

ANSC/NUTR 618
Lipids and Lipid Metabolism
General Chemistry of Fatty Acids

I. Common Saturated Fatty Acids

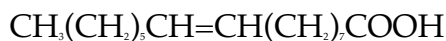
NO. OF CARBONS	COMMON NAME	GENEVA NAME	STRUCTURE
4	Butyric	Tetranoic	$\text{CH}_3(\text{CH}_2)_2\text{COOH}$
6	Caproic	Hexanoic	$\text{CH}_3(\text{CH}_2)_4\text{COOH}$
8	Caprylic	Octanoic	$\text{CH}_3(\text{CH}_2)_6\text{COOH}$
10	Capric	Decanoic	$\text{CH}_3(\text{CH}_2)_8\text{COOH}$
12	Lauric	Dodecanoic	$\text{CH}_3(\text{CH}_2)_{10}\text{COOH}$
14	Myristic	Tetradecanoic	$\text{CH}_3(\text{CH}_2)_{12}\text{COOH}$
16	Palmitic	Hexadecanoic	$\text{CH}_3(\text{CH}_2)_{14}\text{COOH}$
18	Stearic	Octadecanoic	$\text{CH}_3(\text{CH}_2)_{16}\text{COOH}$
20	Arachidic	Eicosanoic	$\text{CH}_3(\text{CH}_2)_{18}\text{COOH}$

(You will need to know the common names for fatty acids.)

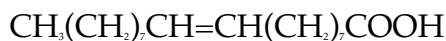
II. Common Dietary Unsaturated Fatty Acids

One Double Bond - monounsaturated

16C **Palmitoleic acid** *cis*-9-Hexadecenoic

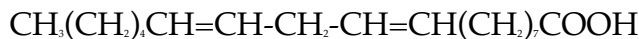


18C **Oleic acid** *cis*-9-Octadecenoic



Two cis-Double Bonds - polyunsaturated

18C **Linoleic acid** *cis*-9,12-Octadecadienoic



Two Conjugated Double Bonds

18C **Conjugated linoleic acid** *cis*-9,*trans*-11-Octadecadienoic



Three Double Bonds

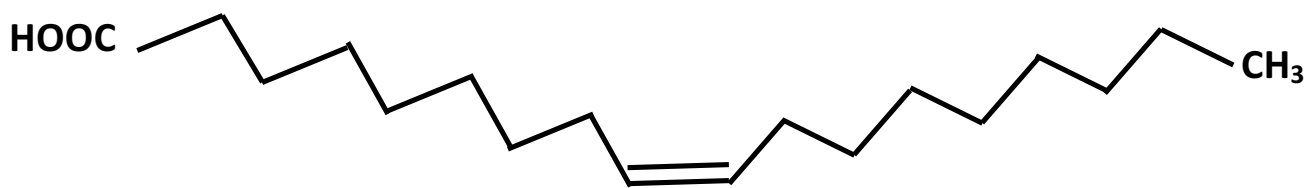
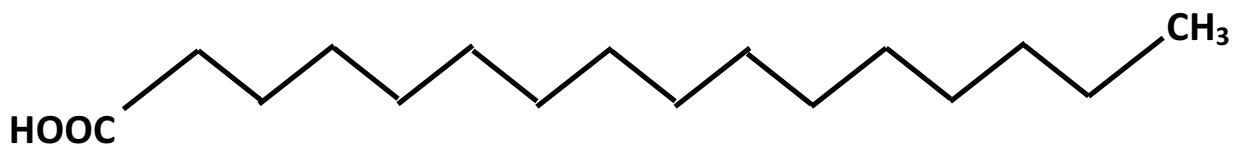
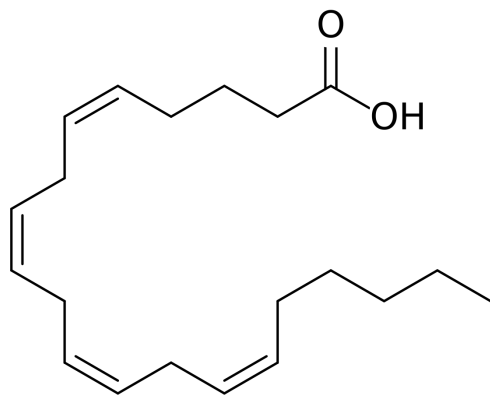
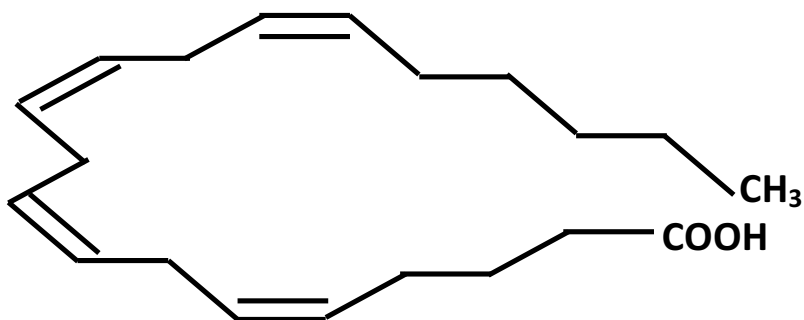
18C **α -Linolenic acid** *cis*-9,12,15-Octadecatrienoic

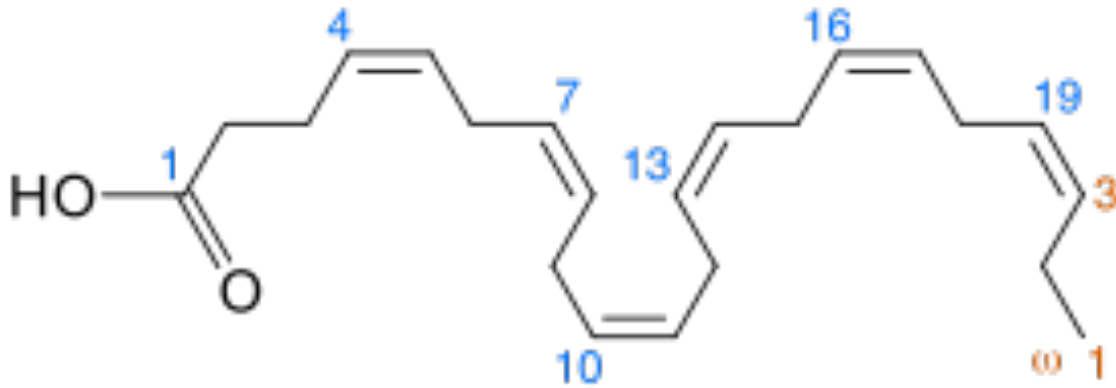


Some important structures



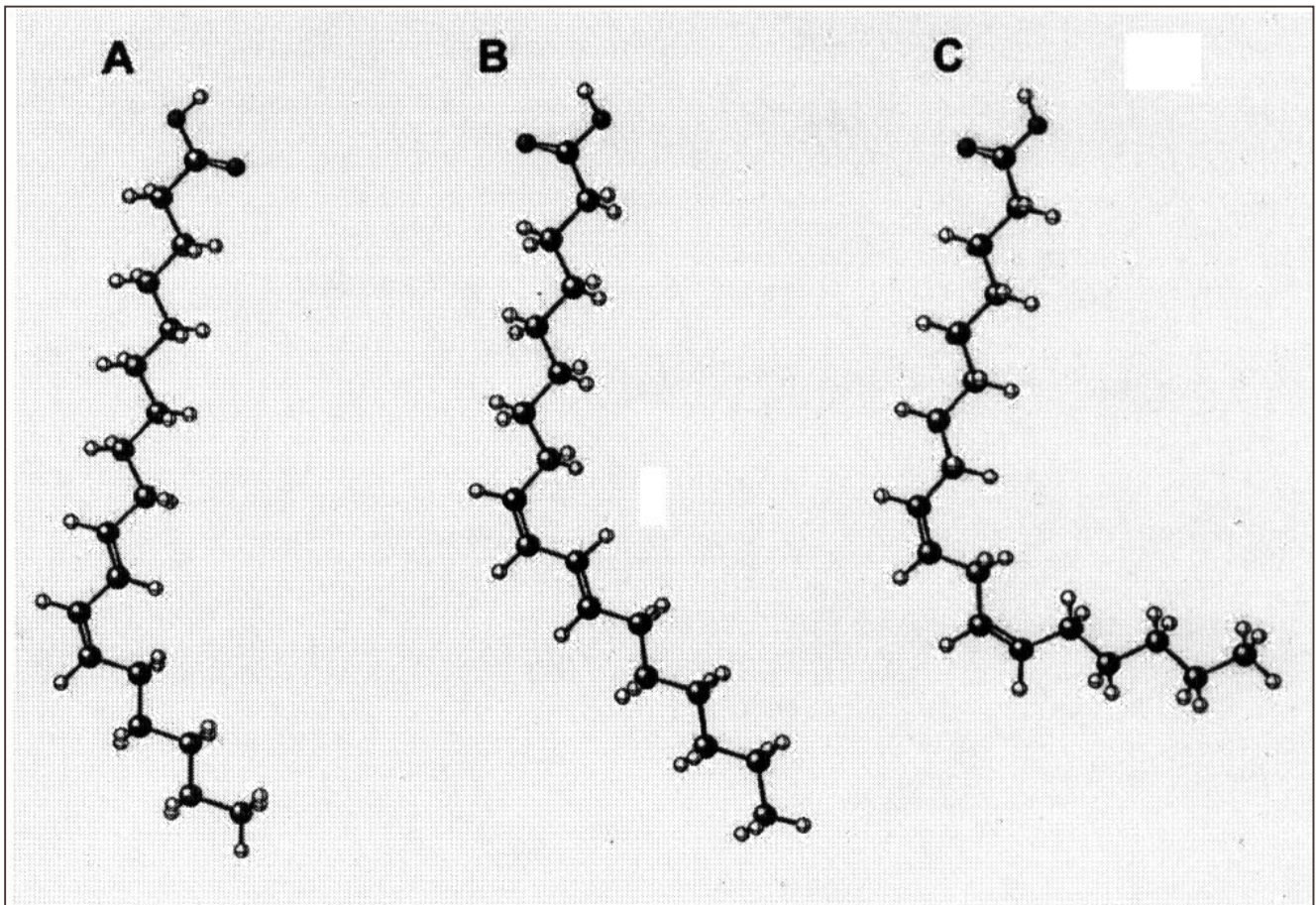
Palmitic acid (16:0)

Oleic acid (18:1n-9 or 18:1*cis*-9)Arachidonic acid (20:4n-6 or 20:4*cis*-5, 8, 11, 14)



Docosahexanoic acid (22:6 n -3 or 22:6 cis -4, 7, 10, 13, 16, 19)

trans-10, *cis*-12 conjugated linoleic acid (A), *cis*-9, *trans*-11 conjugated linoleic acid (B), and *cis*-9, *cis*-12 linoleic acid (C).



III. Melting points

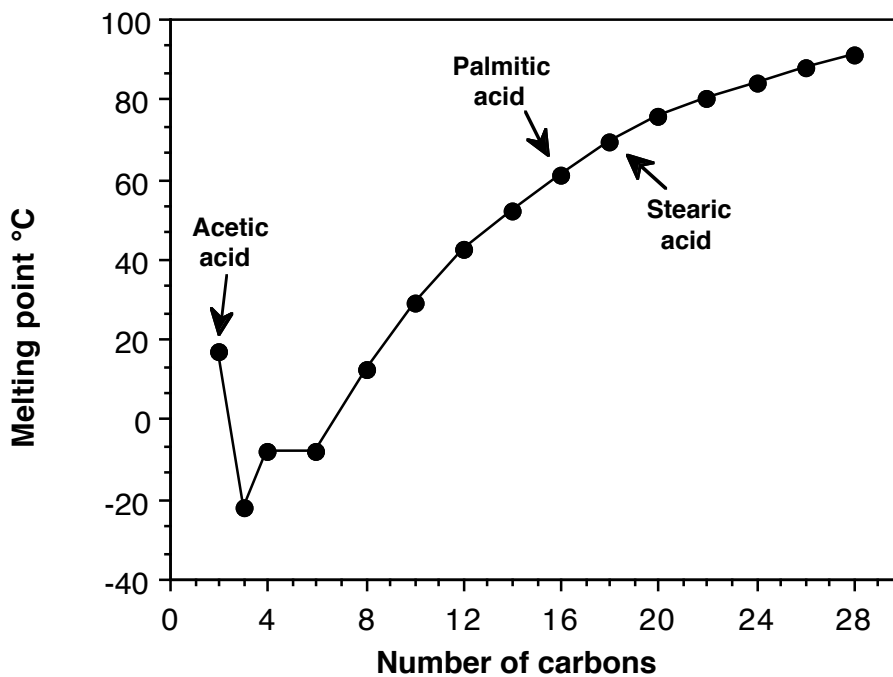
A. Increased chain length

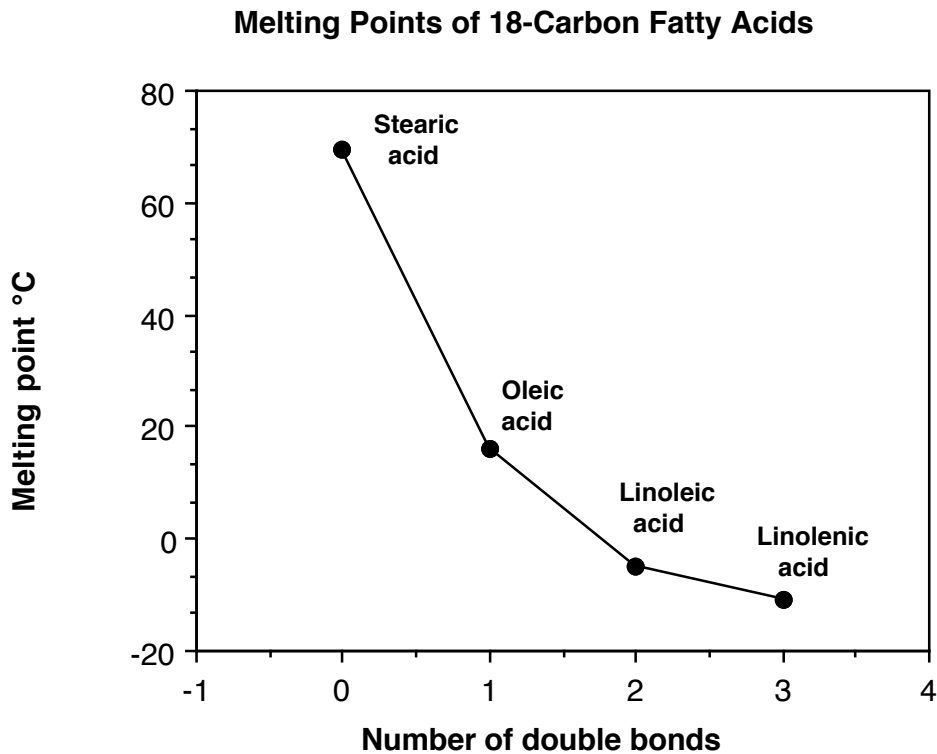
1. Acetic acid (smallest fatty acid) is anomalous because of polarity.
2. With increased chain length (> 3 carbons), melting point increases.

B. Increased double bonds

1. As *cis*-double bonds increase, melting point decreases.
2. *trans*-double bonds do not cause a kink in the molecule, so have less effect on melting point.

Melting Points of Saturated Fatty Acids





C. Fatty Acid Crystals

1. Crystals of oleic acid (**at right**) have a highly ordered structure.
2. The *cis* double bonds are tilted in opposite directions to the plane of the molecules.
3. This configuration provides maximum van der Waals forces.

