10.4: Physical Properties

Physical state

Ethene, Propene, and Butene exists as colorless gases. Members of the 5 or more carbons such as Pentene, Hexene, and Heptene are liquid, and members of the 15 carbons or more are solids.

Density

Alkenes are lighter than water, therefore, are insoluble in water. Alkenes are only soluble in nonpolar solvent.

Solubility

Alkenes are virtually insoluble in water, but dissolve in organic solvents. The reasons for this are exactly the same as for the alkanes.

Boiling Points

The boiling point of each alkene is very similar to that of the alkane with the same number of carbon atoms. Ethene, propene and the various butenes are gases at room temperature. All the rest that you are likely to come across are liquids.

Boiling points of alkenes depends on more molecular mass (chain length). The more intermolecular mass is added, the higher the boiling point. Intermolecular forces of alkenes gets stronger with increase in the size of the molecules.

Compound	Boiling points (oC)
Ethene	-104
Propene	-47
Trans-2-Butene	0.9
Cis-2-butene	3.7
Trans 1,2-dichlorobutene	155
Cis 1,2-dichlorobutene	152
1-Pentene	30
Trans-2-Pentene	36
Cis-2-Pentene	37
1-Heptene	115
3-Octene	122
3-Nonene	147
5-Decene	170

In each case, the alkene has a boiling point which is a small number of degrees lower than the corresponding alkane. The only attractions involved are Van der Waals dispersion forces, and these depend on the shape of the molecule and the number of electrons it contains. Each alkene has 2 fewer electrons than the alkane with the same number of carbons.

Melting Points

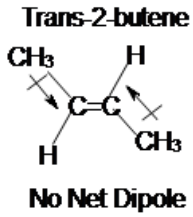
Melting points of alkenes depends on the packaging of the molecules. Alkenes have similar melting points to that of alkanes, however, in cis isomers molecules are package in a U-bending shape, therefore, will display a lower melting points to that of the trans isomers.

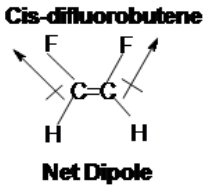
Compound	Melting Points (0C)

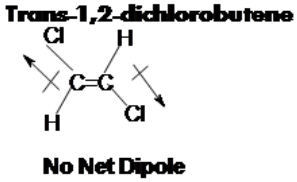
Ethene	-169
Propene	-185
Butene	-138
1-Pentene	-165
Trans-2-Pentene	-135
Cis-2-Pentene	-180
1-Heptene	-119
3-Octene	-101.9
3-Nonene	-81.4
5-Decene	-66.3

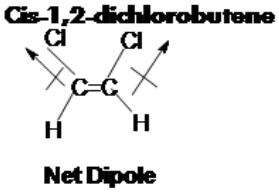
Polarity

Chemical structure and fuctional groups can affect the polarity of alkenes compounds. The sp^2 carbon is much more electron-withdrawing than the sp3 hybridize orbitals, therefore, creates a weak dipole along the substituent weak alkenly carbon bond. The two individual dipoles together form a net molecular dipole. In trans-subsituted alkenes, the dipole cancel each other out. In cis-subsituted alkenes there is a net dipole, therefore contributing to higher boiling in cis-isomers than trans-isomers.









Contributors

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