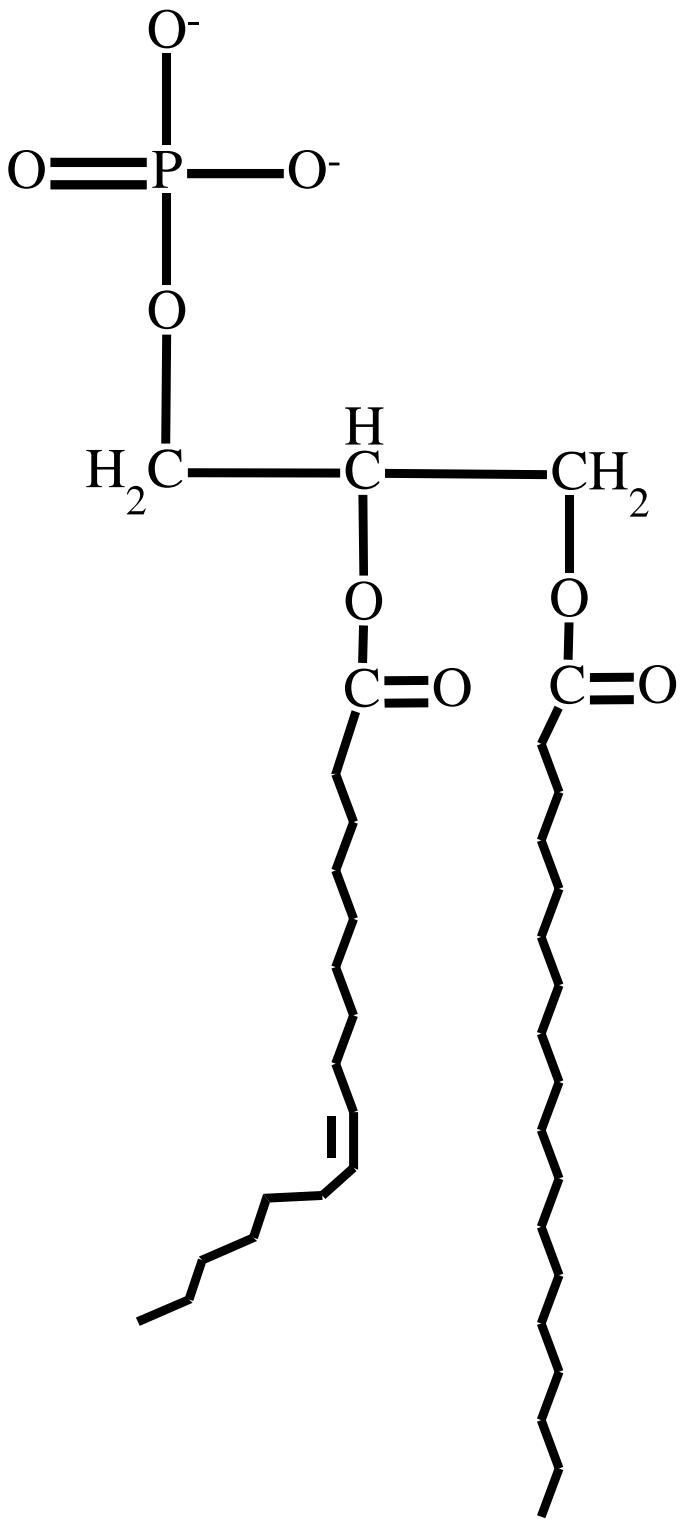
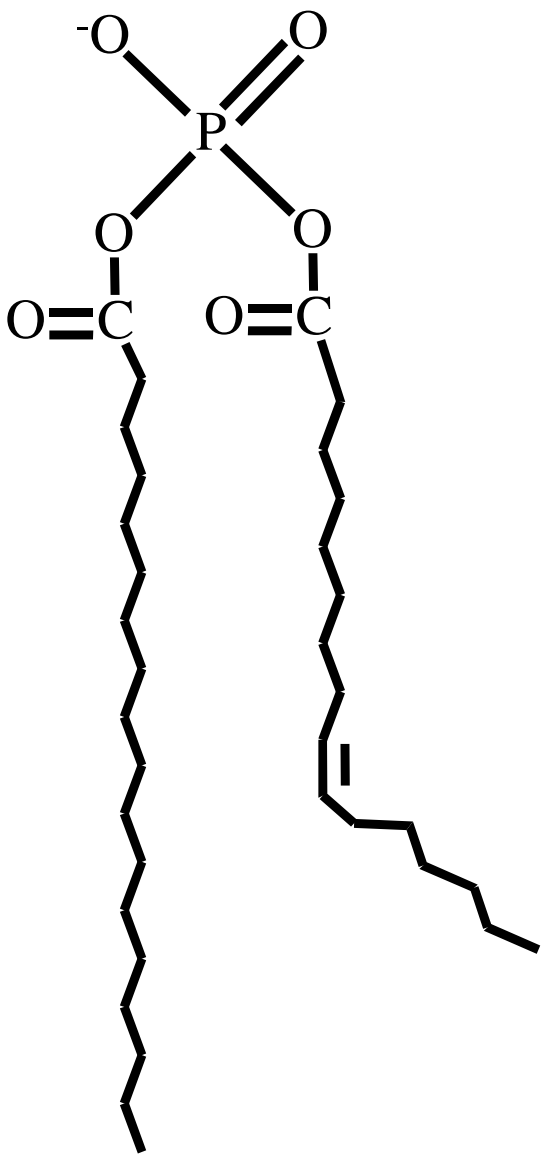


Figure 1: The simplified structures of two fatty acids are shown.

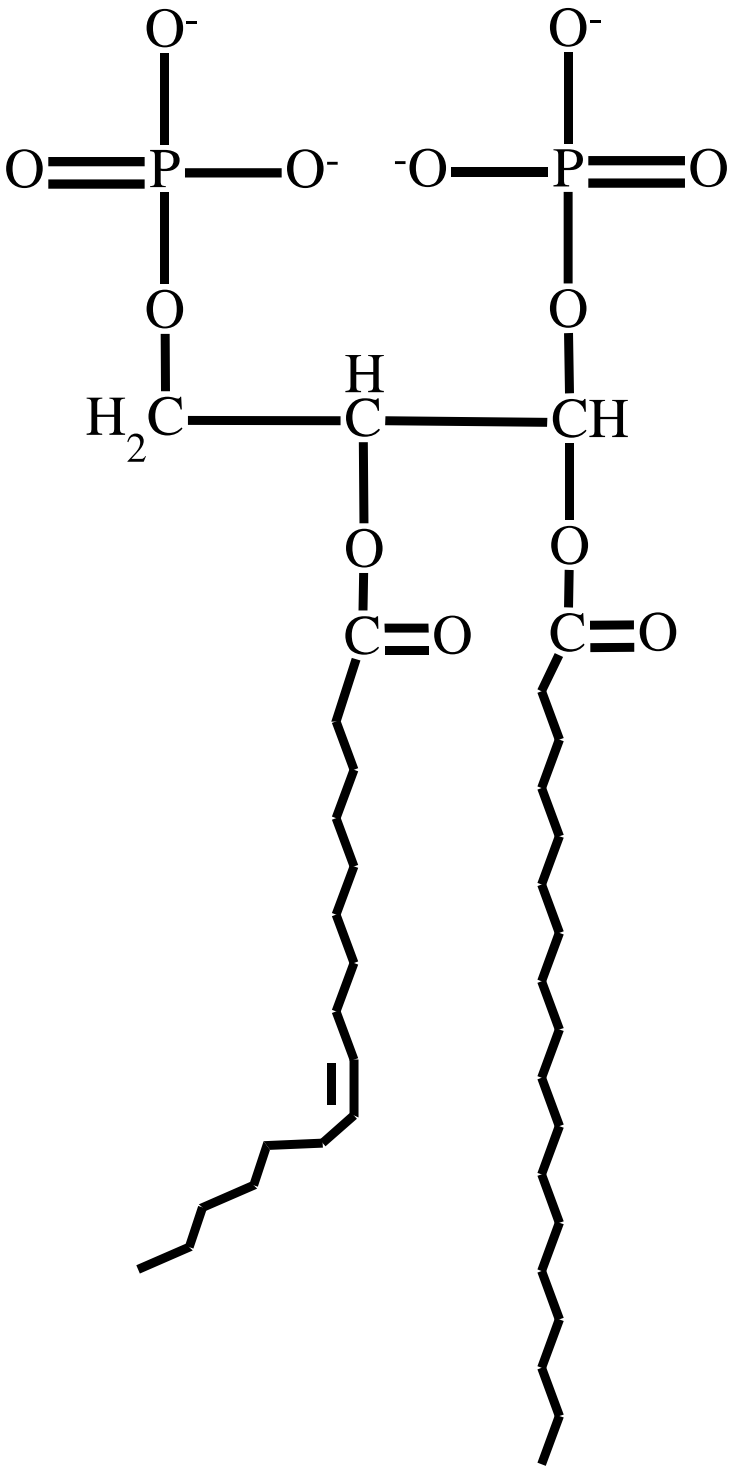
Which of the images below represent a phospholipid that could be formed from the fatty acids shown in Figure 1? Select all that apply.



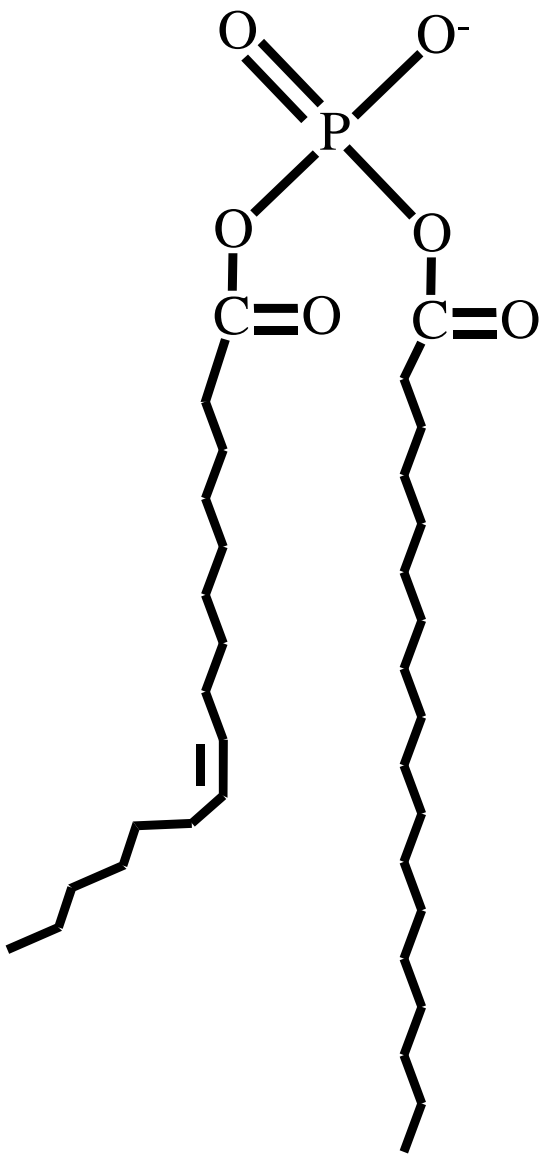
A



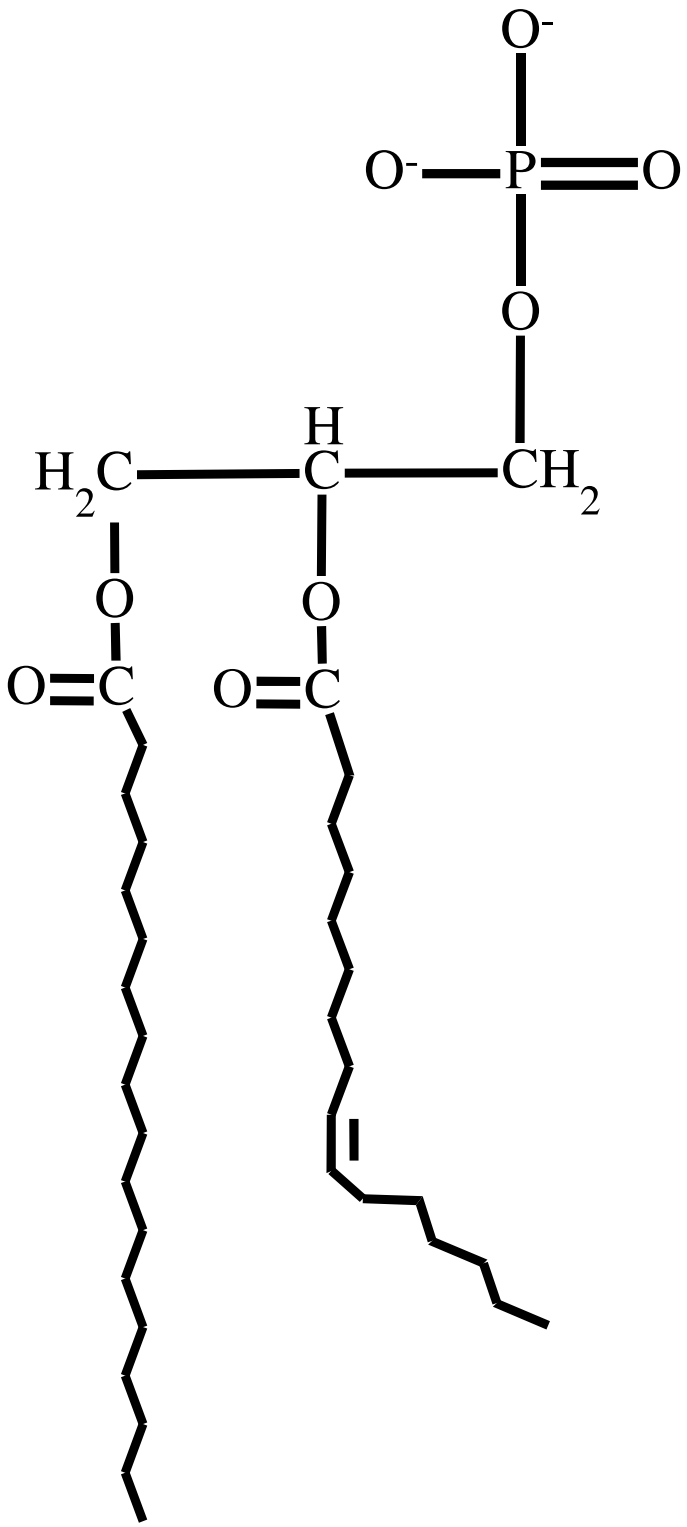
B



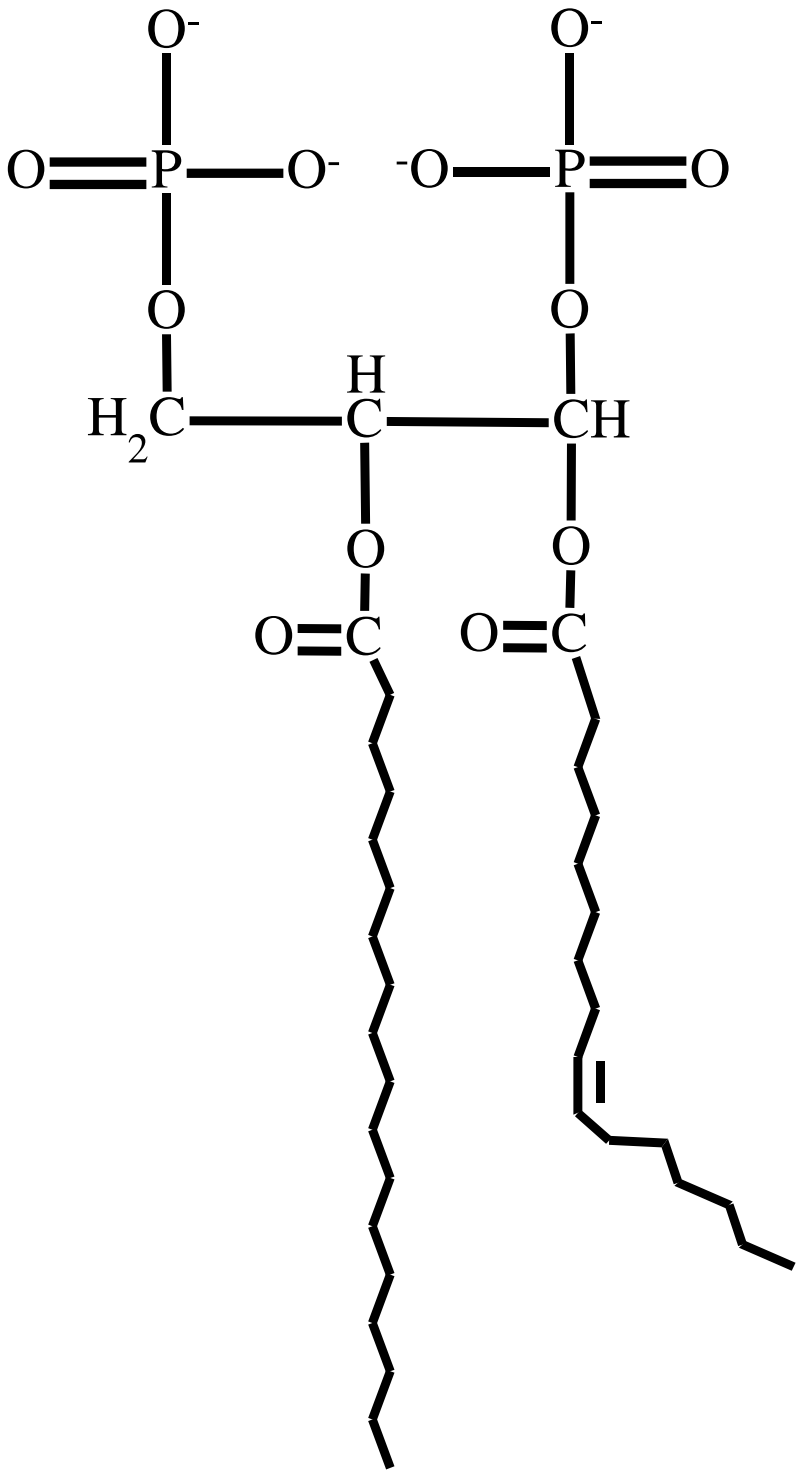
c



D



E



F

A

B

C

D

E

F

Part C

Phospholipid properties

The "head" of a phospholipid (composed of the [ ]) is charged and therefore [ ]. The "tail" (composed of the [ ]) is non-polar and therefore [ ]. Phospholipids are therefore described as [ ] (molecules that contain both a hydrophilic and a hydrophobic part).

Items:

hydrophilic | hydrophobic | amphipathic | fatty acids | phosphate group

Part D

Phospholipid function

Which of the following is the main function of phospholipids?

- insulation & protection
- precursor for steroid hormones
- act as biological catalysts
- forming cell and organelle membranes
- energy storage

Question deck:

STEM SMART Biology Week 6 - Lipids

Sterols

Subject & topics: Biology | Biochemistry | Lipids **Stage & difficulty:** A Level C1

Sterols are a type of lipid that have very different structures from other lipids. However, they are also classed as lipids because they are not water-soluble.

A sterol is a molecule with a core composed of four hydrocarbon rings. This core is connected to a hydroxyl (OH) group at one end and to a hydrocarbon chain at the opposite end.

Figure 1 shows the structure of cholesterol, the main sterol in animals, which is a component of animal cell membranes. Different sterols share the same basic structure, but they differ in the structure of the hydrocarbon chain and in the number/location of carbon-carbon double bonds in the core.

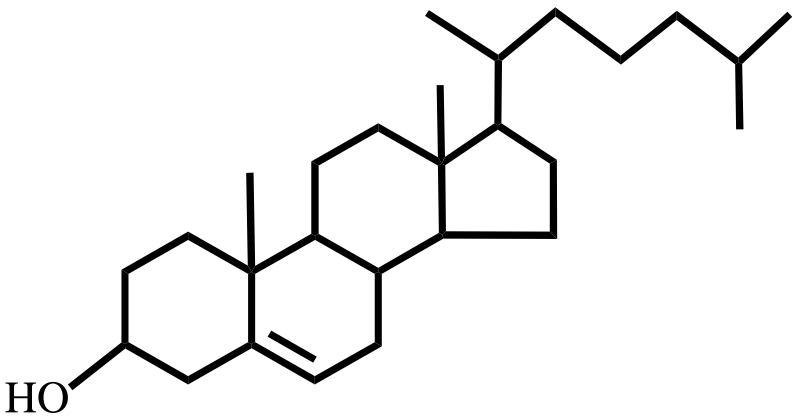


Figure 1: Cholesterol structure.

Part A

Cholesterol polarity

Fill in the table below to describe each part of a cholesterol molecule and how cholesterol sits within the phospholipid bilayer.

Part	Polar or non-polar	Hydrophilic or hydrophobic	Membrane position
core (4 hydrocarbon rings)			
hydroxyl group			
hydrocarbon chain			

Items:

polar | non-polar | hydrophilic | hydrophobic | among phospholipid heads | among phospholipid tails

Part B

Cholesterol functions

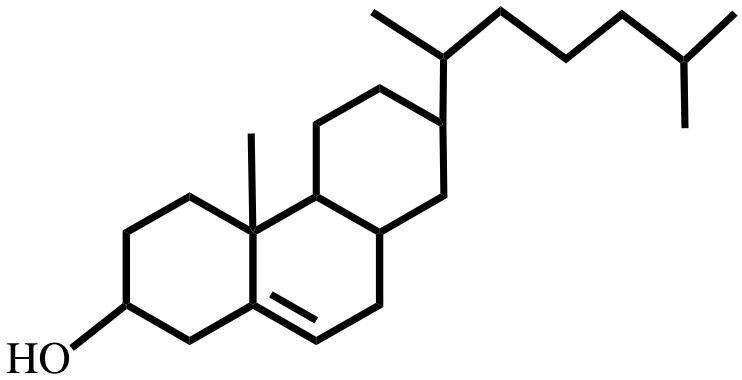
Cholesterol is an important sterol in animals. Which of the following are functions of cholesterol? Select all that apply.

- [ ] precursor for steroid hormones
- [ ] energy storage
- [ ] acts as a biological catalyst
- [ ] insulation & protection
- [ ] regulates membrane fluidity

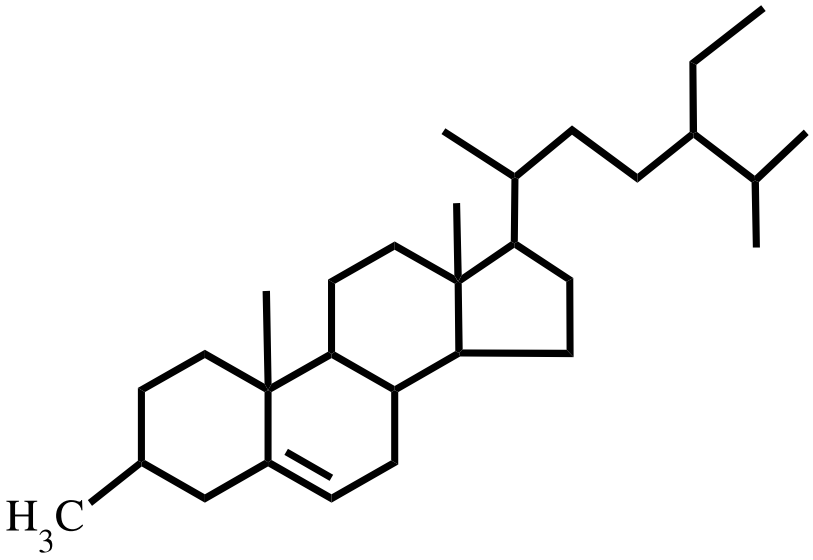
Part C

Identify the sterols

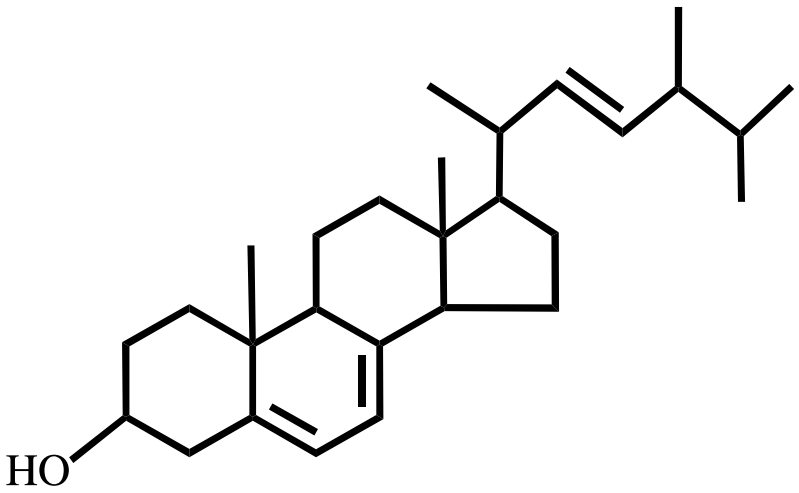
Which of the images below are sterols?



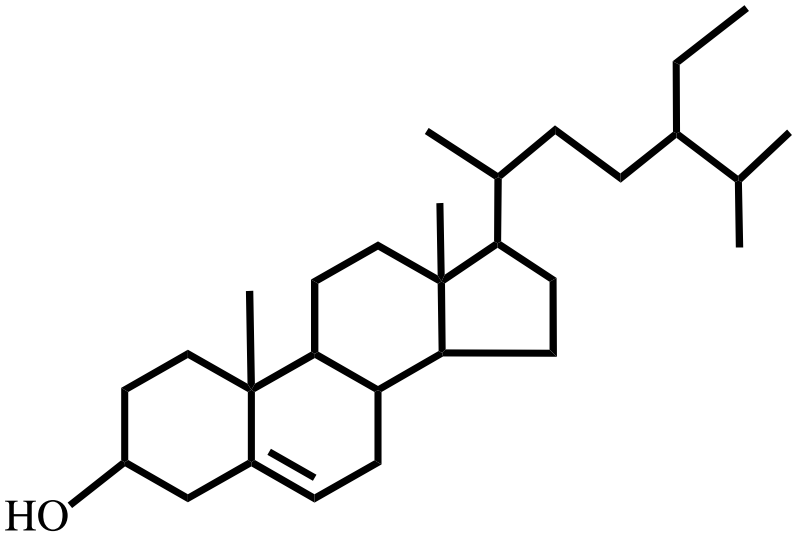
A



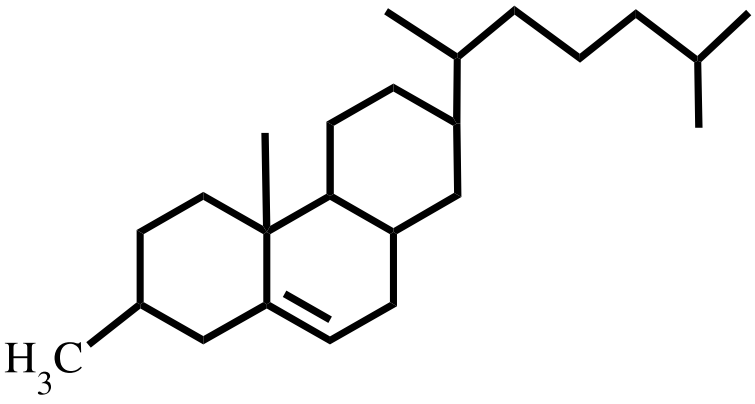
B



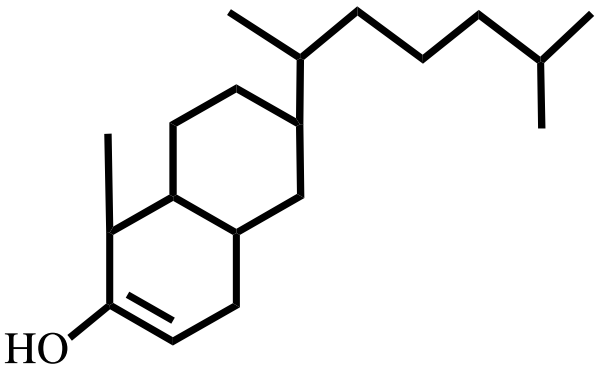
C



D



E



F

- [ ] A
- [ ] B
- [ ] C
- [ ] D
- [ ] E
- [ ] F

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Question deck:
STEM SMART Biology Week 6 - Lipids

Fatty Acid Saturation

Subject & topics: Biology | Biochemistry | Lipids **Stage & difficulty:** A Level C1

Stearic acid is a fatty acid. It contains 18 carbon atoms and zero carbon–carbon double bonds. It can be represented by the notation $\mathrm{C}18:0$, where 18 is the number of carbons and 0 is the number of carbon–carbon double bonds present.

Oleic acid can be represented by $\mathrm{C}18:1$.

Linoleic acid can be represented by $\mathrm{C}18:2$.

A triglyceride was formed using one of each of the three fatty acids.

Part A

Saturation and melting points

Match the saturation type and relative melting point to the fatty acid.

Fatty acid	Saturation type	Melting point (relative)
Stearic acid		
Oleic acid		
Linoleic acid		

Items:

unsaturated | intermediate | polyunsaturated | saturated | lowest | highest

Part B

Hydrogen numbers

Within the triglyceride, how many hydrogen atoms does the stearic acid chain have?

Within the triglyceride, how many hydrogen atoms does the oleic acid chain have?

Within the triglyceride, how many hydrogen atoms does the linoleic acid chain have?

Part C

Oxygen numbers

How many oxygen atoms does the triglyceride have?

Part D

Identify the fatty acids

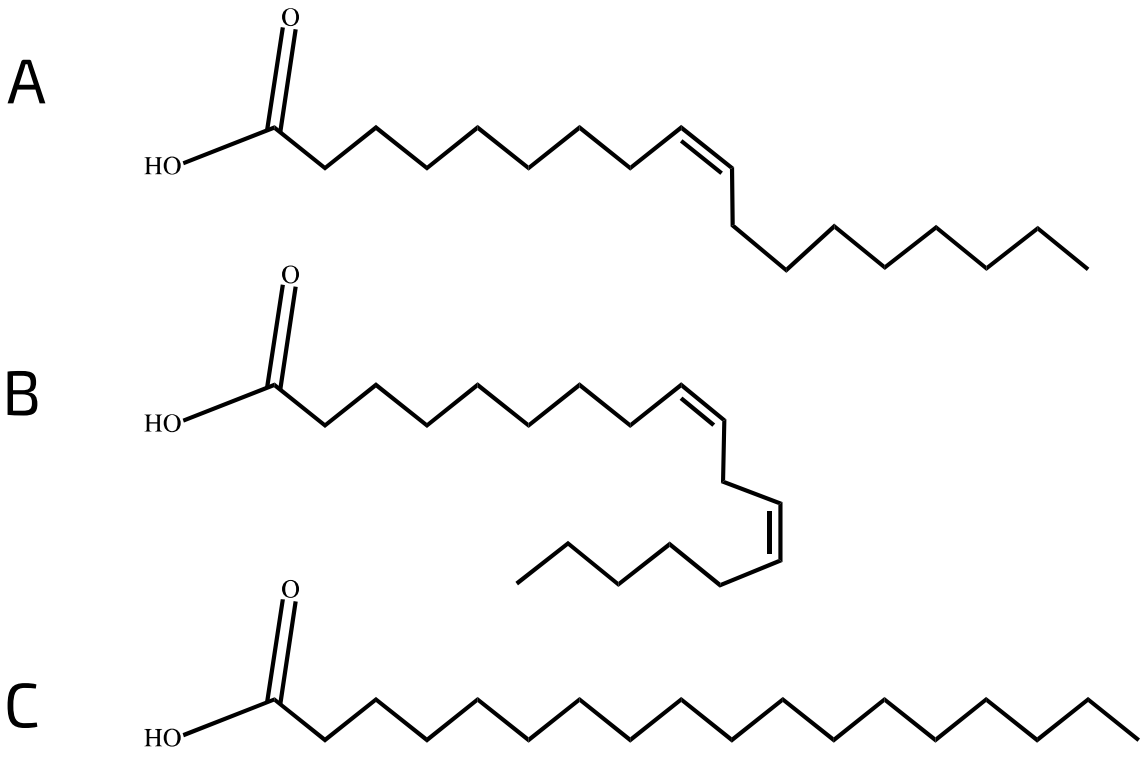

Figure 1: Structures of three fatty acids.

Match the fatty acids to the labels in **Figure 1**.

Letter	Fatty acid
A	
B	
C	

Items:

stearic acid | oleic acid | linoleic acid

Question elements adapted with permission from NSAA 2022 Specimen Paper Section 2 Q21

Question deck:

STEM SMART Biology Week 6 - Lipids

Testing For Lipids

Subject & topics: Biology | Biochemistry | Lipids **Stage & difficulty:** A Level P1

The test used to determine if lipids are present in a sample is [ ]. This involves adding [ ] and water to the sample and shaking. If the solution remains clear then there are [ ] in the sample. If [ ] forms, then there are [ ] in the sample.

Items:

lipids | no lipids | a white emulsion | ethanol | Benedict's reagent | the emulsion test | Benedict's test | a red colour

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Question deck:
STEM SMART Biology Week 6 - Lipids

Lipids Overview

Subject & topics: Biology | Biochemistry | Lipids **Stage & difficulty:** A Level P1

Part A

Lipid definition

What is the defining characteristic of a lipid?

- contains glycerol and one or more fatty acid
- form bilayers
- form part of cell membranes
- composed of amino acids
- insoluble in water
- composed of monosaccharides
- contains a hydrophilic region and a hydrophobic region
- soluble in water

Part B

Lipid properties

Match the lipids to their properties.

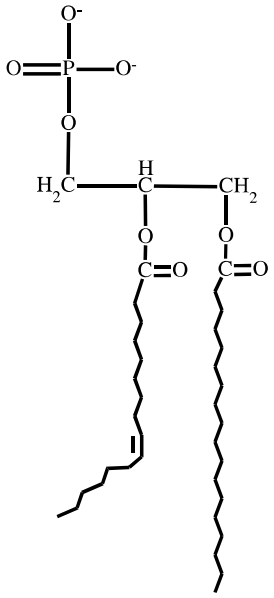
Lipid	Components	Polarity	Functions
	glycerol, 3 fatty acids		energy storage, insulation, protection
	glycerol, 2 fatty acids, phosphate group		
	4 carbon rings, hydrocarbon chain, hydroxyl group		regulate membrane fluidity, precursor for steroid hormones

Items:

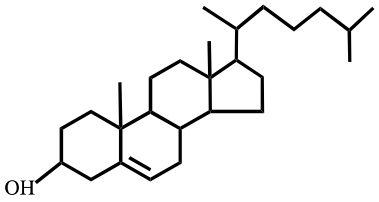
Sterols | hydrophobic | Triglycerides | Phospholipids | form membranes | amphipathic

Part C

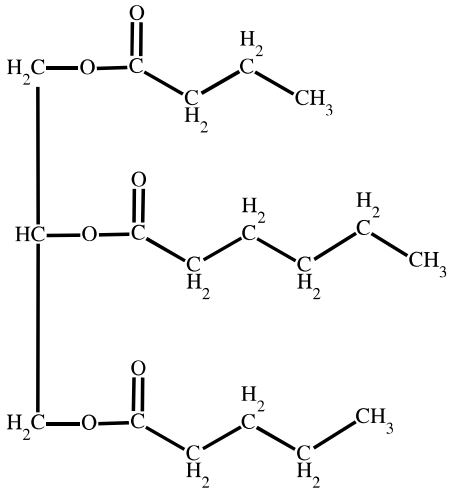
Lipid structures



A



B



C

Match the type of lipid to the image above.

A: [ ]

B: [ ]

C: [ ]

Items:

proteolipid | triglyceride | phospholipid | diglyceride | sterol | glycolipid