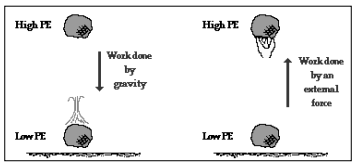
Electric Potential & Electric Energy

Book – Ch. 33.4 - 33.5

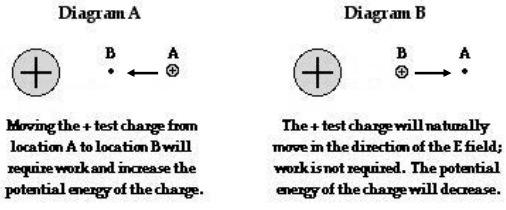
Potential Energy & Work

- Last semester we discussed potential energy as it relates to gravity.

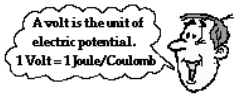


- When moving from high PE to low PE, the work is done naturally (by gravity) *by* the system.
- When moving from low to high, work has to be done *on* the system by some external force.

- To move a charge against its natural direction requires work.



- Electrical potential energy – PE of an object due to its position relative to an electric force.
- Results from the interaction of two object's charges.
- Any time a charge moves because of an electric force, work is done.



Voltage = Potential Difference

- ***Potential difference*** **-** amount of work done per unit charge.
- Because the unit is the volt (V), potential difference is often called ***voltage*** and uses the symbol (V).

1 Volt = 1 Joule / Coulomb

Voltage $V = \frac{W}{q}$

Symbols	**Units**
V = voltage	Volts (V)
W = work (PE)	Joules (J)
q = charge	Coulomb (C)

Example #1

- If a conductor connected to the terminal of a battery has a potential difference (voltage) of 12 V, then each coulomb of charge has a potential energy of ___ J.

$$V = \frac{W}{q}$$

Example #2

- If a charge of 2 x 10^{-5} C has a PE of 540 J, its voltage is ___V.

Example #3

- If a rubber balloon is charged to 5000 V, and the amount of charge on the balloon is 1×10^{-7} C, then the potential energy of this charge is ___ J.

Example # 4

- A force of 0.032 N is required to move a charge of 4.2×10^{-6} C in an electric field between two points which are 0.25 m apart.
- What is the potential difference (voltage) between the points?