Triglycerides

A Level

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:

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

Part B Condensation consequences

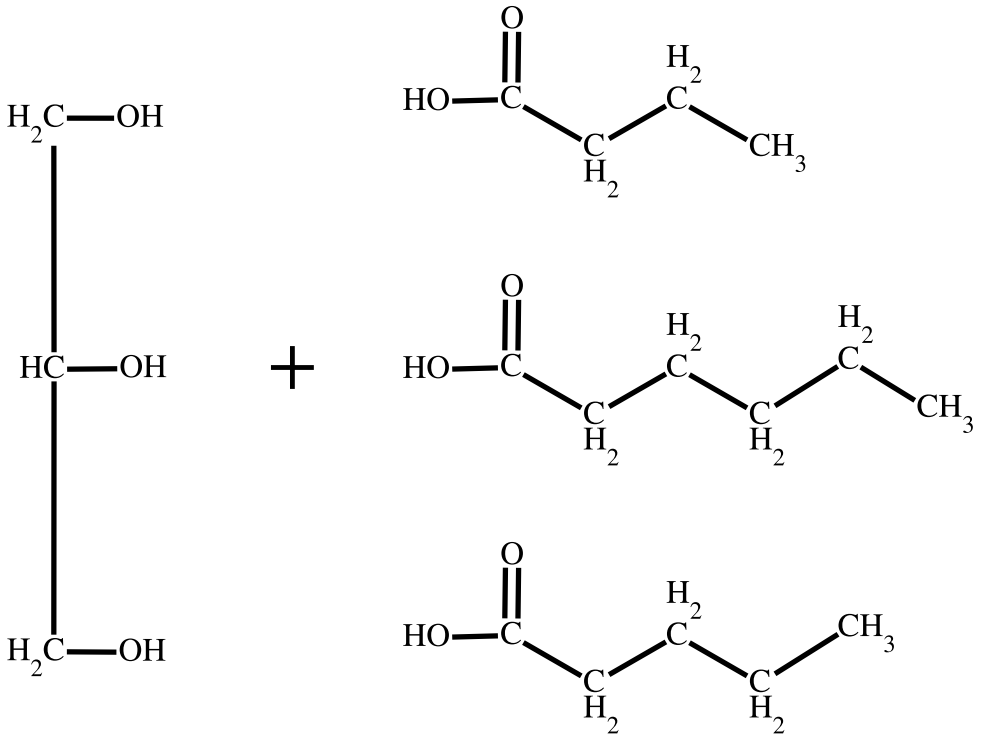
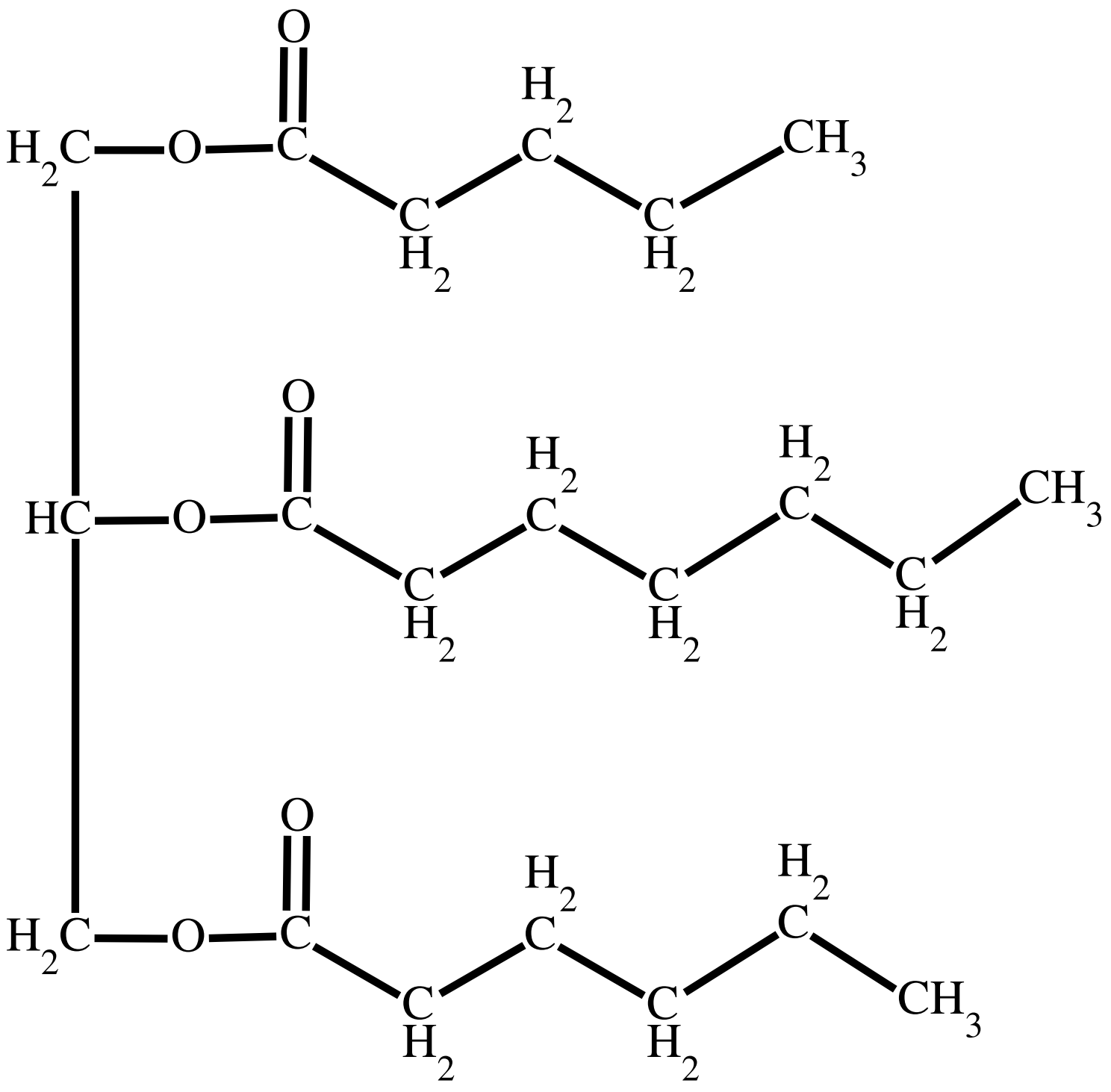
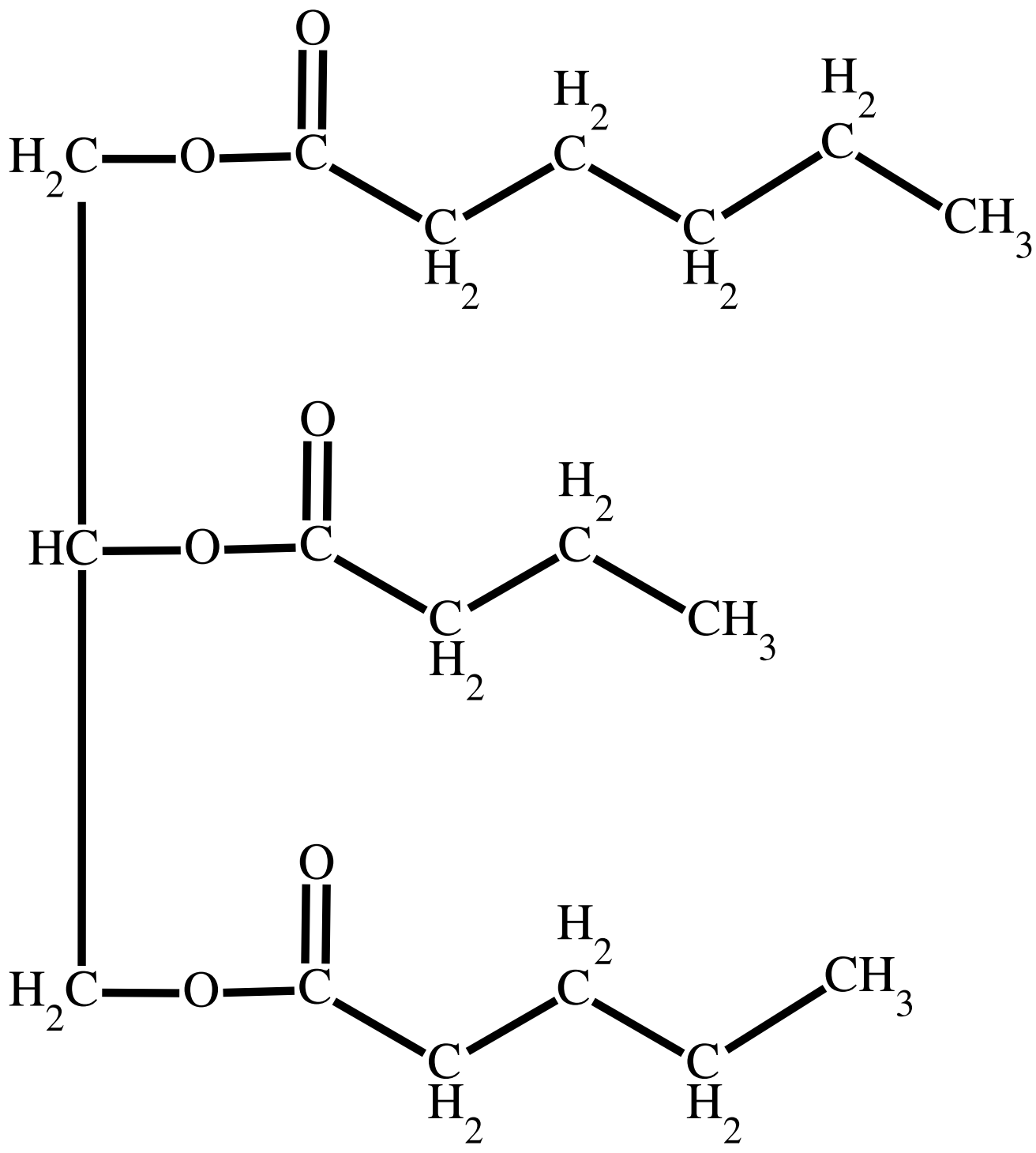


Figure 1: A condensation reaction between one glycerol molecule and three fatty acids.

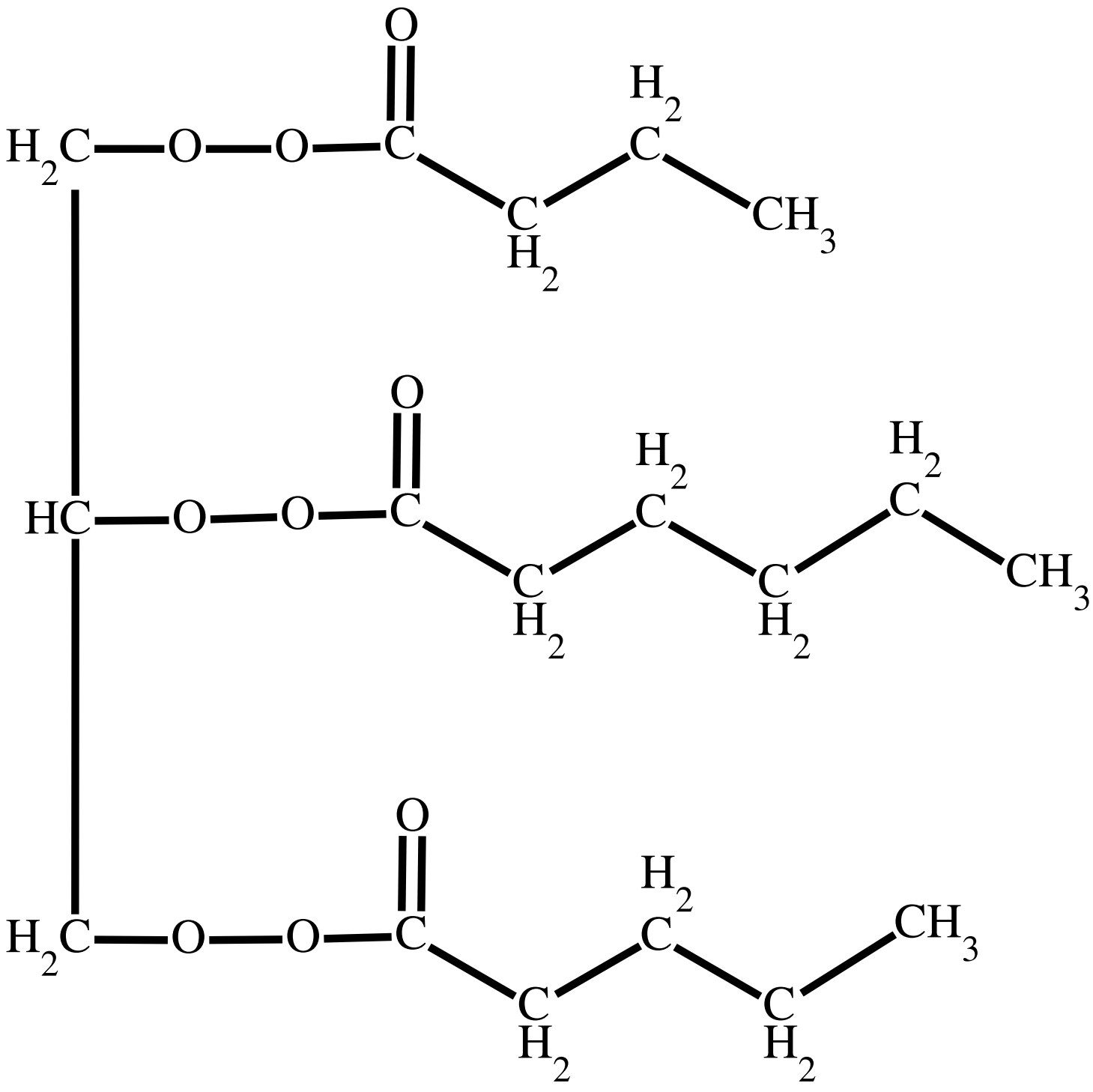
Which of the images below represent triglycerides that could be formed in the condensation reaction shown in Figure 1? Select all that apply.



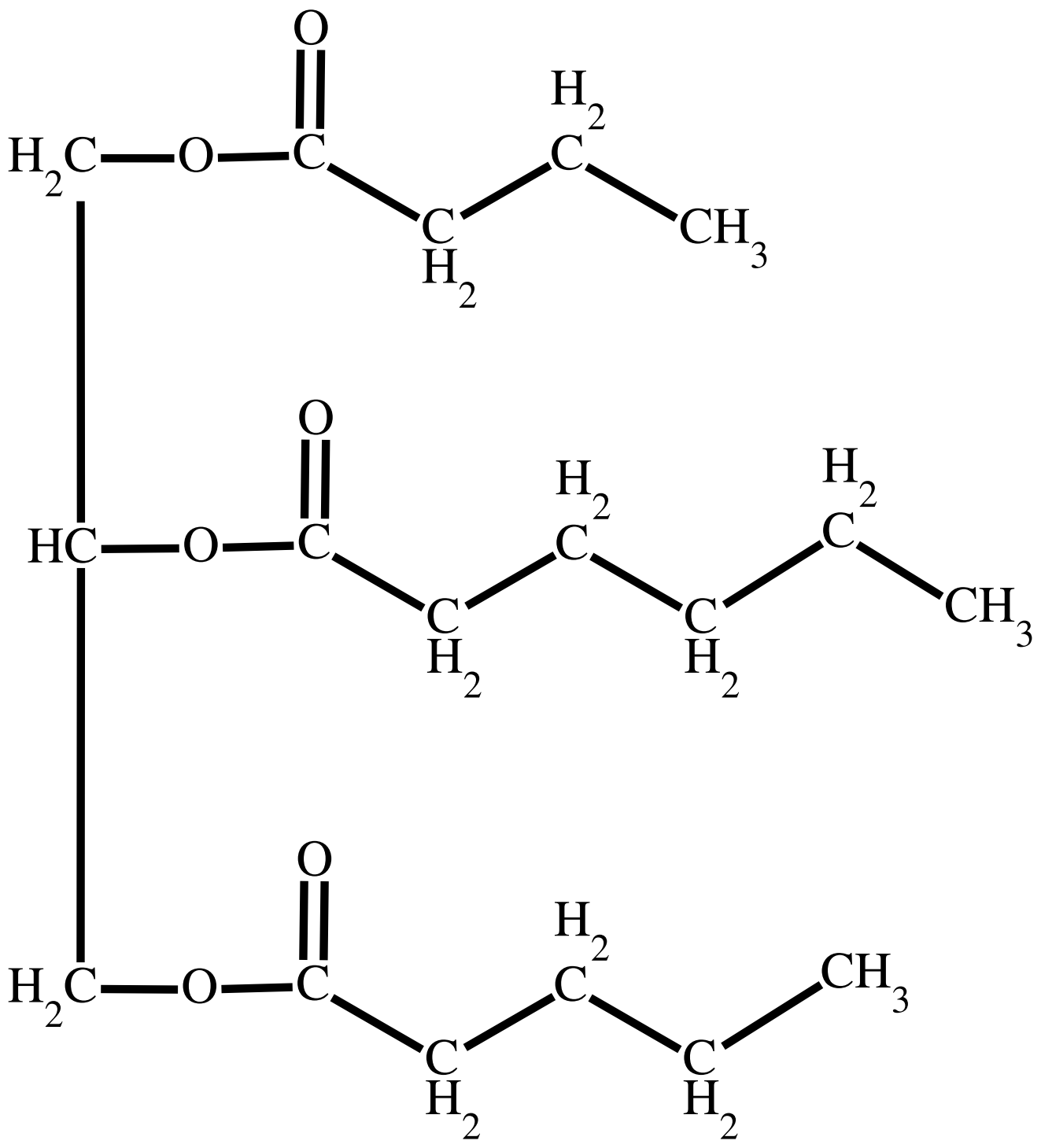
A



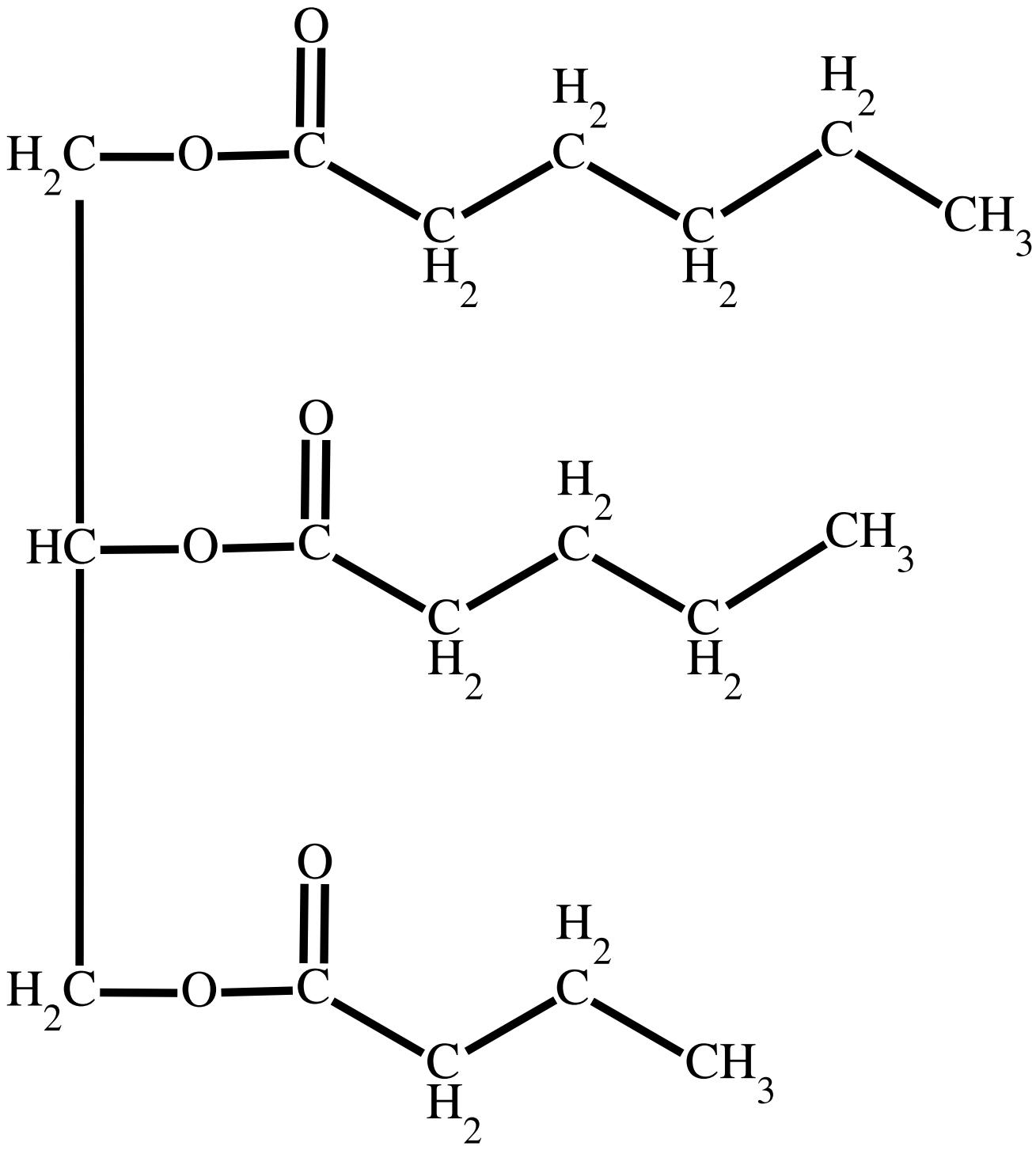
B



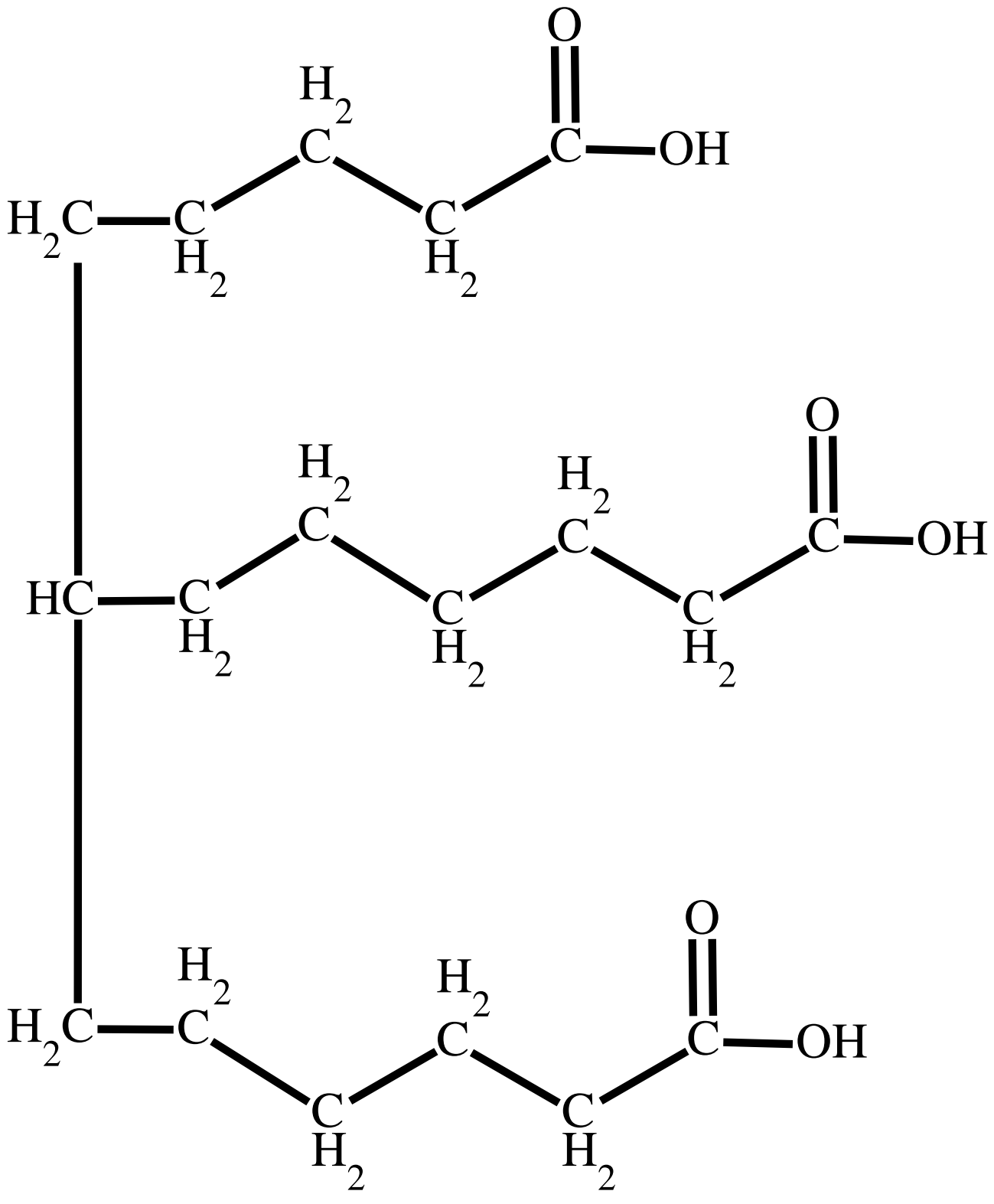
c



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.

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

Phospholipids

A Level

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:

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

Part B Phospholipid possibilities

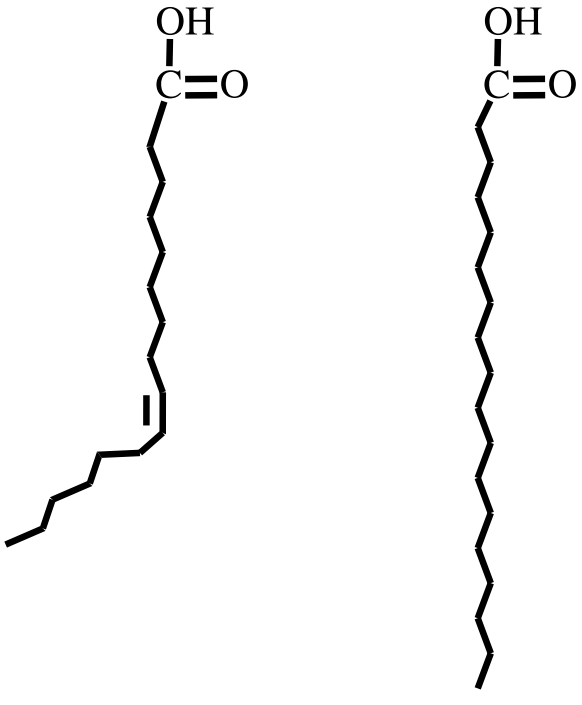
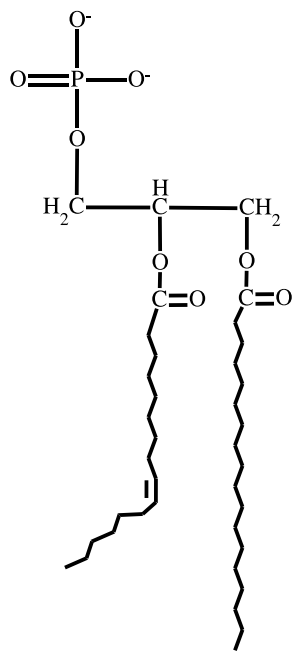
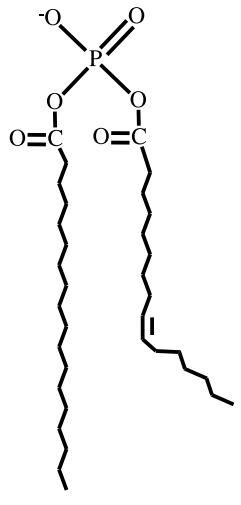


Figure 1: The simplified structures of two fatty acids are shown.

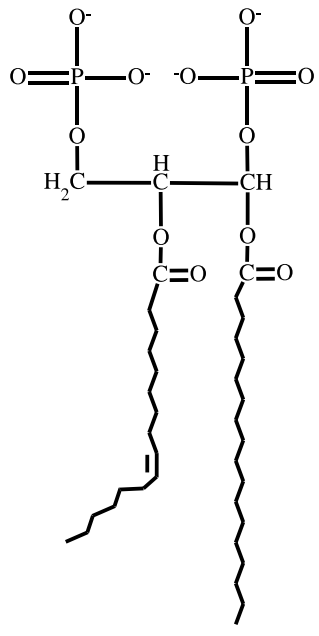
Which of the images below represent a phospholipid that could be formed from the fatty acids shown in Figure 1? Select all that apply.



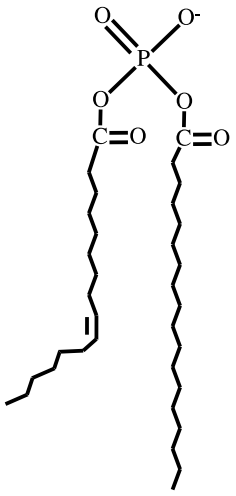
A



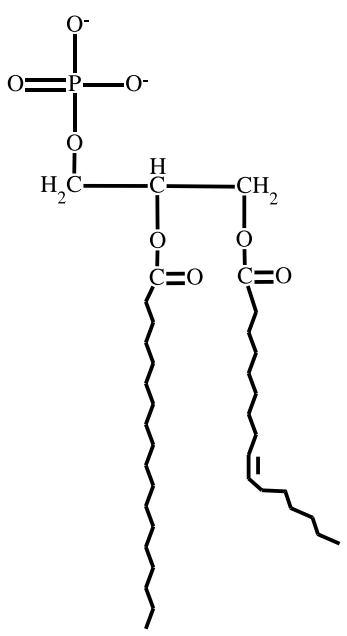
B



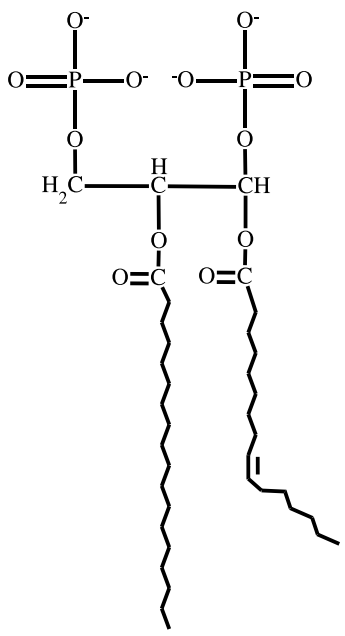
C



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 **phosphate group** **fatty acids** **hydrophobic** **amphipathic**

Part D Phospholipid function

Which of the following is the main function of phospholipids?

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

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STEM SMART Biology Week 5

Sterols

A Level

C C C

Part A Sterol structure

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

A sterol is a molecule with a core of [ ] carbon-rings. This core is connected to a [ ] at one end, and to a hydrocarbon chain at the opposite end. The [ ] is polar and therefore [ ], whereas the rest of the molecule is non-polar and therefore [ ].

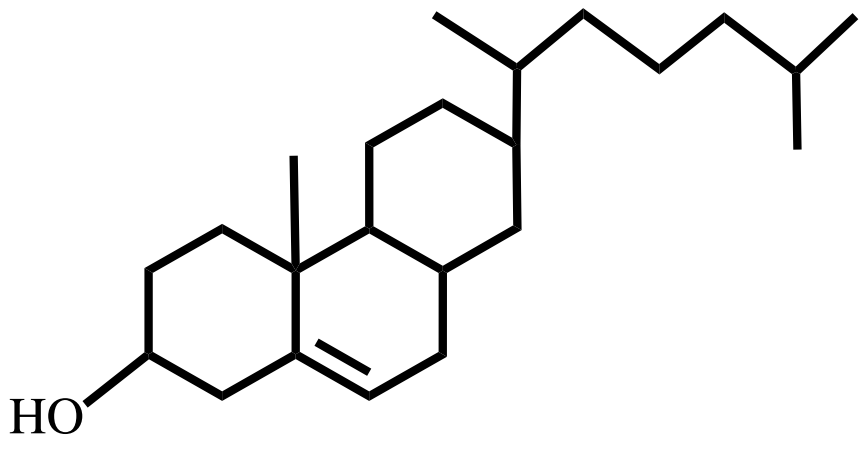
Sterols (e.g. cholesterol) are found in eukaryotic cell membranes, with the [ ] facing out of the membrane (like the phospholipid heads) and the rest of the sterol facing into the membrane (like the phospholipid tails).

Items:

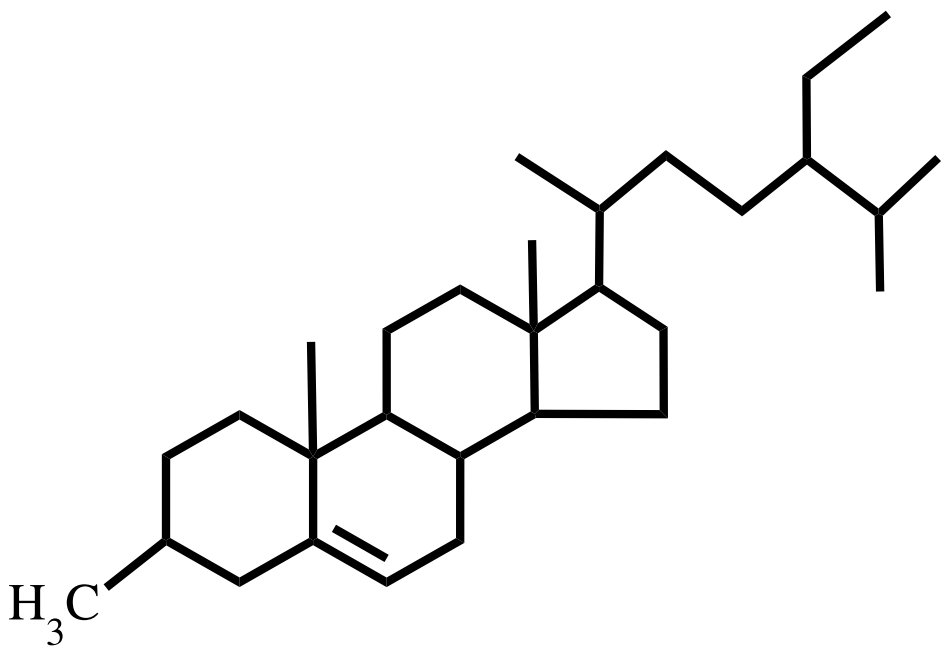
hydroxyl group **two** **carboxyl group** **four** **three** **hydrophobic** **hydrophilic** **phospholipids**

Part B Identify the sterols!

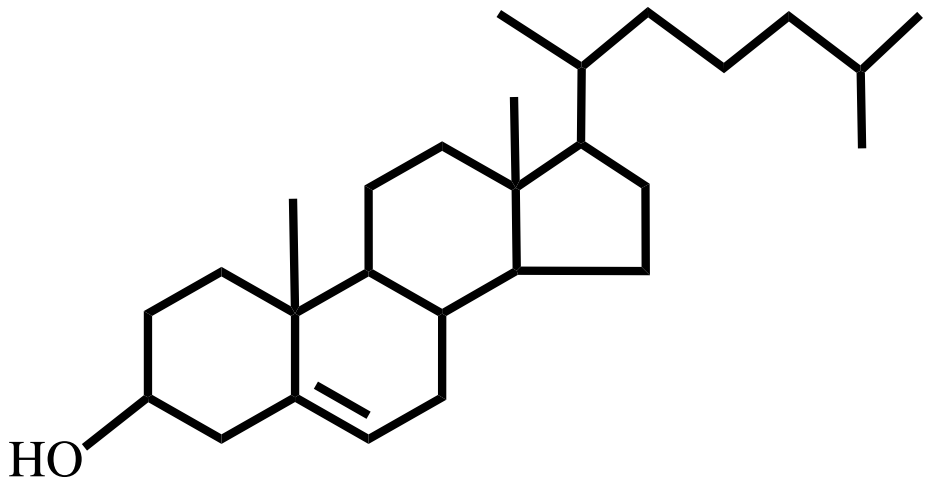
Which of the images below are sterols?



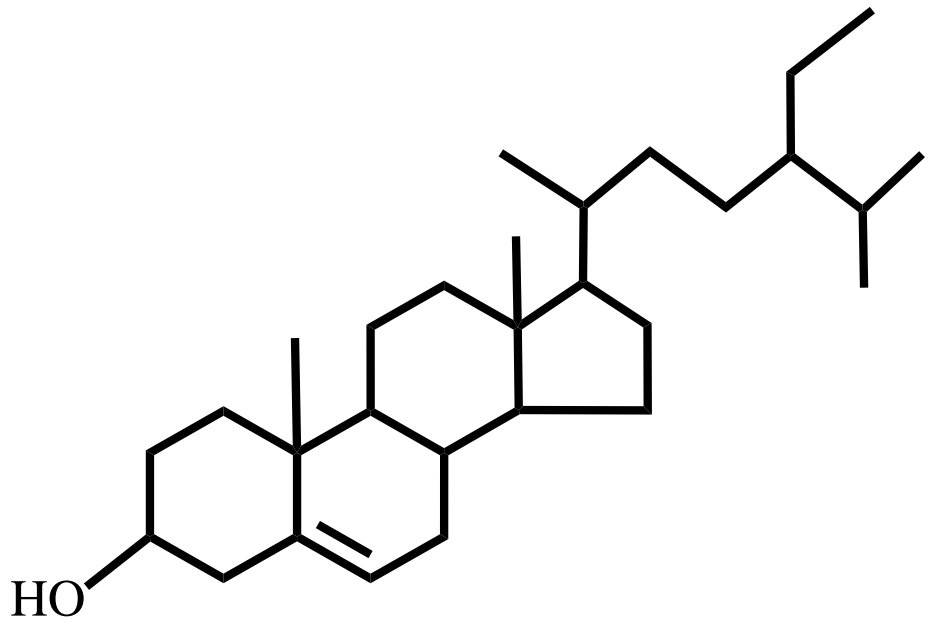
A



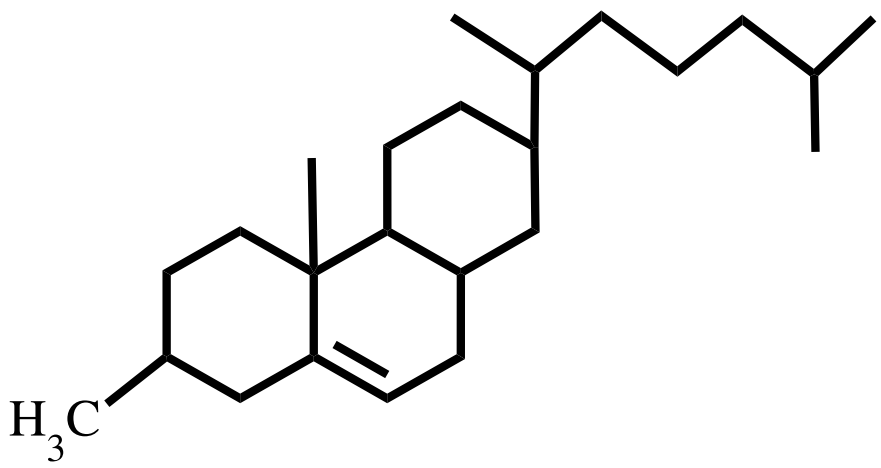
B



C



D



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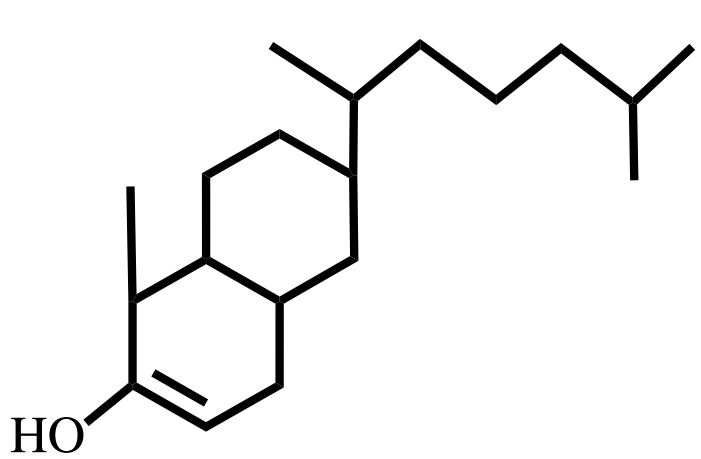

F

- [ ] A
- [ ] B
- [ ] C
- [ ] D

- [ ] E
- [ ] F

Part C Cholesterol

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

- [ ] act as biological catalysts
- [ ] precursor for steroid hormones
- [ ] insulation & protection
- [ ] energy storage
- [ ] regulates membrane fluidity

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Fatty Acid Saturation

A Level

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:

lowest **unsaturated** **intermediate** **polyunsaturated** **saturated** **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

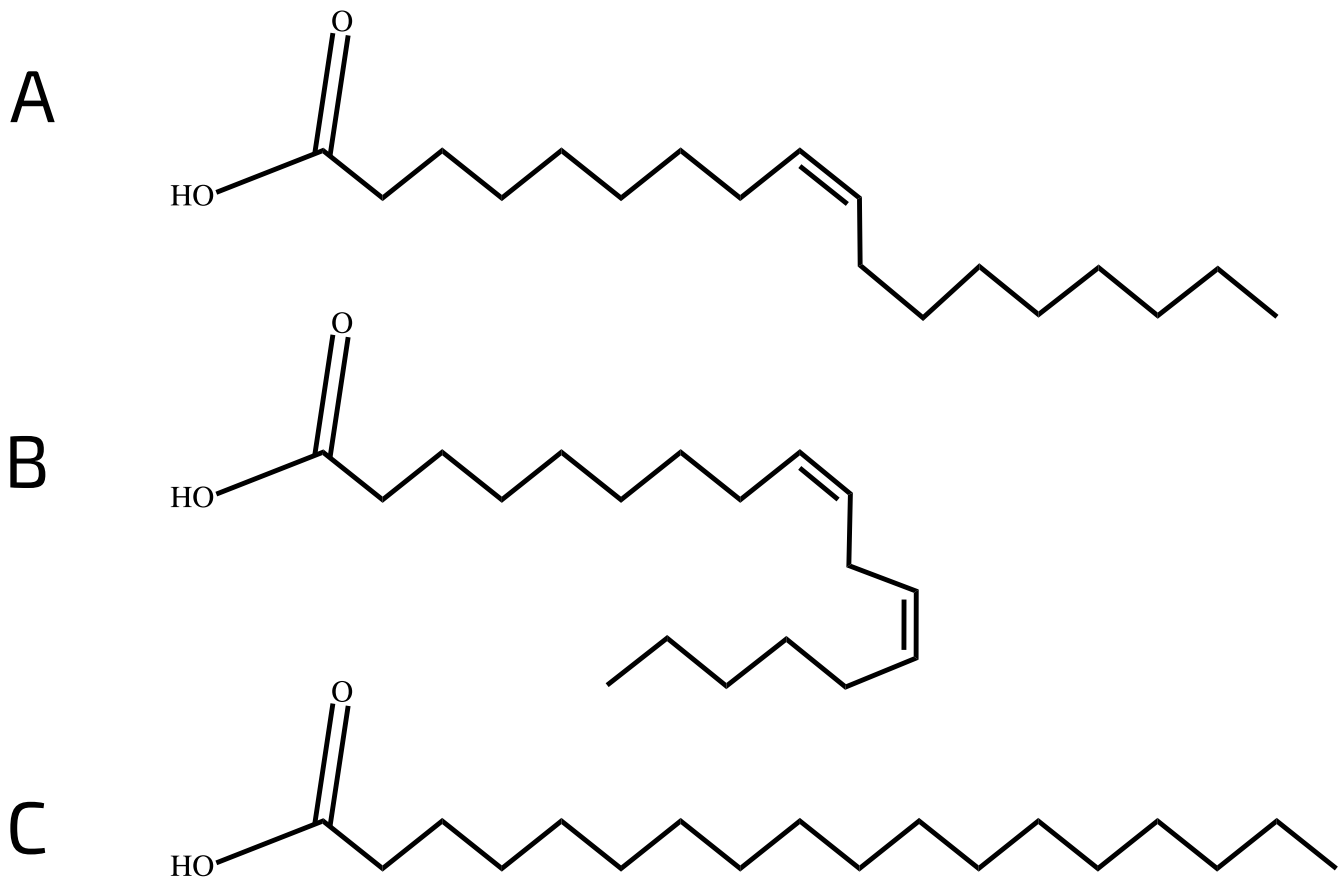

Figure 1: Structures of three fatty acids.

Match the fatty acids to the labels in Figure 1.

Letter	Fatty acid
A	
B	
C	

Items:

linoleic acid **stearic acid** **oleic acid**

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

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Testing For Lipids

A Level

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:

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

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Gameboard:

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Lipids Overview

A Level

Part A Lipid definition

What is the defining characteristic of a lipid?

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

Part B Lipid properties

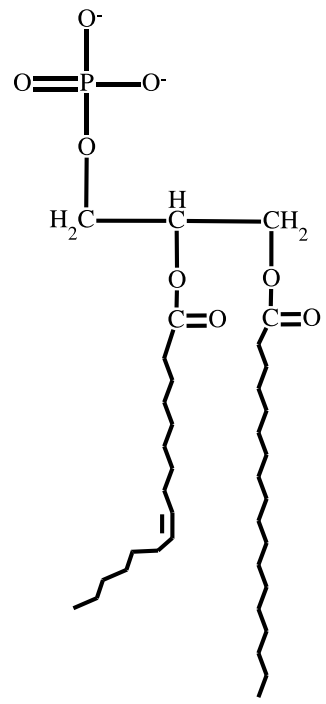
Match the lipids to their properties.

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

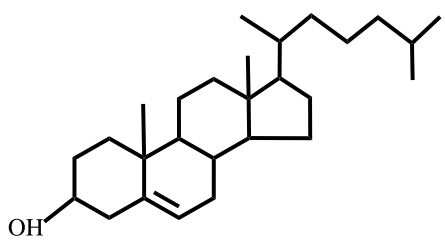
Items:

hydrophobic **form membranes** **amphipathic** **Phospholipids** **Sterols** **Triglycerides**

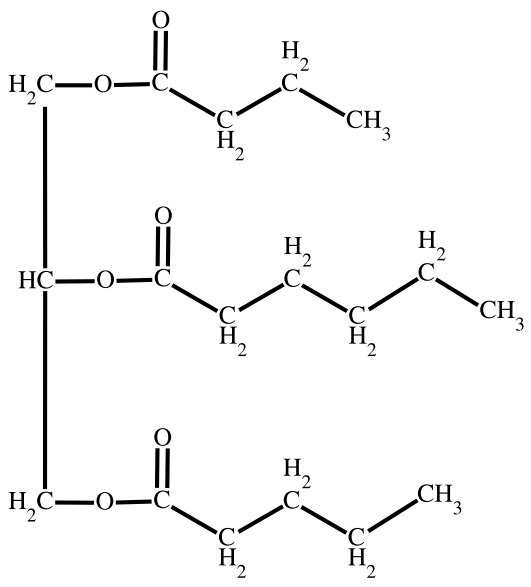
Part C Lipid structures



A



B



C

Match the type of lipid to the image above.

A:

B:

C:

Items:

sterol	diglyceride	phospholipid	glycolipid	proteolipid	triglyceride

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