Phytochemical elements
Elements in Phytochemicals

Catechin, an antioxidant molecule abundant in Green Tea
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Berberine, an antimicrobial molecule in Oregon Grape
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Alliin, a sulfur compound in Garlic
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Elements in Phytochemicals

Geranyl pyrophosphate, precursor of the monoterpenes
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Geranyl pyrophosphate, precursor of the monoterpenes
Phytochemical Bonding
Bonding in Phytochemicals

Carbon forms four bonds with a tetrahedral geometry
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Bonding in Phytochemicals

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Two carbon atoms can double bond with each other, introducing a ‘stiffness’ into the molecule.
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Two carbons can also triple-bond to each other, resulting in a linear architecture.
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Two carbons can also triple-bond to each other, resulting in a linear structure.
Bonding in Phytochemicals

This immune-modulating isobutylamide from Echinacea has two carbon-carbon triple bonds.
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Bonding in Phytochemicals

The benzene ring shares electrons all around
Bonding in Phytochemicals

Resonance delocalization results in stability
Bonding in Phytochemicals

Carbon forms four bonds with a tetrahedral geometry.

3 single bonds to hydrogens & one to another carbon.
Bonding in Phytochemicals

3 single bonds to hydrogens & one to another carbon

Carbon atoms can also double bond with each other.
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3 single bonds to hydrogens & one to another carbon

Carbon-oxygen double bond

Carbon-oxygen single bond

Carbon-carbon double bond

Carbon can form one or two bonds to oxygen

α-Linolenic acid
Bonding in Phytochemicals

Oxygen forms two bonds & has two non-bonding e⁻ pairs
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Oxygen can form a double bond with carbon
Bonding in Phytochemicals

Oxygen can form a double bond with carbon

Acetone
Bonding in Phytochemicals

Rarely, you’ll see oxygen with both a double & a single bond, as in the anthocyanidins
Nitrogen usually forms three single bonds & has one lone pair of electrons.
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Bonding in Phytochemicals

But sometimes it can form four bonds by carrying a positive charge (NH$_4^+$)
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Bonding in Phytochemicals

Betanidin, a purple antioxidant molecule in Beets & Pokeberries, has both types of nitrogen bonds.
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Sulfur can form various numbers of bonds, but most commonly two or four
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Phosphorus generally forms five bonds in phytomolecules
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