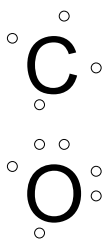


Multiple Bonds

Multiple Bonds

- Sometimes atoms share more than one pair of valence electrons.
- A double bond is when atoms share two pairs (4 total) of electrons
- A triple bond is when atoms share three pairs (6 total) of electrons
- Table 16.1, p.443 - Know which elements are diatomic (Oxygen?)

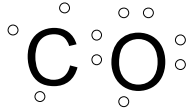
Carbon dioxide



- CO_2 - Carbon is central atom (more metallic)
- Carbon has 4 valence electrons
- Wants 4 more
- Oxygen has 6 valence electrons
- Wants 2 more

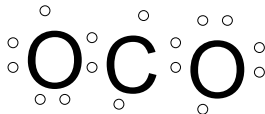
Carbon dioxide

- Attaching 1 oxygen leaves the oxygen 1 short, and the carbon 3 short



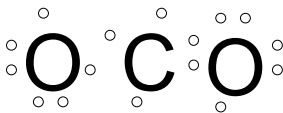
Carbon dioxide

- Attaching the second oxygen leaves both oxygen 1 short and the carbon 2 short



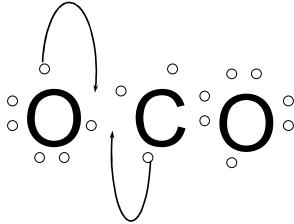
Carbon dioxide

- The only solution is to share more



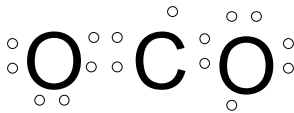
Carbon dioxide

- The only solution is to share more



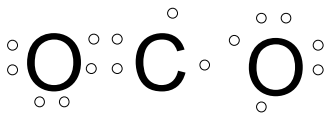
Carbon dioxide

- The only solution is to share more



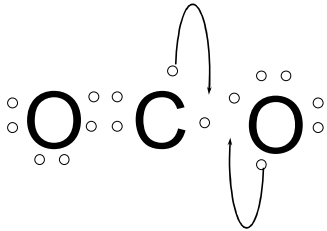
Carbon dioxide

- The only solution is to share more



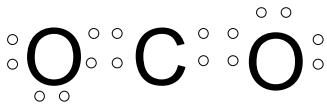
Carbon dioxide

- The only solution is to share more



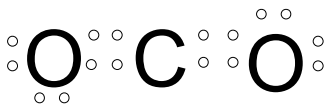
Carbon dioxide

- The only solution is to share more



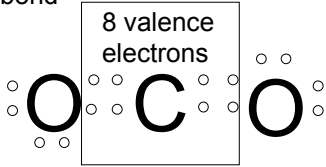
Carbon dioxide

- The only solution is to share more
- Requires two double bonds
- Each atom can count all the electrons in the bond



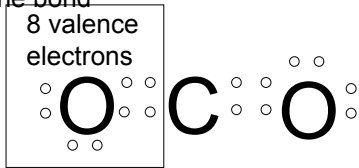
Carbon dioxide

- The only solution is to share more
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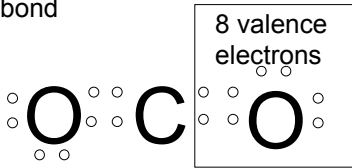
Carbon dioxide

- The only solution is to share more
- Requires two double bonds
- Each atom can count all the electrons in the bond



Carbon dioxide

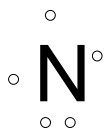
- The only solution is to share more
- Requires two double bonds
- Each atom can count all the electrons in the bond



How to draw them?

- Add up all the valence electrons.
- Count up the total number of electrons to make all atoms happy.
- Subtract; then Divide by 2
- Tells you how many bonds - draw them.
- Fill in the rest of the valence electrons to fill atoms up.

Example



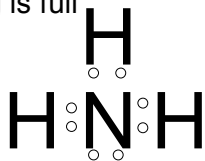
- NH_3 , which is ammonia
- N - has 5 valence electrons, wants 8
- H - has 1 (x3) valence electron, wants 2 (x3)



- NH_3 has $5+3 = 8$
- NH_3 wants $8+6 = 14$
- $(14-8)/2 = 3$ bonds
- 4 atoms with 3 bonds

Examples

- Draw in the bonds
- All 8 electrons are accounted for
- Everything is full



Example

- HCN: C is central atom
- N - has 5 valence electrons, wants 8
- C - has 4 valence electrons, wants 8
- H - has 1 valence electron, wants 2
- HCN has $5+4+1 = 10$
- HCN wants $8+8+2 = 18$
- $(18-10)/2 = 4$ bonds
- 3 atoms with 4 bonds - will require multiple bonds - not to H however

HCN

- Put single bond between each atom
- Need to add 2 more bonds
- Must go between C and N



HCN

- Put in single bonds
- Need 2 more bonds
- Must go between C and N
- Uses 8 electrons - 2 more to add to equal the 10 it has



HCN

- Put in single bonds
- Need 2 more bonds
- Must go between C and N
- Uses 8 electrons - 2 more to add
- Must go on N to fill octet