

Understand Valence Bond Possibilities

How many bonds can/will an atom form in a molecule?

- This comes straight from the Periodic Table and having a working knowledge of how it is essential. An atom with one electron in its valence shell will form one bond, most likely by giving that electron away (think Li, Na, K). Atoms with seven electrons will form one bond to gain the octet (think F, Cl, Br). An atom with four valence electrons (carbon!) will need to form 4 bonds maximum to achieve the octet.
- Electronegativity (EN) of elements dictates what type(s) of bonds are formed but the valence atomic structure governs **how many**. The table below gives an idea of what to expect. Just remember that 8 is the desired number for most of the upper key elements. Smaller atoms (H, Li, etc.) don't need 8 as 1s shell can be filled to give a full valence.

Number of bonds formed by each of the important early elements.

1	2	3	4	3	2	1	0
H							He
Li	Be	B	C	N	O	F	Ne
Na	Mg	Al	Si	P	S	Cl	Ar
K						Br	
						I	

- Carbon is very flexible, due to its middling EN. It forms 4 bonds in its stable (neutral) molecules but will be able to cope with three bonds temporarily in intermediates. C will never form 5 bonds in Organic 1 or 2. Boron (B) and Aluminium (Al) are unique at this stage in that they form 3 bonds in neutral molecules but will form 4 (for the octet) during the various reactions in which they feature. They are used as Lewis Acids.
- Atoms to the right of C will have lone pair(s) in their neutral molecules and will be able to share with other atoms to form common species such as hydronium or ammonium in which the central O or N atom has a positive charge. Same as in General Chemistry.