Lewis dot structures with atoms that break the octet rule

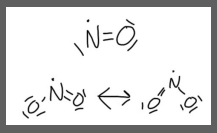
Breaking the octet rule

- Some compounds have atoms with more or less than 8 electrons around them (breaking the octet rule)
- There are 3 types
- 1. odd numbered electrons
- 2. electron deficient compounds
- 3. expanded valence shells

Odd electron

- Although rare, it is possible to have compounds that have an odd number of electrons.
- Obviously it is not possible to satisfy the octet rule with an odd number of electrons, ONE CANNOT BE A PAIR!
- Two compounds are NO and NO_2
- They will have a free electron on N.

Lewis dot



- The formal charge is appropriate for each atom and the molecule
- Compounds with a free electron, unpaired electron, are called **free radicals**.
- They are **highly reactive**.
- These two compounds are used in nitrous oxide systems in cars

Electron deficient compounds

- This is rare. It is only found Boron, Beryllium or Aluminum compounds. All are highly reactive.
- Beryllium, aluminum are a metals, however, since its valence shell is so close to the nucleus it can form covalent bonds (rarely).
- All atoms are electron deficient (have less than 4 electrons), and therefore when they form bonds they can't make it all the way up to 8 electrons

Examples

- BI_3
- BeH_2

Expanded valance shells

- One atom will have more than 8 valence electrons.
- This requires a highly electronegative atoms (fluorine, oxygen, or chlorine) to bond with a nonmetal with its outer shell **3 p or higher**. The extra electrons can use the unused d orbital. Exactly how this works is undergoing more research (it is disputed)
- **Only the central atom will have more than 8 electrons.**
- C, N, O, F and Ne can't have more than 8 electrons. There is no 2 d orbital so there is nowhere to put the extra electrons.
- All nonmetals underneath them on the periodic table do have an used d orbital for the electrons.

Examples

- PF_5
- SF_6
- XeF_4
- XeF_2
- ClF_5
- ClF_3