The Stuff that is Stuff

Let us review what the stuff is that make up stuff.

All our stuff is made up of atoms.

Atoms are made up of 3 components.

1)

2)

3)

The center of the atom is called the _____. It is

made up of _____ and _____.

An _____ orbits the nucleus.

We need to be careful about how we think of an 'orbit'. This is a term still used but it is not really true. Physicists used to think in this manner but we now have quantum mechanics and have a better understanding of the true behaviour of elementary particles.

The word 'orbit' gives the fallacious analogy of Sun & Planet. This is not close to reality. The electron is not in a place… it is everywhere. It is better thought of as a standing wave. As such it is all around the nucleus at the same time.

If SkyDome (I refuse to say the advertised name) is the size of an atom:
A proton is a marble in the middle.
An electron is a grain of sand at the outer perimeter.

	Charge	Mass(kg)	amu
Proton	+1	1.67×10^{-27}	1
Neutron	0	1.68×10^{-27}	1
Electron	-1	9.11×10^{-31}	0

Charge is measured in Coulombs. It has a magnitude of $\pm 1.6 \times 10^{-19}$C.

A Coulomb is the SI unit of electric charge, equal to the quantity of electricity conveyed in one second by a current of one ampere.

Electricity is really the build up or the lack of electrons.

The total charge on an object is represented by Q.

$$Q = ne$$

Objects with opposite charges will attract.
Objects with same charges will repel.

This is Coulomb's Law.

This will be the focus of this unit.

Coulomb's Law:

$$F_e = \frac{kq_1q_2}{r^2}$$

where k is the "Coulomb Constant" and has a magnitude of:
$9.00 \times 10^9 \ \frac{Nm^2}{C^2}$.

Conductors:

Some metalloids and transition metals make good conductors. A conductor is an element that gives up its electrons easily. This is in contrast to an inductor that does not.

In a conductive metal the electrons are so loosely tied to the nucleus that we think of them as a "sea of electrons". They flow easily through the material.

The Law of Conservation of Charge:

The total charge in the universe must be conserved. The total charge before an event and after must be the same.

Let's do some physics!

What is the electric force (F_e) between a 6μC charge and a -3μC charge at a distance of 2m away.

Hints:

1) Avoid signs in calculation. Use logic to determine attraction / repulsion.
2) Do not be tied to a horizontal x-axis!
3) 40.5mN towards each other.

Something a little more complicated…
We add a 8μC charge on the other side of the electron above.
What is the charge on the electron?

F_e=13.5mN

Last one…

Let us move the 8μC charge directly under the electron.

F_e=67.5mN @ 233°