Name: Key

Notes - 19.1 Electric Potential Energy: Potential Difference

1. When a free positive charge q is accelerated by an electric field, it is acquires kinetic energy.

2. The process is analogous to an object being accelerated by a gravitational field. It is as if the charge is going down an electrical hill where its electric potential energy is converted to kinetic energy.

3. The change in electric potential energy ΔU_E is equal to $q\Delta V$ where q is the charge and ΔV is the change in the electric potential. The units of these parameters are:

U_E	J
q	C
V	V

4. $\Delta U_E = q\Delta V$, so 1 volt = $1 \frac{J}{C}$.

5. Suppose you have a 12.0 V motorcycle battery that can move 5000 C of charge, and a 12.0 V car battery that can move 60,000 C of charge. How much energy does each deliver? (Assume that the numerical value of each charge is accurate to three significant figures.)

$$\Delta U_{mc} = (5000 C)(12.0 V) = \boxed{6.00 \times 10^4 J}$$

$$\Delta U_c = (60{,}000 C)(12.0 V) = \boxed{7.20 \times 10^5 J}$$

6. The energy per electron is very small in macroscopic situations, but on a submicroscopic scale, such energy per particle (electron, proton, or ion) can be of great importance. For example, even a tiny fraction of a joule can be great enough for these particles to destroy organic molecules and harm living tissue. The particle may do its damage by direct collision, or it may create harmful x-rays, which can also inflict damage. It is useful to have an energy unit related to submicroscopic effects. An energy unit called the electron volt (eV), which is the energy given to a fundamental charge accelerated through a potential difference of 1 volt.