ELECTRONEGATIVITY

The electronegativity of an atom is the attracting power that the nucleus has for it’s own outer electrons and those of it’s neighbours i.e. how bad it wants electrons.

An atom’s electronegativity is determined by Coulomb’s Law, which states, “the size of the force is proportional to the size of the charges and inversely proportional to the square of the distance between them”. In symbols it is represented as:

\[ F = \frac{kq_1q_2}{d^2} \]

where: F = force (N)
  k = constant (dependent on the medium through which the force is acting) e.g. air
  q_1 = charge on an electron (C)
  q_2 = core charge (C)
    = no. of protons an outer electron sees
    = no. of protons – no. of inner shell electrons
    = main Group Number
  d = distance of electron from the nucleus (m)

Examples of how to calculate the core charge:

Sodium – Atomic number 11
  Electron configuration 2.8.1
  Core charge = 11 (no. of p^+s) – 10 (no. of inner e^-s)
    +1 (Group i)

Chlorine – Atomic number 17
  Electron configuration 2.8.7
  Core charge = 17 (no. of p^+s) – 10 (no. of inner e^-s)
    +7 (Group vii)
Neon holds onto its own electrons with a core charge of +8, but it can’t hold any more electrons in that shell. If it was to form bonds, the electron must go into the next shell where the core charge is zero. Group viii elements do not form any compounds under normal conditions and are therefore given no electronegativity values.

Linus Pauling assigned numerical values to represent the electronegativity of the various elements. The larger the number the more strongly the nucleus holds onto it’s own electrons and tries to attract nearby ones. Fluorine is the most electronegative element and is rated 4.0 on the Pauling scale. Oxygen is the second most electronegative element at 3.5 and chlorine is third at 3.0.

Electronegativity values increase as you go across a period and decrease as you go down a group.

Non-metals have a high electronegativity (greater than 2) because they only need 1, 2 or 3 more electrons to fill their outer shell.

Metals have a low electronegativity (less than 2) because it is easier for them to lose 1, 2 or 3 electrons in order to achieve a full outer shell.