

Subatomic Particles

Four Fundamental Forces of Nature (physics):

- gravity
- electromagnetic force (includes electrostatic force)
- strong nuclear force (holds the nucleus together)
- weak nuclear force (holds protons and electron together to form neutrons)

Force Equation:

- the force equation governs the way charged particles interact
- it is used for point charges (small and spherical)

$$F = \frac{-kq_1q_2}{d^2}$$

F = force

q_1 = first point charge

q_2 = second point charge

d = distance between point charges

-k = is an annoying constant

- useful to ignore k making the equation

$$F \propto \frac{q_1q_2}{d^2}$$

- this can be thought of as being like

$$F = \frac{q_1q_2}{d^2}$$

- conclusions that can be reached from this equation are
 - the greater the charges, the greater the force
 - the greater the distance, the weaker the force
- the second point has the greater effect because of the exponent of 2

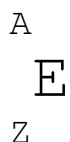
charge #1 (q_1)	charge #2 (q_2)	distance (d)	force (F)	attraction or repulsion
1+	2-	1	2 (ignore the sign)	attraction
4- (4 x greater)	2-	1	8 (4 x greater)	repulsion
1+	2+	2 (2 x greater)	0.5 (4 x less)	repulsion
3+	5-	4	0.9375	attraction
1+	1+	1/4	16	repulsion

Subatomic Particles:

name	symbol	charge	mass	location
proton	p ⁺	1+	1 u	in the nucleus
neutron	n	0	1 u	in the nucleus
electron	e ⁻	1-	0.00055 u	orbits the nucleus

Atomic Symbols:

- short hand method of describing the composition of any atom



E = the element symbol (eg H, C, Fe)

Z = atomic number = the number of p⁺ in the nucleus
(also the number of e⁻ in a neutral atom)

A = mass number = the number of nucleons found in the nucleus (a nucleon is either a p⁺ or a n)

$$A = p^+ + n$$

- it makes sense to group protons and neutrons together in the mass number since they have the same mass (1 u)
- 1 u is equivalent to 1.6066×10^{-24} g

185 W 74	# of p^+ = 74 # of n = 111 # of e^- = 74
51 Ti 22	# of p^+ = 22 # of n = 29 # of e^- = 22
193 Pt 78	# of p^+ = 78 # of n = 115 # of e^- = 78
234 Th 90	# of p^+ = 90 # of n = 144 # of e^- = 90