Formal Charge (Section 1-7): When an atom does not have it's normal bonding

- Atoms with formal charge dominate reactivity. Therefore the ability to recognize and identify atoms with formal charge is really important!

- **Skills**:
  1. Identify the formal charge for any atom that does not have normal bonding
  2. Identify the number of bonds and lone pairs associated with any atom whose formal charge is specified

- Note: Designation of formal charge is required. If you don't write the charge sign next to an atom that should have formal charge, you will lose test points!

Formal Charge Equations:

1. FC = group # - (bonds + unshared e's) (use to calculate FC)
2. Group # - FC = bonds + unshared electrons (given formal charge, use to find lone pairs)

Practical: (memorize)

C 4 bonds ⟷ neutral
3 bonds and zero lone pairs ⟷ cation +1
3 bonds and one lone pair ⟷ anion -1

N 4 bonds ⟷ cation +1
3 bonds and one lone pair ⟷ neutral

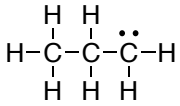
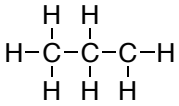
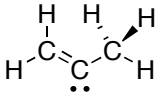
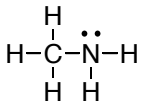
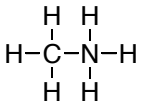
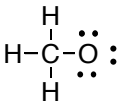
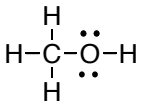
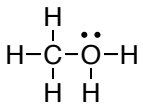
O 3 bonds and one lone pair ⟷ cation +1
2 bonds and 2 lone pairs ⟷ neutral
1 bond and three lone pairs ⟷ anion -1

FORMAL CHARGE

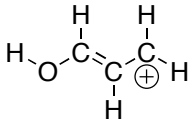
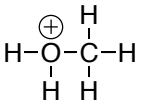
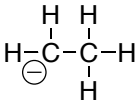
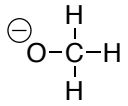
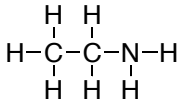
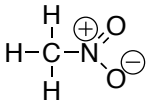
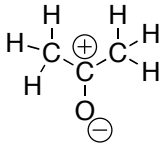
# of bonds	C	N	O	F
4	0	+1		
3	–1 or +1	0	+1	
2		–1	0	
1			–1	0

Formal Charge Practice (Section 1-7)

1. Assign any **formal charges** to atoms that need them:

2. Fill in lone pairs on any atoms that need them (whether atoms with formal charge or neutral atoms):

> Notice: **With the exception of carbocations, all other C/N/O atoms end up with a combined total of four when you sum up their bonds and lone-pairs**. So apart from carbocations, if you know the number of bonds, you can fill in the correct number of lone pairs without even thinking much!