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Physics 2 – Sec H3

Honors Project

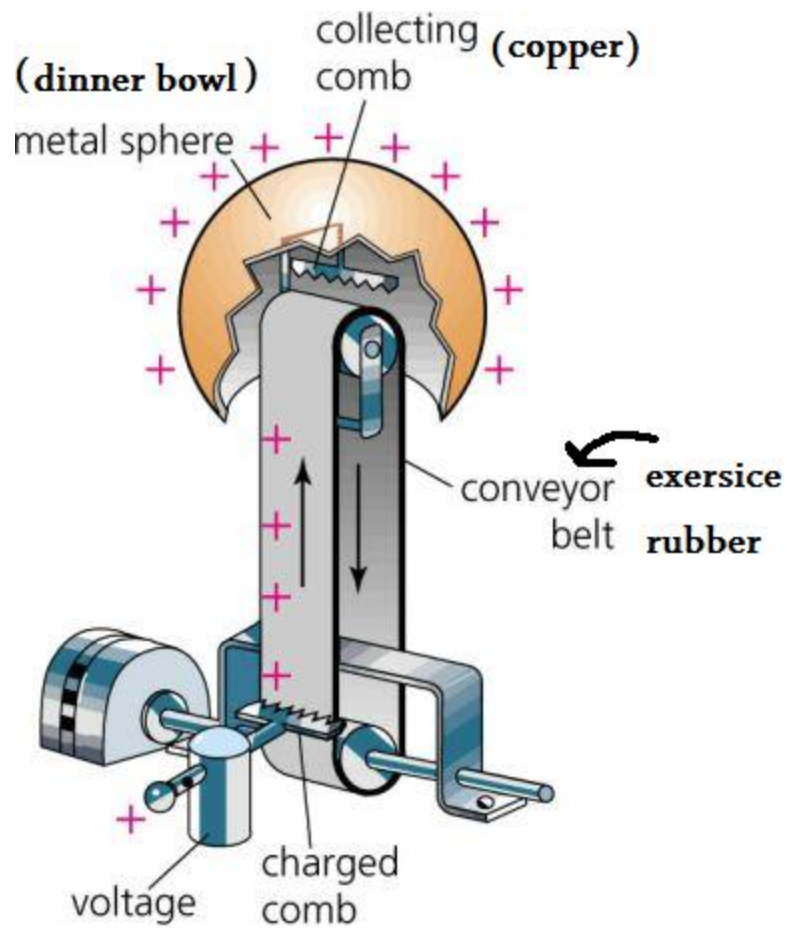
Building a Van de Graaff Generator

A Van de Graaff generator is a machine which uses a rotating belt, made from a dielectric material, to gather a stable voltage in a hollow metal globe. In order to build a Van de Graaff several materials are needed: an elastic belt, two rollers that have opposite natural charges like nylon and PVC, a hollow tube capable of surrounding the belt and rollers, a large metal sphere with a hole able to fit around the hollow tube, and a power source/generator of some kind. (1)

The generator spins the bottom roller which rotates the belt, while the top roller freely spins. The belt, in this case a strip of elastic exercise rubber, runs between two pulleys, the bottom being a nylon roller and the top a PVC pipe. An electrode, in the form of a copper wire with comb spread ends, is positioned near the top pulley near the elastic band and runs to inside the sphere. As the belt is pulled away from the lower nylon roller, it pulls away some of the roller's positive charge. When the belt reaches the top roller, the charge jumps from the belt to the copper wires that were fanned out near the PVC, which is an insulating material. The charge is distributed in the metal sphere and gathers a larger charge as long as the belt is being rotated. The larger the sphere and the further away from the ground it is, the larger potential of charge it can hold. When you touch the metal sphere, the buildup of static electricity will

move from the sphere to your grounded body. This will create a static discharge and produce a spark. (1)(2)

There are a few different methods when it comes to building a Van de Graaff. In some generators, an electric charge is transported onto the rapidly moving belt driven by a pulley mounted on the grounded end of the structure. The top pulley is enclosed within a large metal sphere. The belt is charged from the generator by a comb of sharp needles close to the belt at the bottom near the grounded pulley. The air close to the needle points is ionized by the strong electric field, and as a result charge is driven to the surface of the belt. The rotation of the belt carries the charge into the high voltage terminal and transfers it to another similar comb of needles, and from here it passes to the outer surface of the large metal sphere. An ion source within the sphere then creates positive particles that are accelerated as they shoot to ground potential through an evacuated tube. (3)



(3)

- 1- Whitehead, John B. Electricity and Magnetism. New York and London: The Maple Press Company, 1939.
- 2- Gedney, Stephen. "Van de Graaff Generator." 1998. University of Kentucky. 22 Sun 2009 <<http://www.engr.uky.edu/~gedney/courses/ee468/expmnt/vdg.html>>
- 3- Robert Jemison Van de Graaff." 2002. 22 Sun 2009 <<http://chem.ch.huji.ac.il/history/graaff.html>>