(5) **Today**

Section 1.4
Introduction to Chemical Bonding Theories
octet rule etc

Sections 1.5-1.10
Valence Bond Theory

Sections 1.12
Drawing Chemical Structures

Next Class (6)

Sections 1.12
Drawing Chemical Structures

(7) **Second Class from Today**

Sections 2.1 - 2.4
Polar Covalent Bonds, Formal Charges,
Resonance/Electron Delocalization

Sections 2.4 – 2.6
Resonance/Electron Delocalization

Bring Modeling Kits to Class

Third Class from Today (8)

Sections 2.7 – 2.11
Acids and Bases

hybrid orbitals are used to form σ bonds and to hold lone-pair electrons

in the valence bond model, single bonds are always σ bonds

double and triple bonds are formed from σ bonds plus π bonds

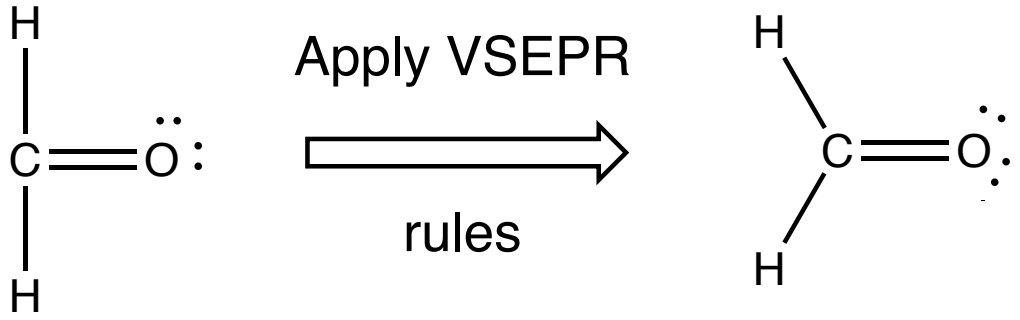
# of σ bonds + pairs of lone-pair electrons = # of hybrid orbitals needed

or

number of directions electrons must be pointed in = # of hybrid orbitals needed

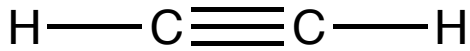
count out the # of atomic orbitals need to make the hybrid orbitals
starting with the 2s orbital (or 3s if appropriate)

name the hybrid orbitals sp^n where n is the number of p orbitals used



https://www.westfield.ma.edu/cmasi/organic/hybrid/hybrid2.html

Identify atoms that use hybrid orbitals to form bonds and hold lone-pair electrons



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Identify atoms that use hybrid orbitals to form bonds and hold lone-pair electrons

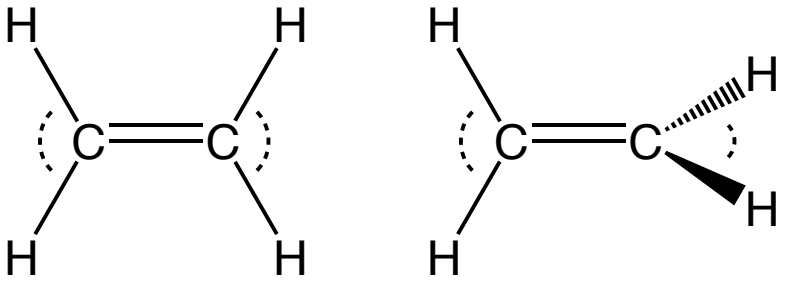
The methyl cation, anion, and radical

Sections 1.5 - 1.10

CH_3^+ CH_3^- $CH_3^\bullet$

Determine the hybridization of unusual molecular fragments

What can we use Valance Bond Theory for?

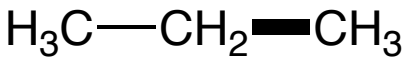


Which one? Both C atoms are trigonal planar

Why is there free rotation around C to C single bonds but not C to C double bonds?

Which bond is stronger?

?



Explain observations and make predictions based on the hybridization of an atom

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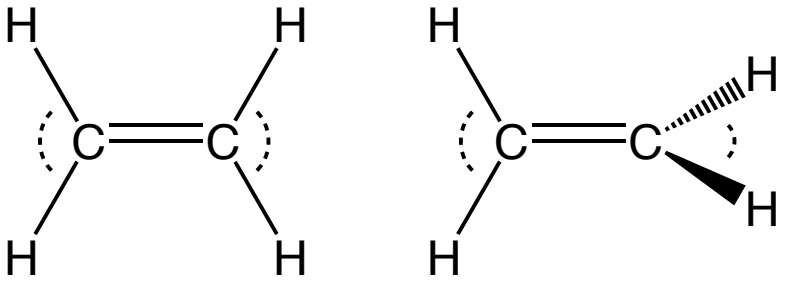

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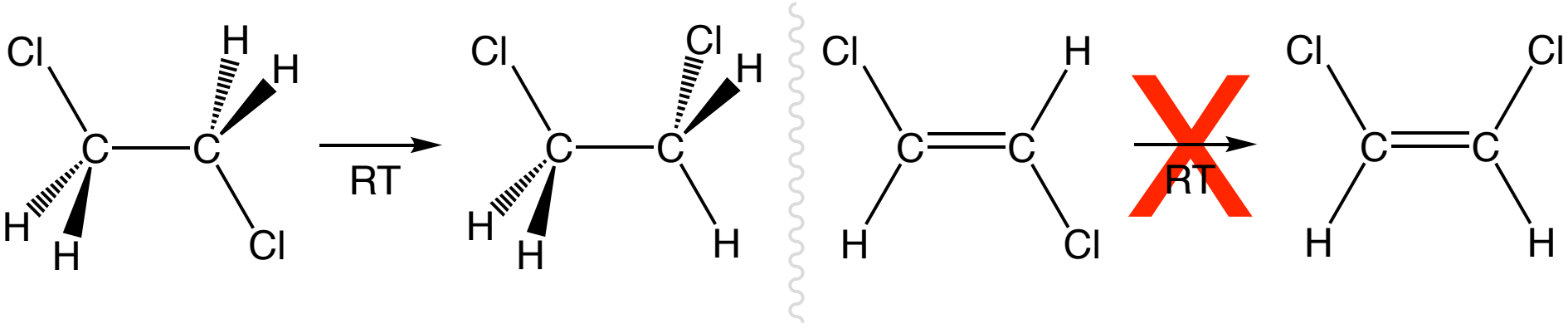

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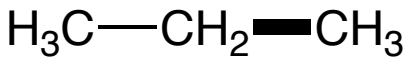
Which bond is strongest?

370 kJ/mol[2], 355±8 kJ/mol[3]



426 kJ/mol[1]

490 kJ/mol[4]

[2] Organic Chemistry, 10th ed. McMurry.

[3] Chem. Rev. **66**, 465 (1966).

[4] J.Chem.Ed. **42**, 502 (1965)

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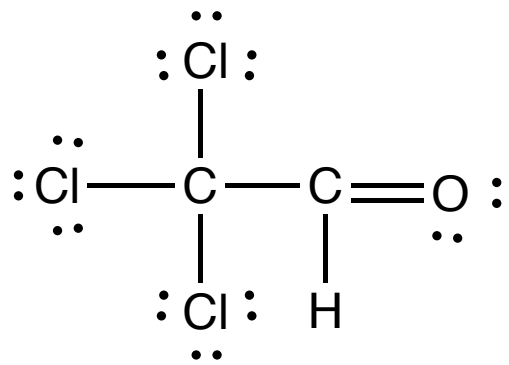
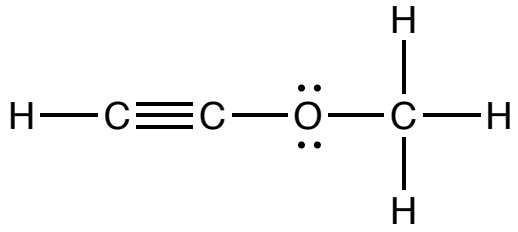
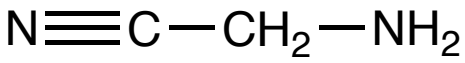
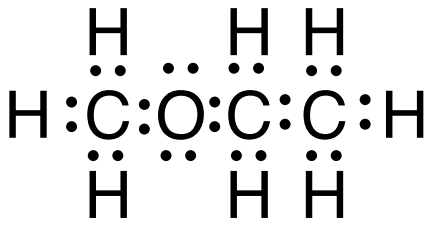
Practice









Chemists use different drawings to place emphasis on different aspects of a molecule.

Representations are used to solve typographical issues.

In organic, molecular formulas are written C_xH_y(and other elements listed alphabetically)

C_3H_8O

In organic, condensed structures typically start with a C, and everything immediately to the right of the C is connected to that first C. When the the first C is finally connected to the second C, now that atoms right of the second C are connected to second C. In acyclic unbranched molecules atoms to the right of the second C are not connected to the first C.

C_3H_8O $CH_3CH_2OCH_3$ $CH_3CH_2CH_2OH$ $CH_3CHOHCH_3$

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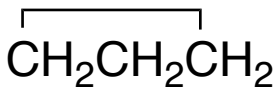
CH_2CHCH_3

Because bonds are not drawn, condensed structures require the reader to bring some chemical knowledge to their interpretation.


CH2CH2CH2

$CH_3CH(OH)CH_2CH_3$ $CH_3(CH_2)_3CH_3$ $CH_3CH_2CH(CH_3)_2$

Parentheses **( )** in structures are typically used to set off side chains, to indicate a repeating unit, or to indicate multiple groups of the same structure.

Often, chemists omit parentheses when they are not absolutely necessary,

$CH_3(CH_2)_3CH_3$

$CH_3CHOHCH_3$

$CH_3CH(OH)CH_3$

$CH_3COCH_2CH_3$

$CH_3C(O)CH_2CH_3$

and sometimes chemists do things for aesthetic reasons.

$C(CH_3)_3OH$ $CH_3C(CH_3)_2OH$ $(CH_3)_3COH$

$CH_3CHOHCH_2CH_3$ $CH_3C(O)CH(CH_3)_2$ CH_3CHO

When a bond ends and the atom isn't labeled it is assumed to be C.

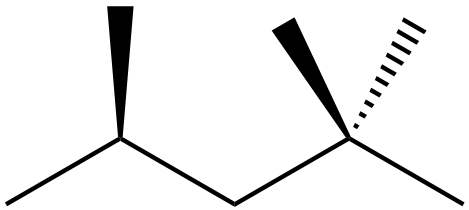
When there aren't enough bonds drawn to a C atom, the "missing" bonds are C atom to H atom bonds.

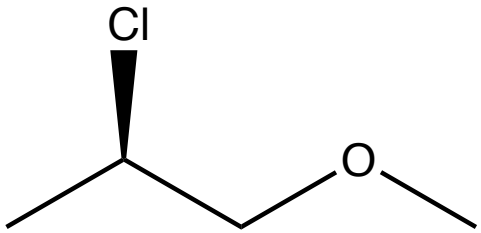
All other atoms are labeled.

Heptane

2-heptanol

Different structures serve different purposes, but they represent the same things





$CH_3CH(OH)CH_2CH(CH_3)CH_2CH_3$