Unsaturated Hydrocarbons

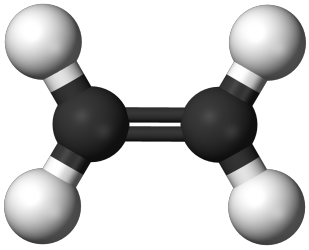
Organic compounds that contain the maximum number of hydrogen atoms per carbon atom are called **saturated compounds**.

Alkanes are saturated compounds.

Compounds that contain double or triple carbon-carbon bonds are called **unsaturated compounds**.

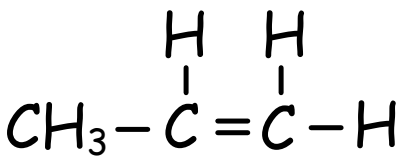
Alkenes are hydrocarbons that contain one or more carbon-carbon double covalent bonds.

Ethene (C_2H_4) is the simplest alkene.



To name an alkene, we follow the same conventions of alkanes (IUPAC system)

- Find the longest parent-chain containing the double bond.
- The carbon-carbon double bond has the lowest possible numbers.



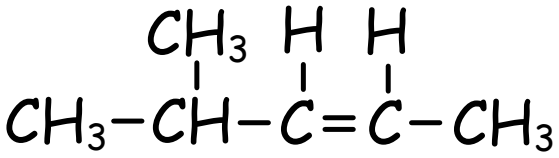
propene
(propylene)

Can this be drawn a different way?

1-butene $CH_2=CH-CH_2-CH_3$

Can this be drawn a different way?

What would be the name of this compound?



Example

Try to draw the structural compound

3-ethyl-2-methyl-2-pentene

Alkynes

Hydrocarbons that contain one or more carbon-carbon triple covalent bonds are called alkynes.

Other carbon bonds may be single or double carbon bonds.

Like alkenes, alkynes are unsaturated bonds.

Alkynes are not common in nature. The simplest alkyne is the gas ethyne.

What would this look like?

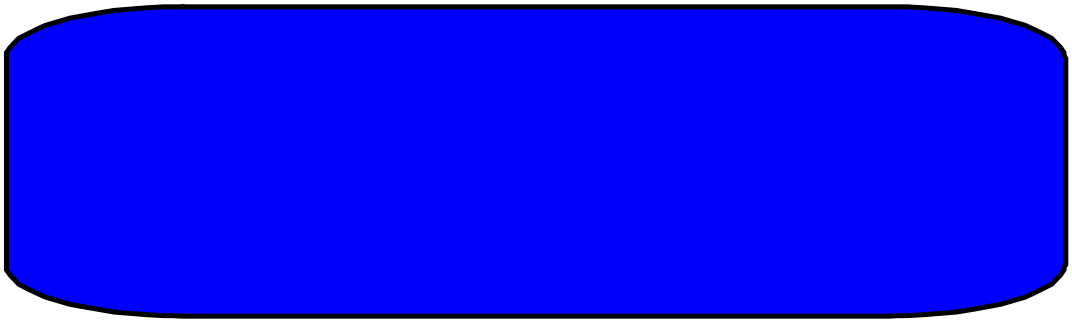
Practice

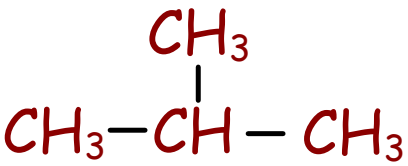
Try to draw the following alkyne

2,2,5-trimethyl-3-hexyne

Isomers

Take a moment to draw the complete or condensed structural formula for C_4H_{10}.





Even though both compounds have the formula C_4H_{10}, their boiling points and other properties differ. They are different substances.

Compounds that have the same molecular formula but different molecular structures are called **isomers**.

The C_4H_{10} example represents structural isomers. That is, they have the same molecular formula but their atoms are joined in a different order.

Structural isomers differ in physical properties such as melting and boiling points. *In general, the more branches, the lower the boiling point.*

When there is a double bond between the carbon atoms, it prevents them from rotating. (Think about the models we've built)

Geometric isomers have atoms joined in the same order, but differ in the orientation of groups around the double bond.

To see this, lets build 2-butene with the models. Can you build it in different ways?

In the **trans configuration**, the methyl groups are on opposite sides of the double bond.

In the **cis configuration**, the methyl groups are on the same side of the double bond.

So, *trans-2-butene* and *cis-2-butene* would be geometric isomers and have different physical and chemical properties.

Geometric isomers are possible whenever each carbon of the double bond has at least one substituent.

Example

Using the models, build the *cis* and *trans* geometric isomers for 2-pentene. Then, draw condensed structural diagrams for each.

Alkanes, Alkynes, and Isomers Worksheet

Review and Recap

Structure	Saturation	General Formula	Type of Bonding	Naming	Simplest Structure
alkanes	**saturated** – all carbon atoms hold the highest allowed amount of hydrogen atoms	C_nH_{2n+2}	Contains all single carbon to hydrogen bonds	ends with the suffix ~ane	 methane
alkenes	**unsaturated** – carbon atoms do not hold the highest allowed amount of hydrogen atoms	C_nH_{2n}	Contains at least one carbon to carbon double bond	ends with the suffix ~ene	 ethylene or ethene
alkynes	**unsaturated**	C_nH_{2n-2}	Contains at least one carbon to carbon triple bond	ends with the suffix ~yne (sometimes referred to as acetylenes)	ethyne or acetylene

Alkanes
https://www.youtube.com/watch?v=UloIw7dhnlQ

Alkenes and Alkynes
https://www.youtube.com/watch?v=CEH3O6l1pbw

How does the body lose fat?
https://www.youtube.com/watch?v=C8ialLlcdcw

Kahoot

https://create.kahoot.it/share/chemi122-alkanes-alkenes-and-alkynes-review/17362c5d-507a-4c4f-b99b-59c6f12f905a