ELECTROSTATICS CH 20

BEN FRANKLIN WAS A MAJOR INVESTIGATOR OF ELECTRICITY. HE THOUGHT IT WAS LIKE A FLUID. HE BELIEVED IT FLOWED FROM WHERE THERE WAS AN EXCESS AMOUNT (A POSITIVE QUANTITY) TO WHERE THERE WAS LESS. (A NEGATIVE AMOUNT)

BEN WAS WRONG, BUT THE LANGUAGE STUCK WHICH IS WHY WE HAVE POSITIVE & NEGATIVE CHARGE

WE NOW KNOW ABOUT ATOMS. PROTONS CARRY A POSITIVE CHARGE AND ARE IN THE NUCLEUS ALONG WITH NEUTRONS. PROTONS CAN <u>NOT</u> BE REMOVED FROM THE NUCLEUS (THINK ATOMIC BOMBS) AND WE DON'T CARE ABOUT NEUTRONS.

WHAT CONCERNS US ARE THE ELECTRONS THAT SURROUND THE NUCLEUS. SPECIFICALLY THE VALANCE ELECTRONS. ELECTRONS CARRY A NEGATIVE CHARGE. IF THE ELECTRONS ARE TIGHTLY BOUND TO THE ATOM THE MATERIAL IS AN INSULATOR, IF IT IS LOOSELY BOUND IT IS A CONDUCTOR.

ELECTRIC CHARGES CAUSE ELECTRIC FORCES.

CHARLES COULOMB DETERMINED THAT THE FORCE ARISEING DUE TO A SEPERATION OF CHARGE IS

$$F_e = K \frac{q_A q_B}{r^2}$$

F_e = ELECTRIC FORCE (NEWTONS - N)

K = CONSTANT $9 \times 10^9 \frac{N \cdot m^2}{C^2}$

q = CHARGE (COULOMB - C)

r = DISTANCE (METERS - m)

LIKE CHARGES REPEL ; UNLIKE ATTRACT

THE CHARGE ON A SINGLE ELECTRON (e^-) OR PROTON (e^+) IS 1.6×10^{-19} C. IT CAN BE POSITIVE OR NEGATIVE. THE SIGN IS THE SIGN OF THE <u>CHARGE</u> NOT THE NUMBER. *

EXAMPLE:

IF YOU HAVE $5.2 \times 10^{15}\ e^-$, HOW MUCH CHARGE IS THERE?

$$5.2 \times 10^{15} * 1.6 \times 10^{-19}\ C = 8.32 \times 10^{-4}\ C \quad (832\ \mu C)$$

A COULOMB IS A HUGE UNIT SO μ (MICRO - 10^{-6}) IS OFTEN USED

HINT: USE THE EE BUTTON ON YOUR CALCULATOR FOR $\times 10^x$

EXAMPLE:

A $-3\mu C$ AND A PROTON ARE SEPERATED BY 4 m. WHAT IS THE FORCE ON THE PROTON?

$$F_c = k\frac{q_A q_B}{r^2} = \frac{9\times10^{9}\,\frac{N\cdot m^2}{C^2}\left(3\times10^{-6}\,C\right)\left(1.6\times10^{-19}\,C\right)}{4\,m^2}$$

$$= 2.7\times10^{-16}\,N$$

NOTE: THE CHARGES ARE <u>UNLIKE</u> SO THEY ATTRACT. FORCE ON PROTON IS TO THE LEFT.

NOTE: DROP THE SIGNS WHEN DOING THE MATH.