

PHYSICS
Electrostatics

- **Electric Force (actually Electromagnetic Force)**

- Similarities to Gravity:
 - ☐ _____ : inverse square law, depends on two bodies, has constant, _____.
 - ☐ _____ : inverse square law, depends on two *charges*, has constant, _____.
- Differences from Gravity:
 - ☐ Electricity is around _____ * times stronger than Gravity.
 - ☐ Electricity is around _____ * times stronger than the Weak Force, which moderates certain nuclear decays, like the neutrino. The range of the Weak Force is only 10^{-16} centimeters.
 - ☐ Electricity is a little weaker (around _____ * times weaker) than the Strong Force (or Nuclear Force), which holds protons and neutrons together in the atom. The range of the Strong Force range is only 10^{-13} centimeters.
 - ☐ Electricity has opposite charges - opposite forces of _____ and _____.
 - ☐ Because of + and - charges, most of space is _____, so you don't feel pushed around.
 - ☐ * *[Strengths of the four forces of nature are reported differently by various authors.]*

- **Electric Charges**

- Positive charge comes from _____ and negative charge comes from _____.
- But electrons don't stay in _____ like planets. If classical physics, they would spiral into the nucleus in about a hundred millionth of a second. Quantum physics says that their wave nature needs space (the shell).
- Also protons don't repel each other apart because of the _____ Force.

- **Conservation of Charge – *no electrons are created or destroyed.***

Actually _____ have $1/3$ and $2/3$ electron charges. But since each proton and neutron is made up of three quarks, and have never been found separated, whole numbers of electrons are still conserved and _____ to electron units. Ions are temporarily charged, looking for balance.

- **Coulomb's Law – [_____]**

- A charge q is 1 _____ (6.25×10^{18} electrons), and k is $9 \times 10^9 \text{ N m}^2 / \text{C}^2$
- A force of 1 _____ in gravity would take two $122,000 \text{ kg}$ masses that are 1 meter apart.
- A force of two 1 _____ charges that are 1 meter apart is 9 billion _____.

- **Conductors and Insulators – are based on electrical flow of _____ or tight _____.**

- Some metals (loose electrons) conduct 10^{15} times greater than glass (tightly bound electrons)!
- _____ can be made to insulate until certain conditions are met - then they conduct!
- _____ have virtually zero resistance and infinite conductivity and are due to sufficiently low or very high temperatures. Uses: power transmission, magnetic levitated trains.

- **Charging**

- Charging by _____ : electrons flow across the touching areas.
- Charging by _____ : electrons are redistributed near the surface (though no touching).
- _____ usually occurs by contact and allows clearing of electricity.
- _____ occurs by an organized redistribution on the atomic level where the charges line up.
- The water molecule is an electric dipole. Microwaves make it oscillate (thereby heating up).

- **The Electric *Field* - a kind of aura that extends through space that attracts or repels electric charge.**

- The electric field, E has _____ and _____. [$E = f / q$]
- <http://www.its.caltech.edu/~phys1/java/phys1/EField/EField.html>
- _____ occurs from conductors (like your car or shielded cable) protecting you.
- _____ store electric charge on plates for later release (camera flash, TV, computer keys).
- **Electric Potential Energy** is due to the location of a charge. Electric potential is _____.
- Electric potential = electric potential energy / charge. [$1 \text{ volt} = 1 \text{ _____} / 1 \text{ _____}$]