

## Mass Number

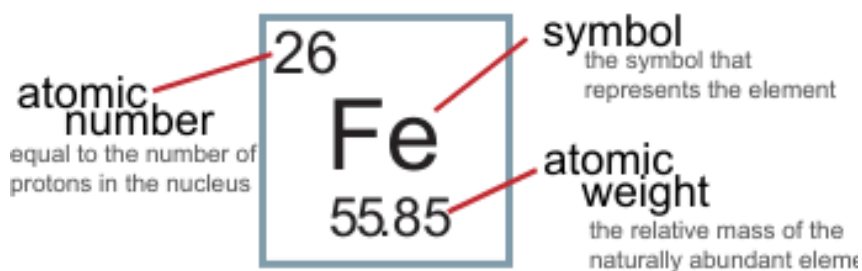
- Protons + neutrons = mass number

Mass number (number of protons plus neutrons)



← Symbol of element

Atomic number (number of protons or electrons)



## Isotopes

- Atoms same atomic number but different mass numbers are isotopes of each other

## Atomic Weight

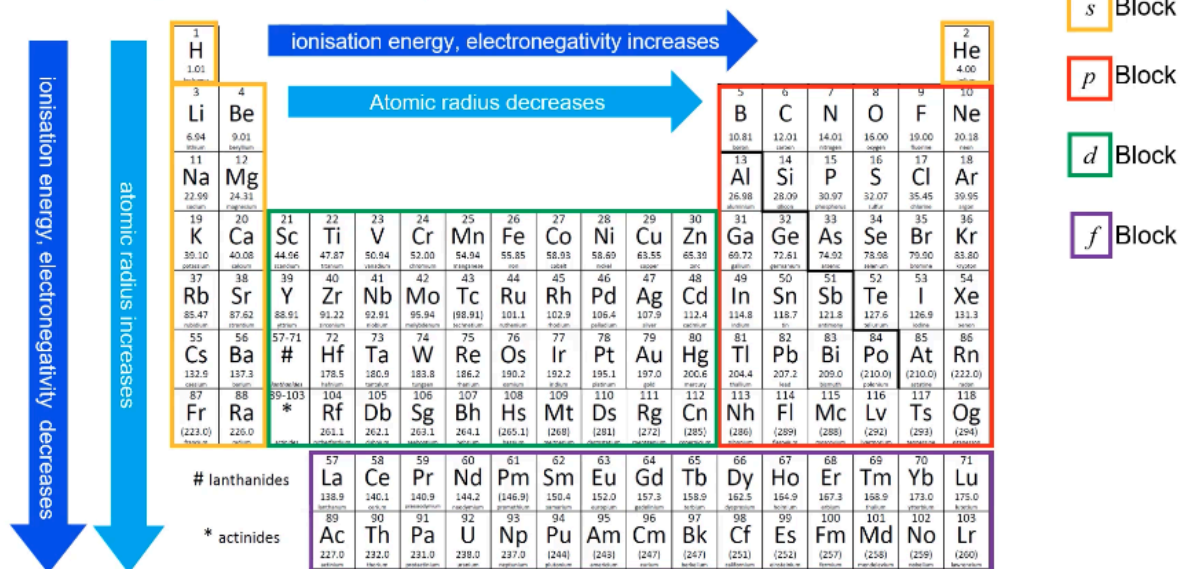
- Recorded in atomic mass units (u)
  - $1 \text{ u} = 1.66054 \times 10^{-24} \text{ g}$

$$\text{Atomic weight} = \Sigma[(\text{isotope mass}) \times (\text{fractional isotope abundance})]$$

## Atoms, molecules, compounds and mixtures

Atoms	Particles making up all substance
Molecules	Atoms that bonded
Compounds	Pure substance consisting of atoms of more than 1 element
Mixtures	Not pure substance & contain a combo of atoms, molecules & compounds

## Periodicity trends summary



## Periodic Trends

### Nuclear Charge

- Increases across a period
- Increases slightly down a group

### Atomic Size

- Atomic radius decreases across a period
  - Due to increasing positive nuclear charge drawing electrons closer into the nucleus
- Atomic radius Increases slightly down a group
  - Due to increasing number of electrons means they have greater probability of being further from the nucleus

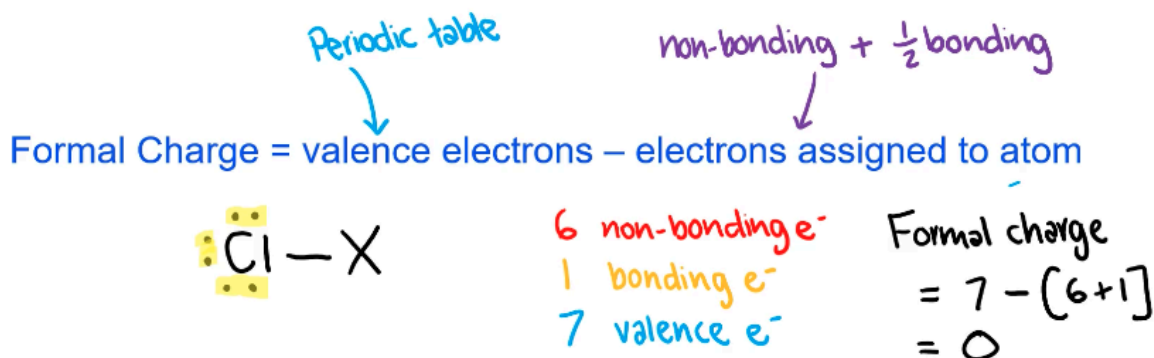
### Ionic Size

- Removing an electron (cation) results in a SMALLER ionic radius
- Adding an electron (anion) results in a LARGER ionic radius

## Calculating Formal Charge

1. Assign non-bonding electrons to the atom on which they are found
2. Assign half the bonding electrons to each atom in the bond

Formal Charge = Valence electron - electron assigned to atom



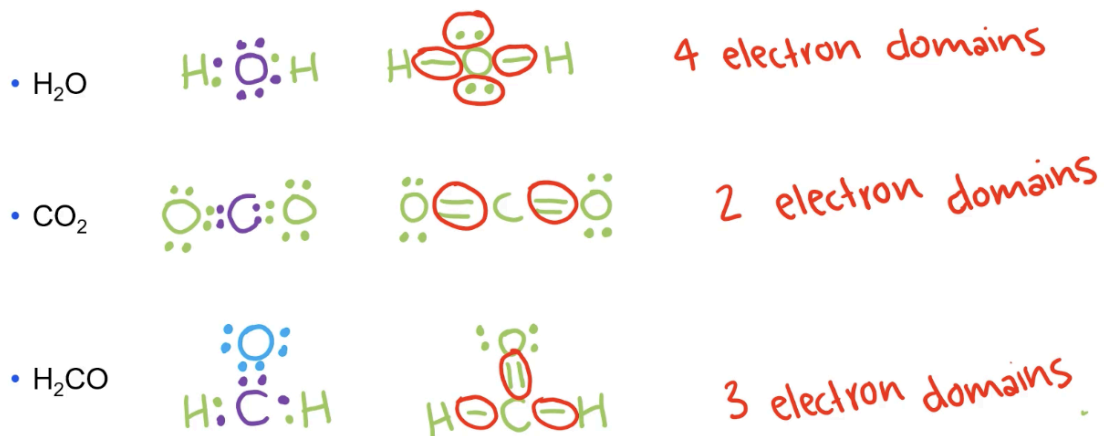
- More stable structure will be:
  - Lowest formal charge on each atom
  - The most negative formal charge on the most electronegative atoms

## Shape of Molecules

### Electron Domains

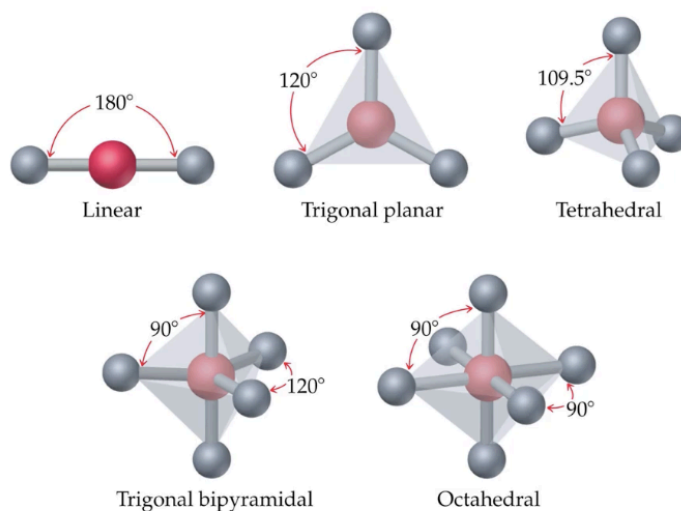
- Region around central atom

How many electron domains does the central atom in each molecule have?



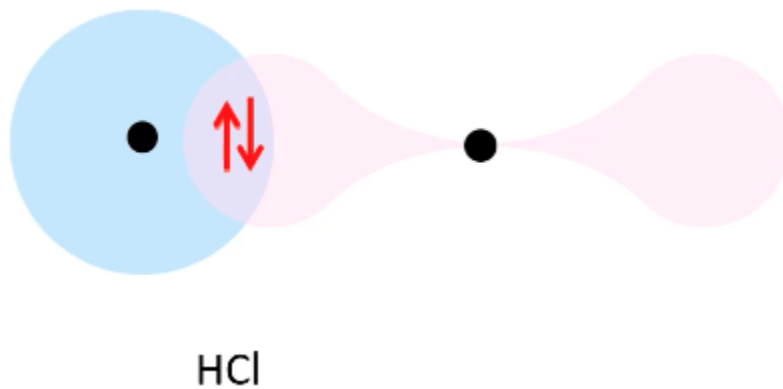
## Electron Domains & Shape

Number of electron domains	Electron-domain geometry
2	Linear (180°)
3	Trigonal planar (120°) <ul style="list-style-type: none"> <li>If one of the electrons is a lone pair it is called bent</li> </ul>
4	Tetrahedral (109.5°) <ul style="list-style-type: none"> <li>If one electron is a non bonding domain its a Trigonal pyramidal</li> <li>If 2 Bent</li> </ul>
5	Trigonal bipyramidal Molecular geometry on lone pairs: <ul style="list-style-type: none"> <li>If 1 → Seesaw</li> <li>If 2 → T shaped</li> <li>If 3 → Linear</li> </ul>
6	Octahedral <ul style="list-style-type: none"> <li>If 1 → square pyramidal</li> <li>If 2 → Square planar</li> </ul>



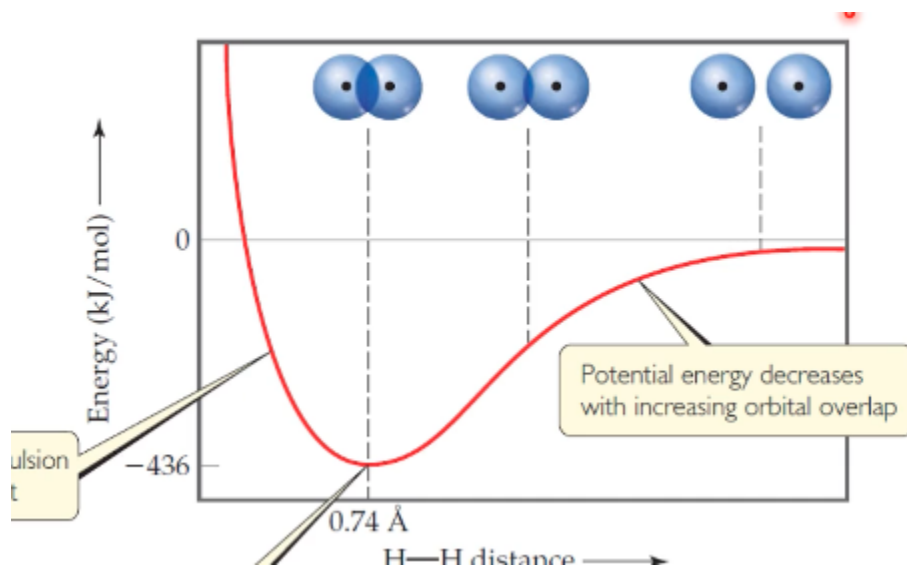
# Lecture 9

Bonds are depicted by an overlap in orbitals:



## Bond Length and Stability

- Increased overlap brings electrons and nuclei closer while decreasing repulsion



- If atoms get too close, the internuclear repulsion greatly raises the energy.