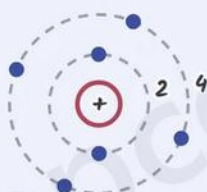


catenation and tetravalency, the homologous series, and the groups that decide the chemistry

Why carbon has so many compounds *

- **catenation** is carbon's ability to bond to other carbon atoms, forming **chains, branches and rings** of great length
- **tetravalency**: carbon has **four valence electrons**, so it forms four bonds and can attach four different things
- carbon **shares electrons rather than transferring them**, because gaining or losing four would need far too much energy
- so carbon compounds are **covalent**, giving them **low melting points**, poor conductivity and general insolubility in water
- the **carbon to carbon bond is very strong**, which makes these compounds stable
- these three facts together, catenation, tetravalency and strong bonding, are why there are **millions** of carbon compounds against a few hundred thousand of everything else



carbon's two shells, the outer one holding four electrons: it is exactly halfway to a full shell, so sharing four times is far cheaper than gaining or losing four, and that is what makes every carbon bond covalent

Saturated and unsaturated

- **alkanes** have only **single carbon to carbon bonds** and are **saturated**, with general formula C_nH_{2n+2}
- **alkenes** have at least one **double bond**, are **unsaturated**, and have formula C_nH_{2n}
- **alkynes** have a **triple bond**, are **unsaturated**, and have formula C_nH_{2n-2}
- **unsaturated compounds are more reactive**, because a multiple bond can open up to add new atoms
- the **addition reaction** is the test: an **unsaturated compound decolourises bromine water** while a saturated one does not
- **saturated compounds undergo substitution** instead, where one atom is swapped for another, usually needing sunlight

The homologous series

- a **homologous series** is a family of compounds with the **same functional group**, each differing from the next by CH_2
- so successive members differ in molecular mass by **14 units**
- all members share **similar chemical properties**, since the functional group is what reacts
- their **physical properties change gradually** along the series, with melting and boiling points rising as the chain lengthens
- one **general formula** covers the whole series, which is why knowing the first member gives you all the rest
- the **functional group** is the atom or group that decides the chemistry, and the carbon chain is largely a spectator

