Condensed structural formulas: Hydrogen atoms are written directly after the carbons. Faster than dash line formulas, atoms attached to any given carbon are written immediately after that carbon, & hydrogens go first.

\[ \text{PPL 1.13: } \text{CH}_3\text{C}(\text{CH}_3)_3 \text{CH}_3 \]

Bond-line formulas: can interpret molecular connectivity and compare different molecular formulas quickly.

In bond-line formulas:
- each line represents a bond
- each bond or terminus represents a carbon atom.
- C's are written only for CH₃ groups at the end of a chain.
- no H's are shown unless a 3D perspective is needed, in which case a wedge is used.
- the number of hydrogens bonded to each carbon is inferred by assuming that hydrogens fill the valence shell unless a charge is indicated.
- if another element is present, other than carbon or hydrogen, the symbol is put at the appropriate location.
- hydrogens that bond to elements other than carbon are written explicitly.

Example: Write the bond-line formulas:

\[ \text{CH}_3 \text{CHCH}_2\text{CH}_2\text{CH}_2\text{OH} \]

1. \[ \text{CH}_3 \text{CHCH}_2\text{CH}_2\text{CH}_2\text{OH} \]
2. \[ \text{C}_6\text{H}_{12}\text{O} \]
3. \[ \text{C}_6\text{H}_{10}\text{O} \]

\[ \text{PPL 1.14: } \text{(a) } \text{C}_2\text{H}_5\text{OH} \text{ (b) } \text{C}_2\text{H}_5\text{CH}_2\text{OH} \]

\[ \text{C}_2\text{H}_5\text{OH} \]

\[ \text{C}_2\text{H}_5\text{CH}_2\text{OH} \]
(2) The actual molecule ion will be better represented by a hybrid (mix/average) of the structures. Resonance structures are not real and only exist on paper → can never be isolated → purely hypothetical

When drawing resonance structures, connect them with double headed arrows to indicate that they are hypothetical, not real.

Example: carbonate ion

\[ \text{\(\text{O}^{2-}\)} \quad \text{\(\text{C}^{2-}\)} \quad \text{\(\text{O}^{2-}\)} \]

RESONANCE STRUCTURES DO NOT REPRESENT EQUILIBRIUM

You can write a non-lewis structure that represents the hybrid i.e (carbonate ion):

\[ \text{O}^2- \quad \text{C} \quad \text{O}^2- \]

* all of the bonds are equal as verified by the experiment

the bonds are in between a single and double bond

- electrostatic potential map: regions of higher electronegativity are red, and those lower are trending towards blue. It is used to show electron charge density.

- Write Lewis resonance structures:
  - curved arrows: movement of bonding + unshared electron
  - double barbed arrow: movement of two electrons

 Separated from illustration of relevant electrons to where they will be in the next structure.

a raw formula with the shifts should be drawn.

Rules:
- Resonance structures are useful when one lewis structure is inadequate
- Only electrons can be moved.