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 9×10^9 N m^2 / C^2**
  - **A force of 1 _____ in gravity would take two 122,000 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 volt = 1 _____ / 1 _____]**