

Potential Energy of Charged Particle in Uniform Electric Field



- Electrostatic force: $\vec{F} = -qE\hat{j}$ (conservative)
- Displacement: $d\vec{s} = dx\hat{i} + dy\hat{j}$
- Potential energy: $U = - \int_{\vec{r}_0}^{\vec{r}} \vec{F} \cdot d\vec{s} = - \int_0^y (-qE)dy = qEy$
- Work: $W_{if} = \int_{\vec{r}_i}^{\vec{r}_f} \vec{F} \cdot d\vec{s} = \int_{y_i}^{y_f} (-qE)dy = -qE(y_f - y_i)$
- Electric potential: $V(y) = - \int_{\vec{r}_0}^{\vec{r}} \vec{E} \cdot d\vec{s} = - \int_0^y (-E)dy = Ey$

