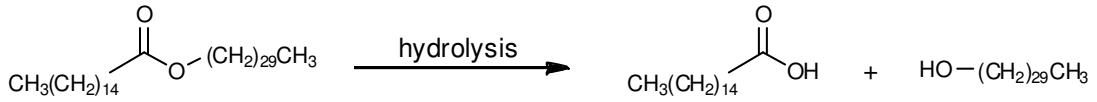
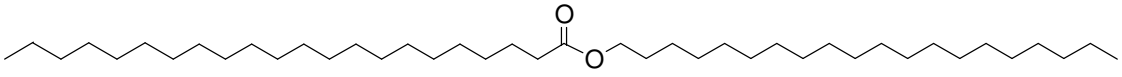
Solutions

26.1



26.2



26.3.

a) trimyristin° b) triarachadin c) triolein d) tristearin

26.4.

tripalmitolein, tripalmitin, and tristearin

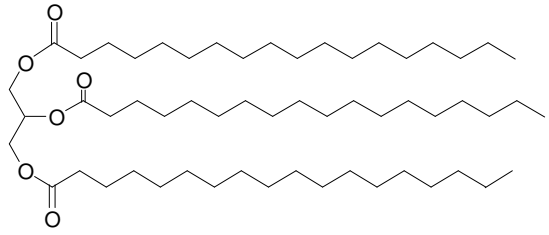
26.5. The fatty acid residues in triarachadin have more carbon atoms than the fatty acid residues in tristearin. Therefore, triarachadin is expected to have a higher melting point. It should be a solid at room temperature, and should therefore be classified as a fat, rather than an oil. Therefore, triglycerides made from lauric acid will also have a low melting point.

26.6.

a) All three fatty acid residues are saturated, with either 16 or 18 carbon atoms, so the triglyceride is expected to have a high melting point. It should be a solid at room temperature, so it is a fat.

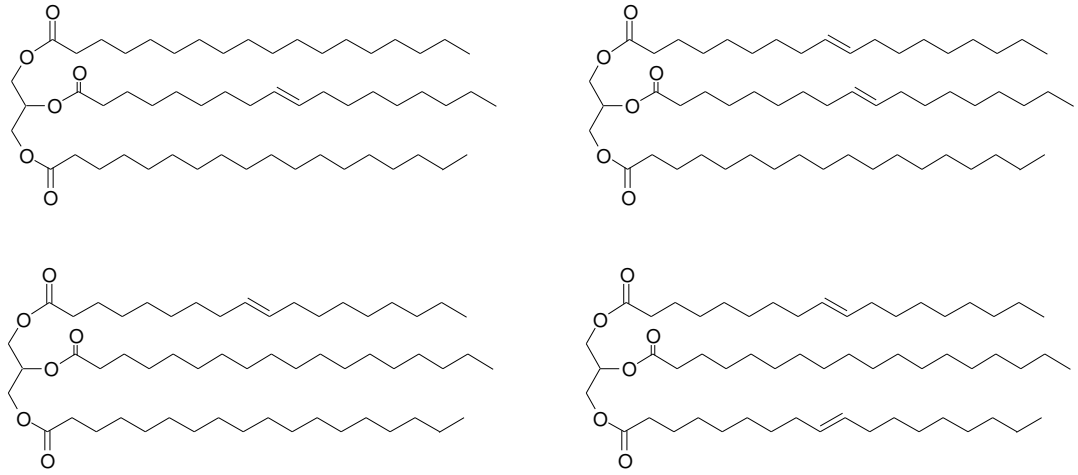
b) All three fatty acid residues are unsaturated, so the triglyceride is expected to have a low melting point. It should be a liquid at room temperature, so it is an oil.

26.7.

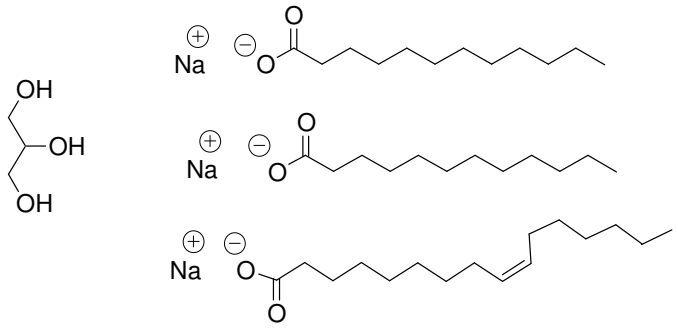


a)
b) Tristearin
c) The melting point of tristearin is higher than triolein.
d) Stearic acid

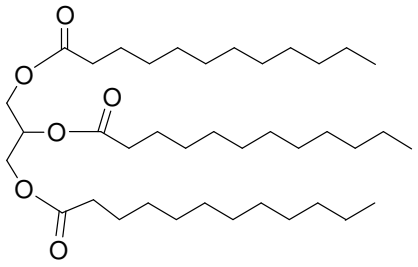
26.8.



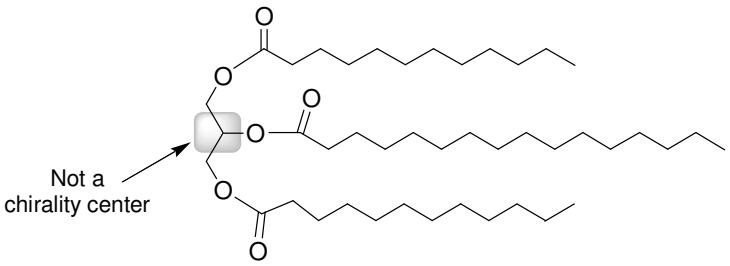
26.9.



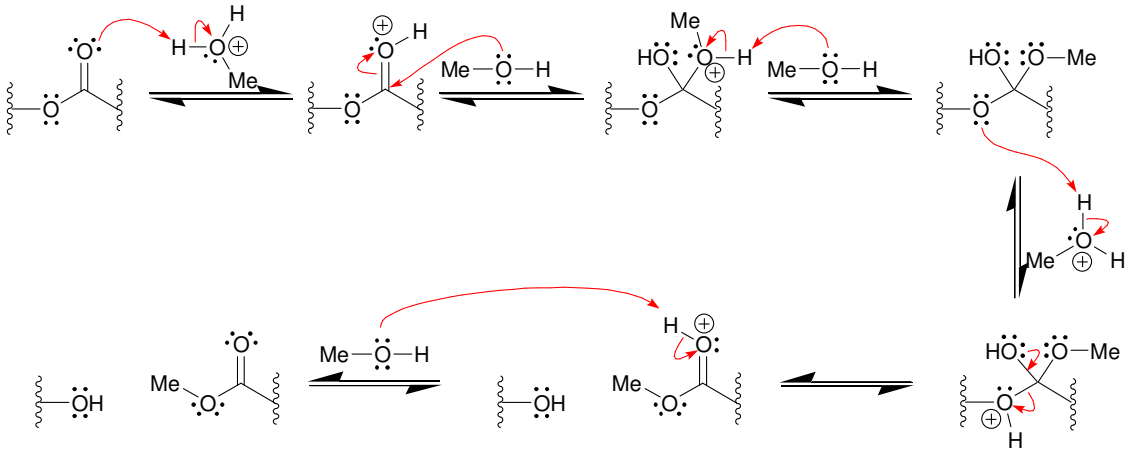
26.10.



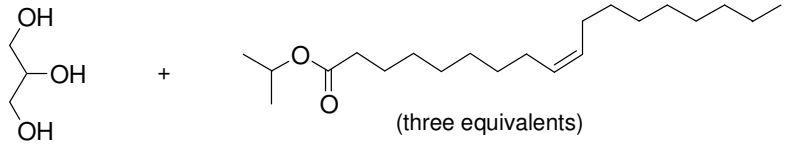
26.11



26.12. Each of the three ester moieties is hydrolyzed via the following mechanism:

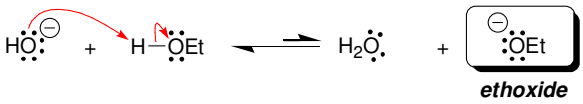


26.13.

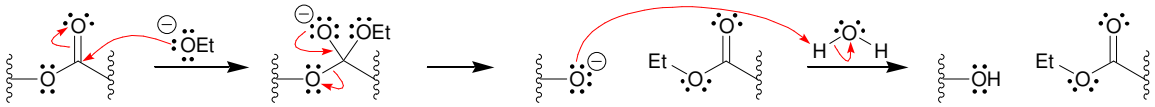


26.14.

a) Hydroxide functions as a catalyst by establishing an equilibrium in which some ethoxide ions are present.

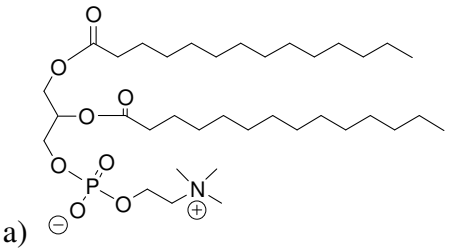


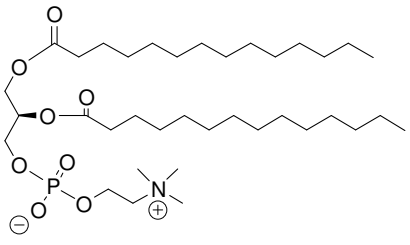
Then, each ester moiety undergoes transesterification via the following mechanism:



b) Hydroxide could function as a nucleophile and triglyceride would undergo hydrolysis rather than transesterification.

26.15.

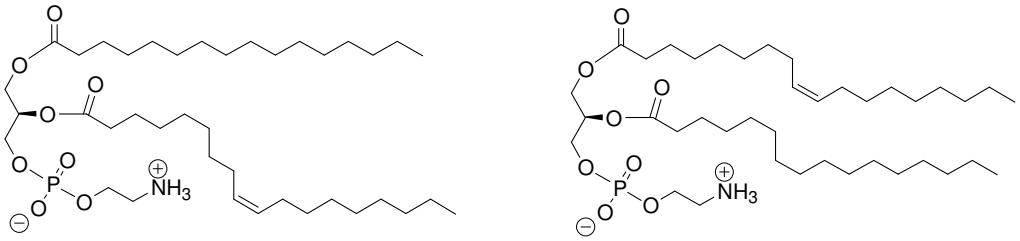




c) No. The C2 position would no longer be a chirality center.

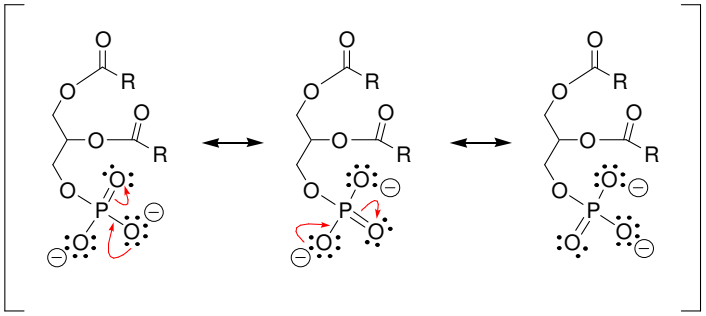
26.16.

a)



b) Yes. The C2 position would still be a chirality center.

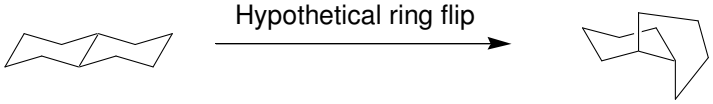
26.17.



26.18. Octanol has a longer hydrophobic tail than hexanol and is therefore more efficient at crossing the nonpolar environment of the cell membrane.

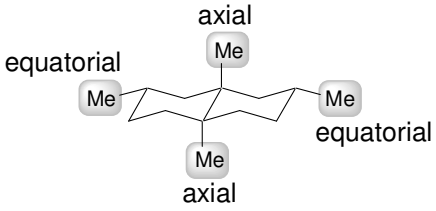
26.19. No. Glycerol has three OH groups (hydrophilic) and no hydrophobic tail. It cannot cross the nonpolar environment of the cell membrane.

26.20. A ring-flip is not possible for *trans*-decalin because one of the rings would have to achieve a geometry that resembles a six-membered ring with a *trans*-alkene, which is not possible. The ring fusions of cholesterol all resemble the ring fusion in *trans*-decalin, so cholesterol cannot undergo ring-flipping.

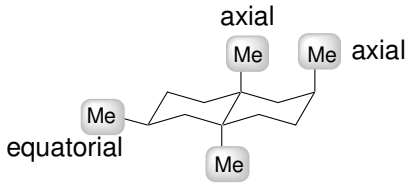


26.21.

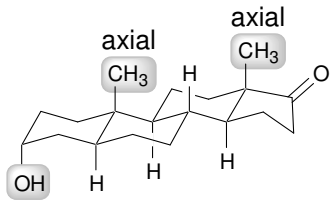
a)



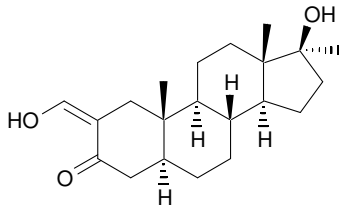
b)



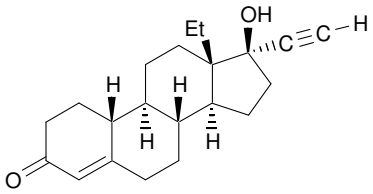
c)



26.22.

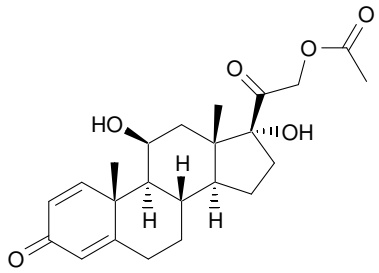


oxymetholone



norgestrel

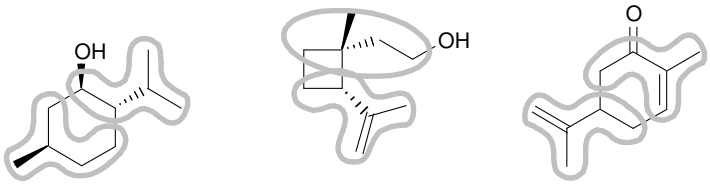
26.23.



26.24.

a) PGE_1 b) $PGF_{1\alpha}$

26.25.

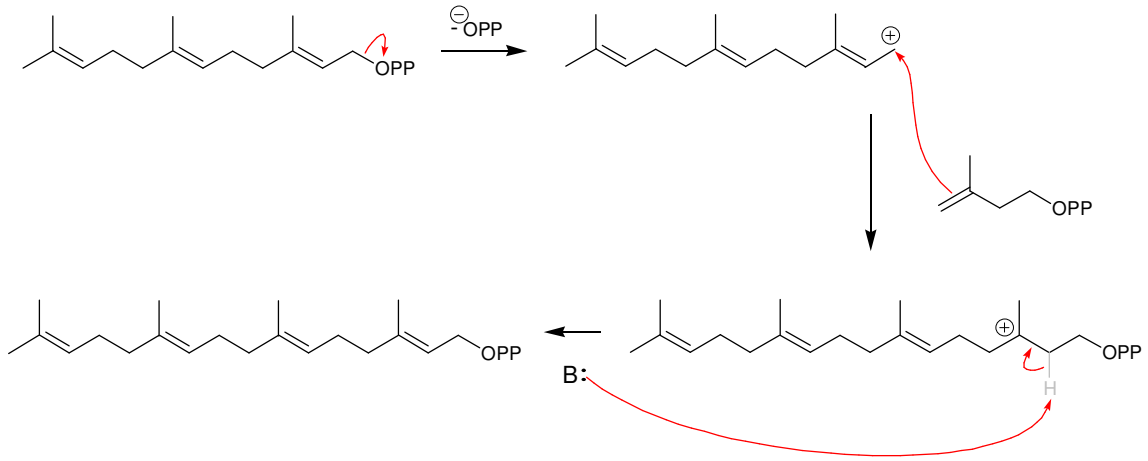


a) ***menthol*** b) ***grandisol*** c) ***carvone***

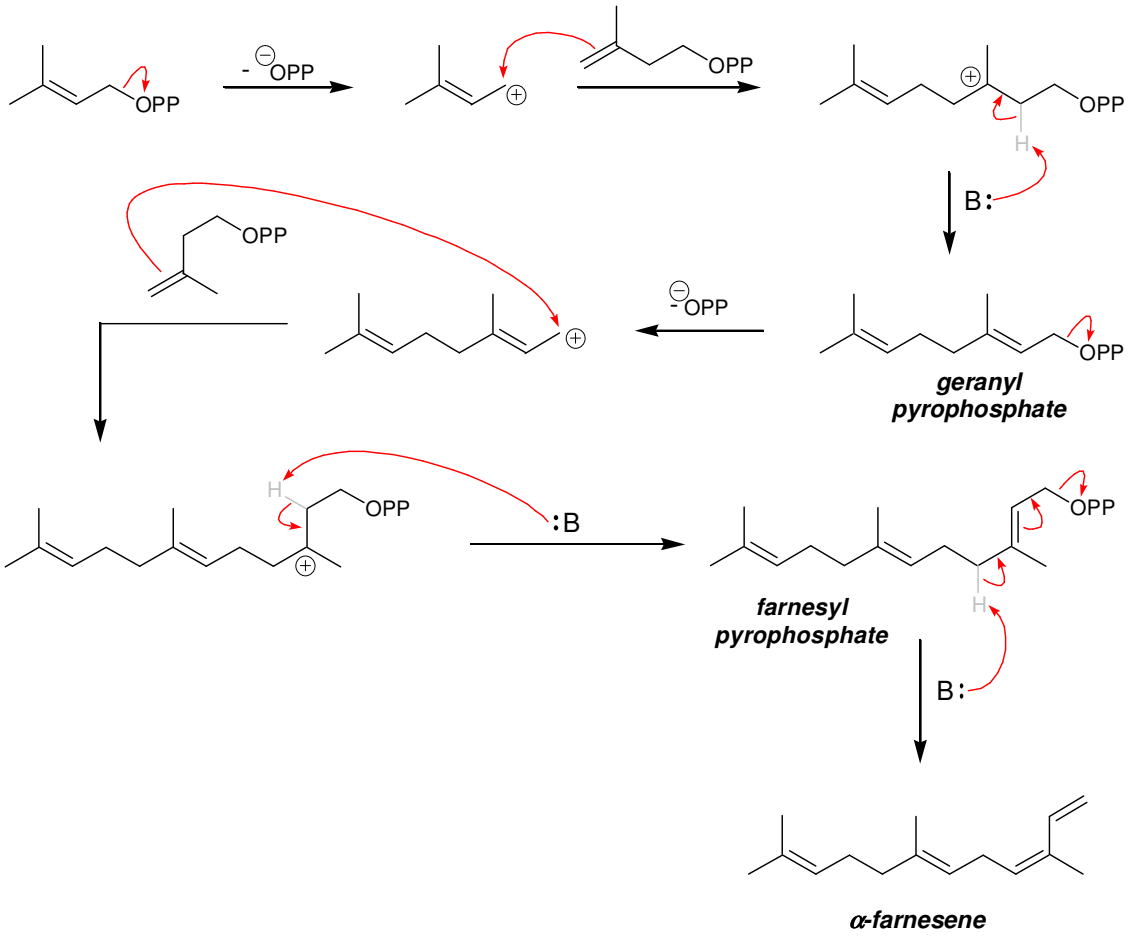
26.26.

a) Yes, it has 10 carbon atoms, which are comprised by the joining of two isoprene units.
b) No, it has 11 carbon atoms.
c) No, it has 11 carbon atoms.
d) No. It has 10 carbon atoms, but the branching pattern cannot be achieved by joining two isoprene units.

26.27.



26.28.

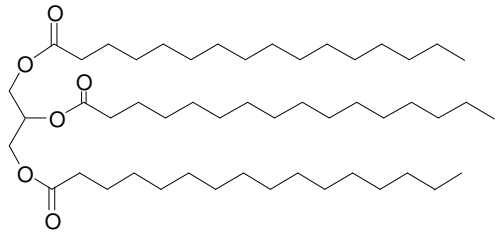


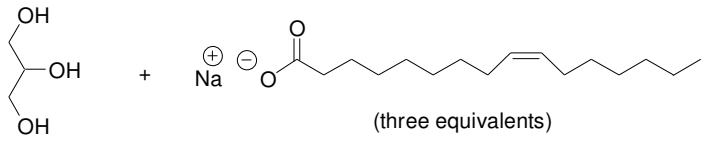
26.29.

a) steroid
b) terpene
c) triglyceride
d) phospholipid
e) prostaglandin
f) wax

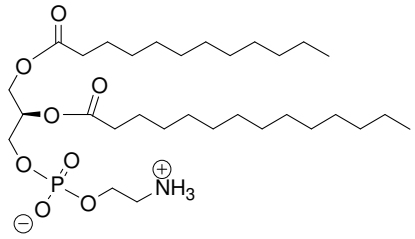
26.30.

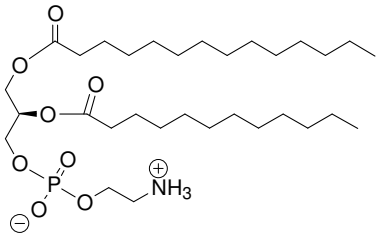
a)



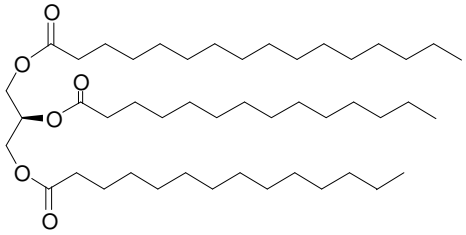
b) 

26.31. Both compounds are chiral:





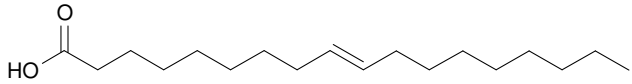
26.32. The fatty acid residues in this triglyceride are saturated, and will not react with molecular hydrogen.



26.33.

a) not a lipid
b) a lipid
c) a lipid
d) a lipid
e) a lipid
f) not a lipid
g) a lipid
h) not a lipid

26.34.



26.35. The fatty acid residues of tristearin are saturated and are therefore less susceptible to auto-oxidation than the unsaturated fatty acid residues in triolein.

26.36. a < b < c

26.37. Water would not be appropriate because it is a polar solvent, and terpenes are nonpolar compounds. Hexane is a nonpolar solvent and would be suitable.

26.38.

a) saturated
b) saturated
c) unsaturated
d) saturated
e) unsaturated
f) unsaturated

26.39. Arachidonic acid

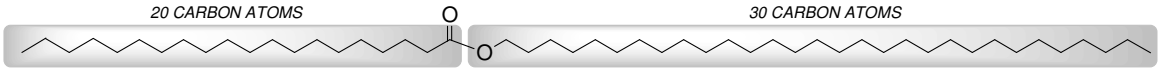
26.40.

a) No. It is an oil.
b) No. It is reactive towards molecular hydrogen in the presence of Ni.
c) Yes. It undergoes hydrolysis to produce unsaturated fatty acids.
d) Yes. It is a complex lipid because it undergoes hydrolysis.
e) No. It is not a wax.
f) No. It does not have a phosphate group.

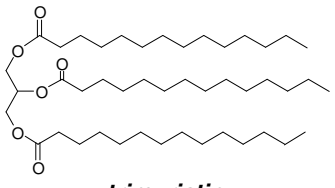
26.41.

a) Yes. It is a fat.
b) Yes. It is unreactive towards molecular hydrogen in the presence of Ni.
c) No. It undergoes hydrolysis to produce fatty acids that are saturated.
d) Yes. It is a complex lipid because it undergoes hydrolysis.
e) No. It is not a wax.
f) No. It does not have a phosphate group.

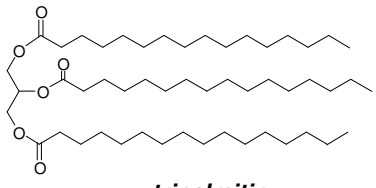
26.42.



26.43. Trimyristin is expected to have a lower melting point than tripalmitin because the former is comprised of fatty acid residues with fewer carbon atoms (14 instead of 16).

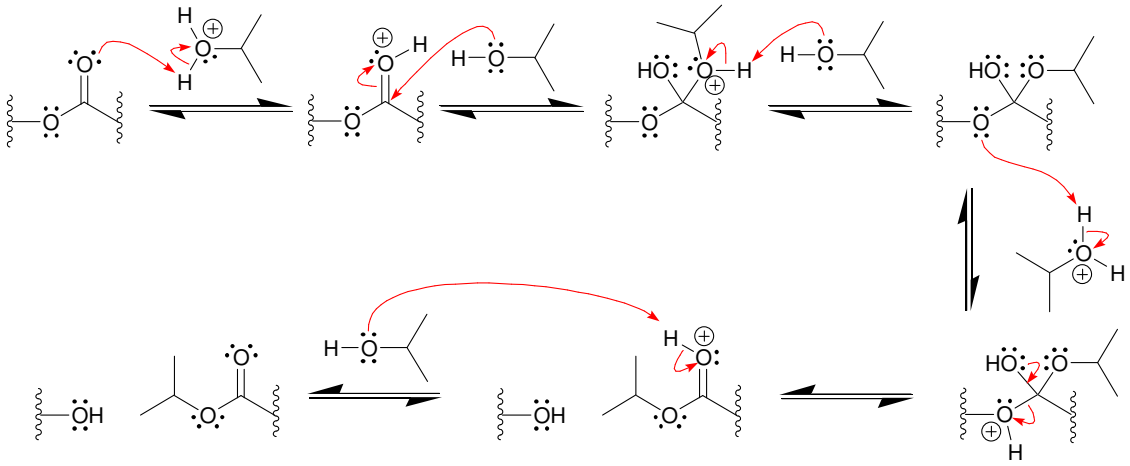


trimyristin



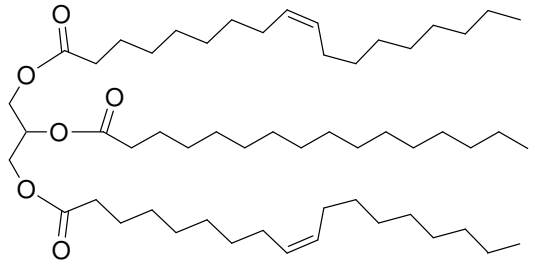
tripalmitin

26.44. Each of the three ester moieties is hydrolyzed via the following mechanism:

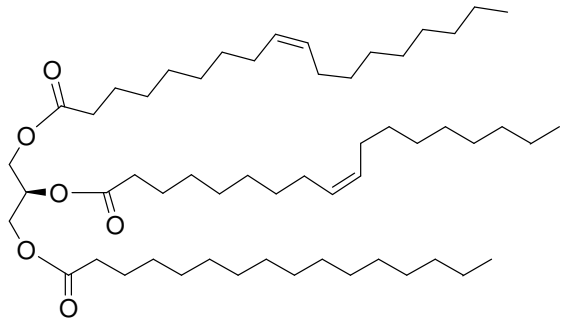


26.45. See the solution to Problem 26.14.

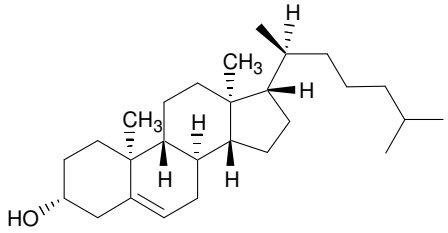
26.46.



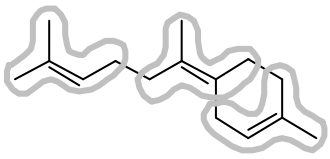
26.47.

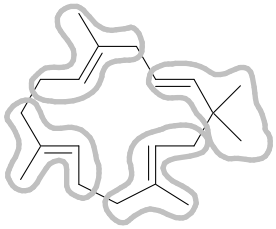


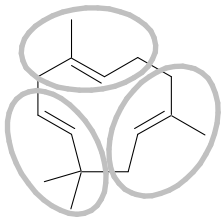
26.48.

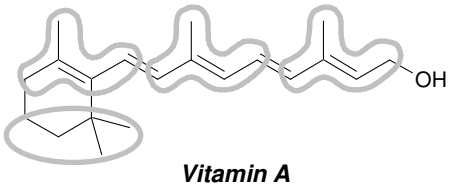


26.49.

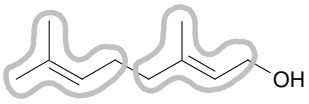
a) 
bisabolene

b) 
flexibilene

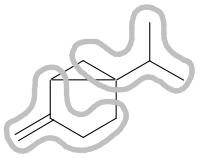
c) 
humulene

d) 

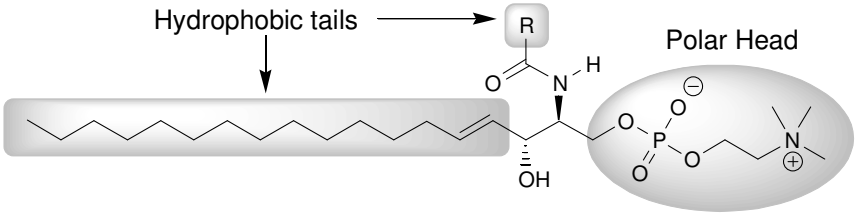
Vitamin A

e) 

geraniol

f) 
sabinene

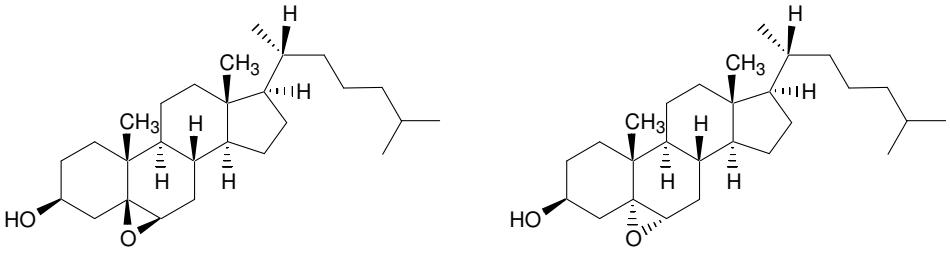
26.50.



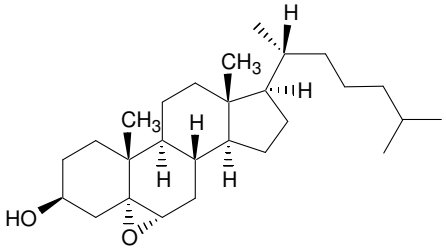
a)

b) Yes, they have one polar head and two hydrophobic tails.

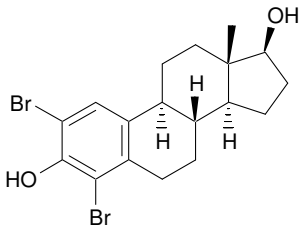
26.51.

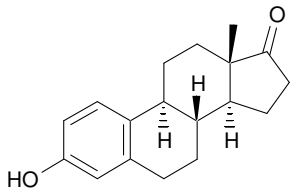
a) 

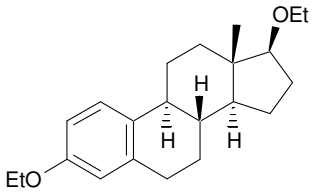
b) The methyl group (C19) provides steric hindrance that blocks one side of the π bond, and only the following is obtained:

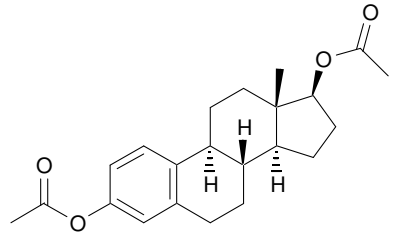


26.52.

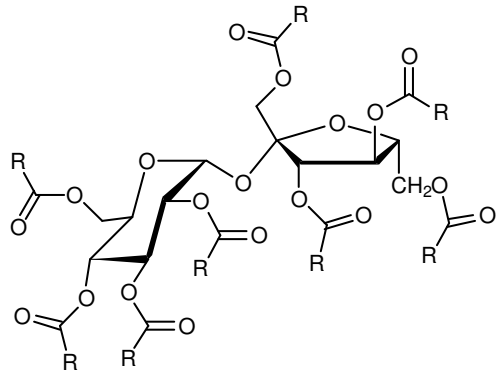
a)


b)


c)


d)


26.53. The compound is chiral.



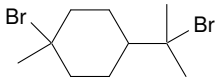
26.54.

a) H_2, Ni
b) H_2, Ni, followed by NaOH, followed by EtI.
c) H_2, Ni, followed by LAH, followed by H_2O
d) O_3, followed by DMS, followed by $Na_2Cr_2O_7$ and H_2SO_4
e) H_2, Ni, followed by PBr_3 and Br_2, followed by H_2O

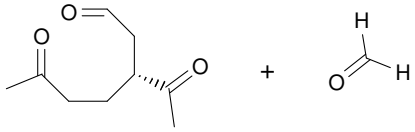
26.55.

a) Limonene is comprised of 10 carbon atoms and is, therefore, a monoterpene.

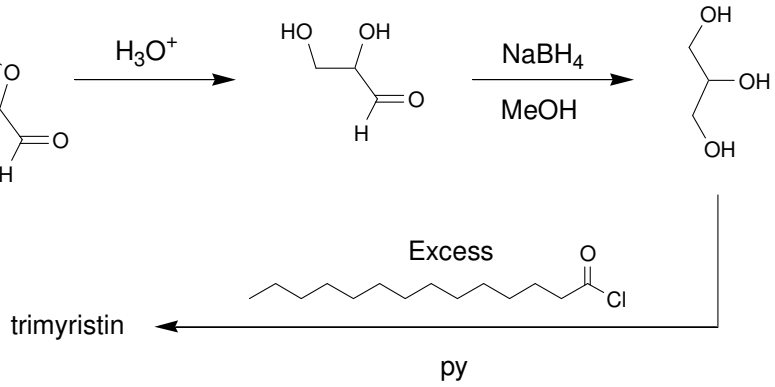
b) The compound does not have any chirality centers and is, therefore, achiral:



c)



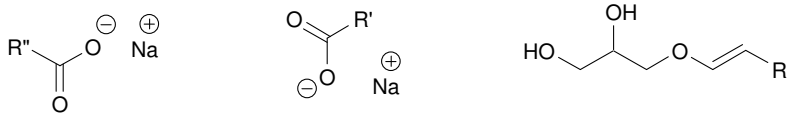
26.56.



26.57.

a) Fats and oils have a glycerol backbone connected to three fatty acid residues. Plasmalogens also have a glycerol backbone, but it is only connected to two fatty acid residues. The third group is not a fatty acid residue.

b)



c)