Force - Field - Energy - Potential

	Force	Field	E_{pot} $W_f = -\Delta E_{pot}$ (W_f: Work by field)	Potential $\frac{W_f}{test\text{-}c} = -\Delta V$	Increment of potential	Homogeneous case
El	$F = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}$ [N] Vector-form: $\vec{F}_{21} = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}\frac{\vec{r}}{r}$ (Force on 2 from 1)	$E = \frac{F}{q_2}$ $\left[\frac{N}{C} = \frac{V}{m}\right]$ Vector (Field-source: 1 Test-charge: q_2)	$E_{pot} = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r}$ [J] Scalar E_{pot} = Work of field to move object from r to where $E_{pot} \equiv 0$. $F = -\frac{\Delta E_{pot}}{\Delta X}$ Small ΔX	$V = \frac{E_{pot}}{q_2}$ $\left[\frac{J}{C} \equiv V\right]$ $W_f = -q_2 \Delta V$ $E = -\frac{\Delta V}{\Delta X}$ Small ΔX	$\Delta V = \frac{\Delta E_{pot}}{q_2}$ $W_f = -\Delta E_{pot}$ $= -q_2 \Delta V$	 V_b +Q + ; V_a −Q − ; d Capacitor $\Delta V = V_b - V_a = V$ $E = \frac{\mp\Delta V}{\Delta X}$. $\|E\| = \frac{V}{d}$ Numerical: $E = \frac{V}{d}$. $\left(Q = CV.\ C = \varepsilon_0\frac{A}{d}\right.$ $\left.E = \frac{Q}{\varepsilon_0 A}\right)$
Grav.	$F = G\frac{m_1 m_2}{r^2}$ [N] Vector-form: $\vec{F}_{21} = -G\frac{m_1 m_2}{r^2}\frac{\vec{r}}{r}$ (Force on 2 from 1)	$g_f = \frac{F}{m_2}$ $\left[\frac{N}{kg} = \frac{m}{s^2}\right]$ Vector (Field-source: 1 Test-mass: m_2)	$E_{pot} = -G\frac{m_1 m_2}{r}$ [J] Scalar $F = -\frac{\Delta E_{pot}}{\Delta X}$ Small ΔX	$V = \frac{E_{pot}}{m_2}$ $\left[\frac{J}{kg} = \frac{m^2}{s^2}\right]$ $W_f = -m_2 \Delta V$ $E = -\frac{\Delta V}{\Delta X}$ Small ΔX	$\Delta V = \frac{\Delta E_{pot}}{m_2}$ $W_f = -\Delta E_{pot}$ $= -m_2 \Delta V$	Near Earth-surface: $F = mg$ (and same direction) $E_{pot} = mgh$ Numerical: $F = \frac{E_{pot}}{h}$ $g = \frac{V}{h}$

Remember: $W_f = \Delta E_{kin} = -\Delta E_{pot}$ if mech. energy conserved.

Homogeneous case of el: $\Delta E_{kin} = -\Delta E_{pot} = -q_2 \times \Delta V = q_2 \times E \times \Delta X$ even for large ΔX