electronegativity $\chi$
\[ \% \text{ ionic character} = \frac{2}{3} \left[ 1 - \exp\left( -\frac{1}{4} (\Delta \chi)^2 \right) \right] \times 100 \]

| Difference in Electronegativity | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 | 2.1 | 2.2 | 2.3 | 2.4 | 2.5 | 2.6 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 |
|-------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| %IC (by L. Pauling)           | 0.2 | 1.0 | 2.2 | 3.9 | 6.1 | 12  | 15  | 18  | 22  | 26  | 30  | 34  | 39  | 43  | 47  | 51  | 56  | 59  | 63  | 67  | 70  | 73  | 76  | 79  | 82  | 84  | 86  | 88  | 89  | 91  | 92  |
| %IC (by Hannay & Smyth)       | 1.6 | 3.3 | 5.1 | 7.0 | 8.9 | 11  | 13  | 15  | 17  | 20  | 22  | 24  | 27  | 29  | 32  | 35  | 37  | 40  | 43  | 46  | 49  | 52  | 55  | 59  | 62  | 65  | 69  | 72  | 76  | 80  | 83  | 87  |
Hybridization

Four tetrahedral $sp^3$ hybrid orbitals

An $sp^3$ hybrid orbital
Four carbon $sp^3$ hybrid orbitals

Four hydrogen 1s atomic orbitals

Methane
Molecular Orbitals

(a)

(b)

(c)

Large separation
No interaction

(d)

Atomic orbitals begin to interact

(e)

formation of shared molecular orbitals
molecular orbital - bonding
Molecular Orbital - antibonding.
$2p_{xa}$  $2p_{xb}$

$\pi_{2p_x}^{*}$ antibonding

$\pi_{2p_x}$ bonding
$2p_{xa}$ and $2p_{xb}$ electrons overlap to form $\pi_{2p_x}$ bonding and antibonding orbitals.

The nodal plane divides the lobes of the orbitals.

$\pi_{2p_x}^{*}$ antibonding orbital has higher energy compared to the $\pi_{2p_x}$ bonding orbital.
Extremes in electronegativity

NaI: $\Delta \chi = 1.73$
CsAu: $\Delta \chi = 1.75$

Cs and Au, both metals, melt to form metallic liquids, *but*…
when the concentration nears 50%

(equal numbers of donors & acceptors)

🌞 electron transfer occurs🌞 !

metallic melt turns into molten salt!!

💧 clear, colorless liquid

💧 big drop in electrical conductivity

💧 shift from electronic to ionic conduction

💧 cesium auride

*SORCERY!*