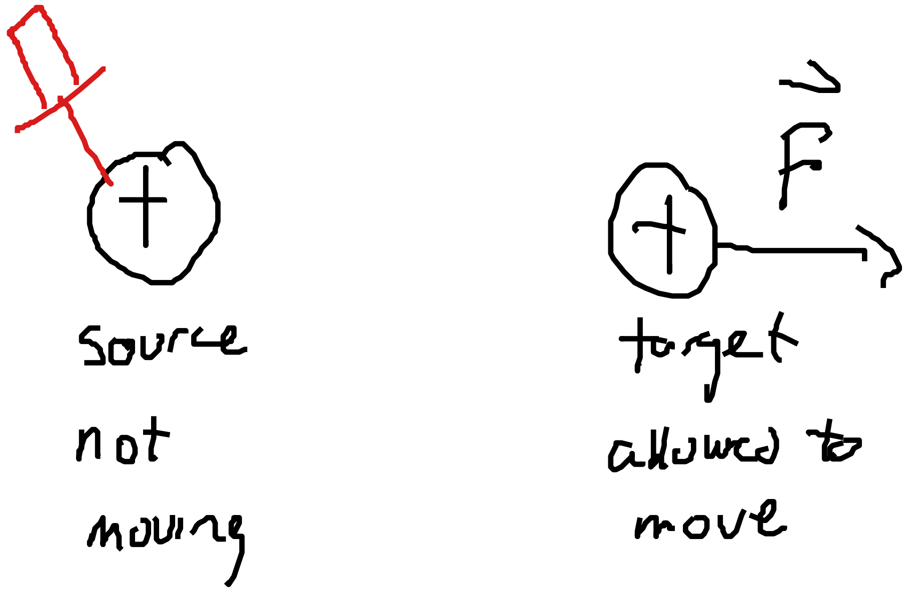


$$\vec{F} = k\,\frac{q_s q_t}{d^2} \longrightarrow$$

$$\vec{a} = \frac{\vec{F}}{m}$$

$\vec{a}$ is always $\longrightarrow$

constantly speeds up

Kinetic Energy is always increasing

Source is doing work on the target $\therefore$ positive work

$$W = \vec{F} \cdot \Delta\vec{r}$$

$$= \longrightarrow \cdot \longrightarrow$$

$$> 0$$

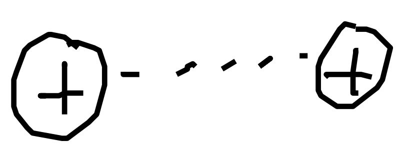
Positive work = giving energy to the target

Work is a transfer of energy

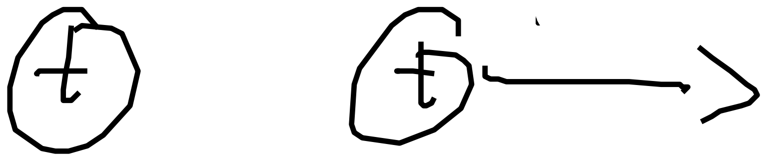
Where does the energy come from?

Stored in electric field as electric potential energy

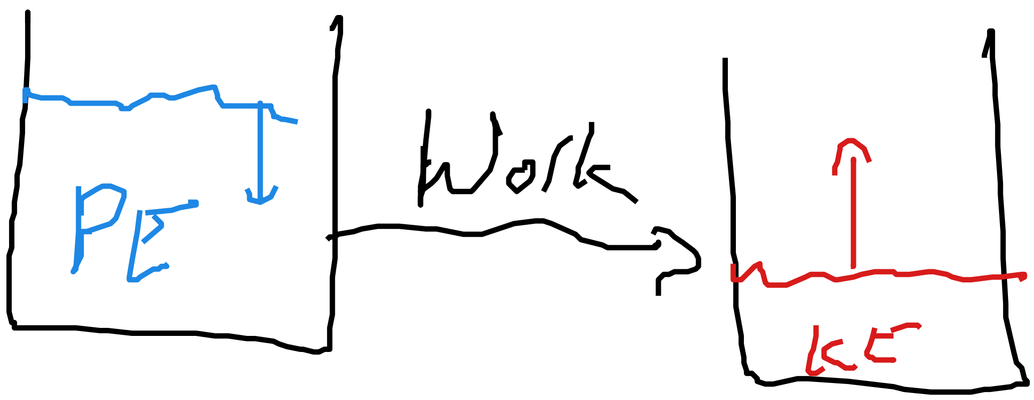
Stored in the "bonds" between charges (as a metaphor)



As target moves away



PE is increasing or decreasing



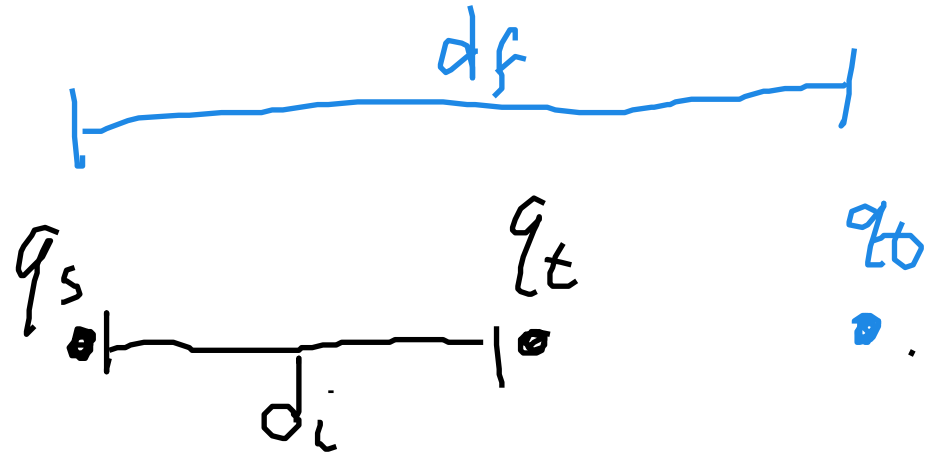
PE decreases as system "relaxes" : returns to state it "wants" to be in

PE increases as system "tenses"

Spontaneous motion (no external force) is always due to a release/decrease in PE.

— — —

Electric potential energy depends only on relative location of the charges.



$$\vec{F} = k\,\frac{q_s q_t}{d^2} \longrightarrow$$

$$\Delta PE = -W_{\text{done on target}}$$

$$= -\int_{d_i}^{d_f} F \, dd$$

$$= -\int_{d_i}^{d_f} k\,\frac{q_s q_t}{d^2} \, dd$$

$$= -k q_s q_t \int_{d_i}^{d_f} d^{-2} \, dd$$

$$= \cancel{-}\, k q_s q_t \left[\cancel{-}\,\frac{1}{d}\right]_{d_i}^{d_f}$$

$$= k q_s q_t \left[\frac{1}{d_f} - \frac{1}{d_i} \right]$$

$$\frac{1}{2} - \frac{1}{3}$$

$$= \frac{1}{6}$$

NOT $\frac{1}{2-3}$

$$\Delta PE = k \frac{q_s q_t}{d_f} - k \frac{q_s q_t}{d_i}$$

$$PE_f - PE_i = k \frac{q_s q_t}{d_f} - k \frac{q_s q_t}{d_i}$$

$$PE = k \frac{q_s q_t}{d}$$ works

$$PE = k \frac{q_s q_t}{d} + 5$$ also works

$$PE_f - PE_i$$

$$\left(k \frac{q_s q_t}{d_f} + 5\right) - \left(k \frac{q_s q_t}{d_i} + 5\right)$$

$$k \frac{q_s q_t}{d_f} \cancel{+5} - k \frac{q_s q_t}{d_i} \cancel{-5}$$

$$PE = k\frac{q_s q_t}{d} + PE_\infty$$

potential energy if two charges are very far apart.

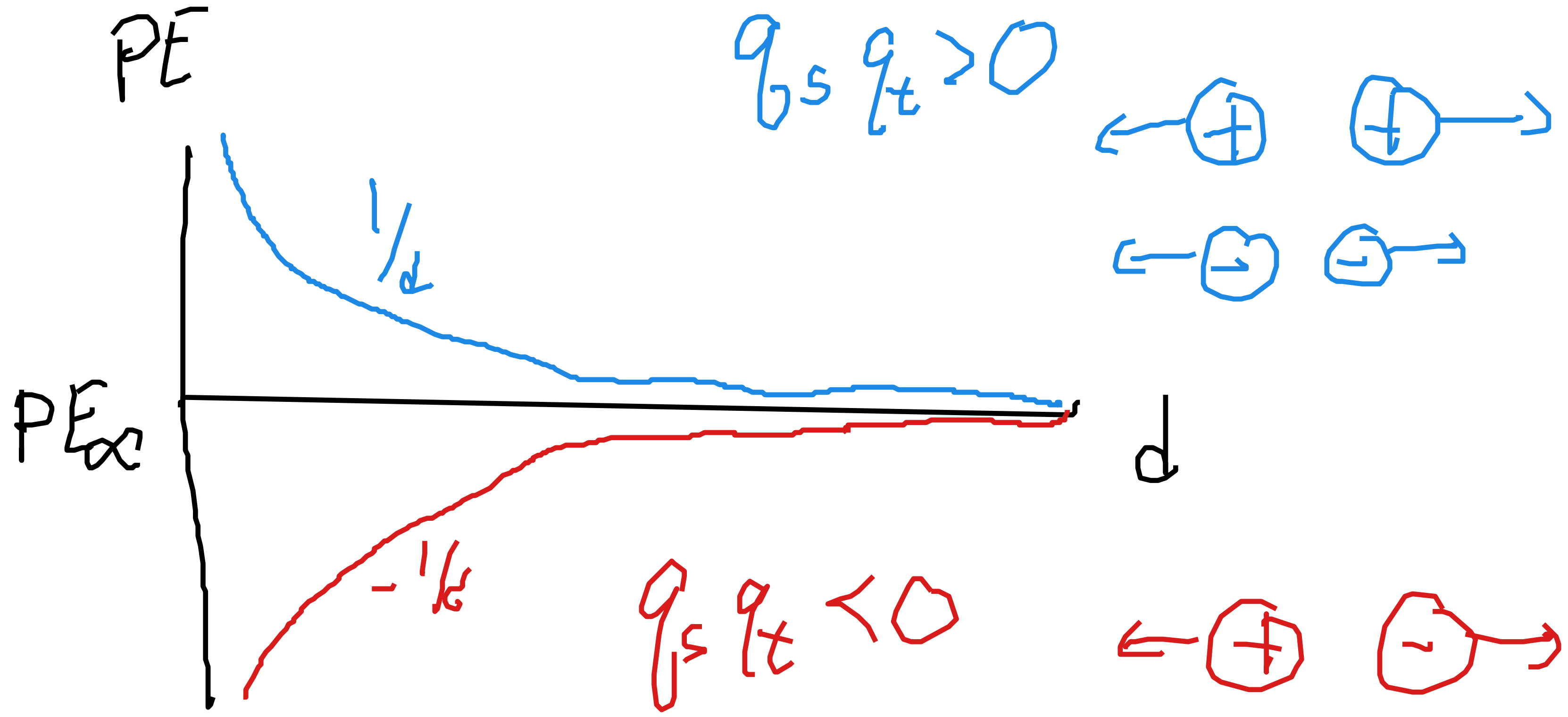
Arbitrary constant.

We saw this with gravity too

$$PE = mgh$$

h can be measured from an arbitrary baseline

Only changes in PE are physically relevant



"larger PE" = "more positive"

or "closer to ∞"

better to say "higher PE"

& "lower PE"

as compared to force where magnitude is what we compare

$|-1000\ N/C| > |2\ N/C|$ $\quad -1000\ J < 2\ J$