AP Physics - Electrostatics - Equation Summary

Note Title 3/10/2009

Only for Point Charges

$\vec{F} = \frac{kqq}{d^2}$ ①

$\vec{E} = \frac{kq}{d^2}$ ①

$V = \frac{kq}{d}$ ①

Both

$\Delta EPE = \text{Work}$

$\Delta EPE = q\Delta V$ ③

$\vec{E} = \frac{\vec{F}}{q}$

Only for Parallel Plates

$C = \frac{Q}{V}$

$C = K\epsilon_0 \frac{A}{d}$

$\Delta V = \vec{E}d$ ②

$EPE = \frac{1}{2}QV = \frac{1}{2}CV^2 = \frac{1}{2}\frac{Q^2}{C}$

$EPE = Q\vec{E}d$ ③

Notes

① Valid only for point charges because point charges obey inverse-square laws: Field strength gets weaker as you go farther away.

② Valid only for parallel plates because we are assuming field strength is constant. Since $|\vec{E}|$ varies for fields around point charges, we would have to use the calculus form of the equation $\Delta V = \int E \cdot ds$ or $\vec{E} = \frac{dV}{ds}$ (see AP Physics C)

③ These two forms of the equation may look identical, but they are not!

$EPE = QEd$ relies on $\Delta V = Ed$, which is only valid for parallel plates (see Note ②).