Missed quiz bc
no clicker

PY 202

freq

reading for Mondays

2, 3, 5, 6

~~competitions~~ E-fields from line charge drops off at $\frac{1}{r}$ not $\frac{1}{r^2}$

$\frac{1}{r}$!

Potential energy

$$\Delta U = -\vec{F}\cdot d\vec{l}$$
$$= -q\,\vec{E}\cdot d\vec{l}$$

Similarities:

$\vec{F}$ — factor q → $\vec{E}$

U (Potential E) — factor q → V (Potential)

$$\frac{\Delta U}{q} = -\vec{E}\cdot d\vec{l} = \Delta V$$

Potential

(Potential energy per unit charge)

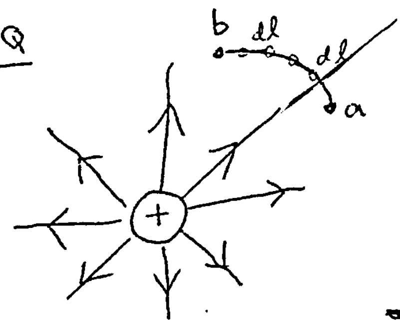
Potential $V = \Delta V = V_b - V_a = -\int_a^b \vec{E}\cdot d\vec{l}$

$= E(b-a)$ for 1-D systems

→ if a very far away, $V = -\int_\infty^b E(dx)$ (Set potential to 0 at $x=\infty$)

$= \; Ex\Big|_\infty^b = Eb$

Positive Pt. Q



$$\vec{E} = \frac{kQ}{r^2}\hat{r}$$

$$d\vec{l} = (\cos\theta\,\hat{r} + \ldots + \hat{r}_\perp)\,dr$$

$$\vec{E}\cdot d\vec{l} = \frac{kQ}{r^2}\hat{r}\cdot(\cos\theta\,\hat{r} + \ldots + \hat{r}_\perp)\,dr$$

$$\int \vec{E}\cdot d\vec{l} = -kQ\int \frac{dr}{r^2}\cos\theta$$

use $\theta = 180° \rightarrow \cos(\theta) = -1$

$$= -kQ\,\frac{1}{r}\Big|_a^b = kQ\left(\frac{1}{a} - \frac{1}{b}\right)$$

if Problem is radial displacement,
kill $\cos\theta$'s (-) and

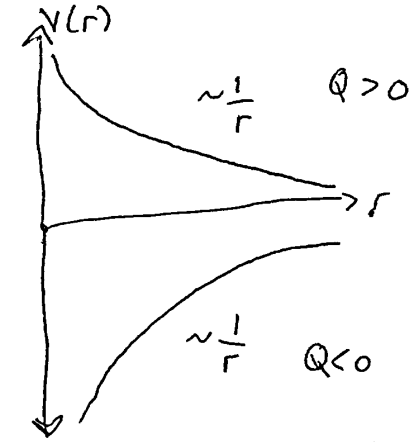
$$V = -\int_a^b \vec{E} \cdot d\vec{l} = -kQ\int_a^b \frac{dr}{r^2} = kQ \frac{1}{r}\Big|_a^b$$

$$V = kQ\left(\frac{1}{b} - \frac{1}{a}\right)$$

$\vec{E} = E\hat{r}$
$d\vec{l} = dl(-\hat{r})$

as $r \to \infty$, $V \to 0$

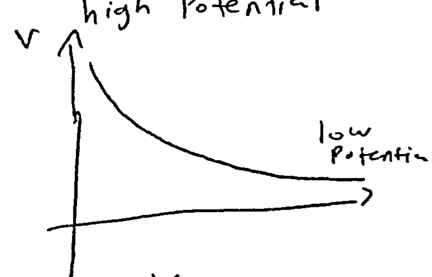
(A) Point charge $V = \dfrac{kQ}{r}$ ($\to 0$ as $r \to \infty$):



Place a second point charge into potential!

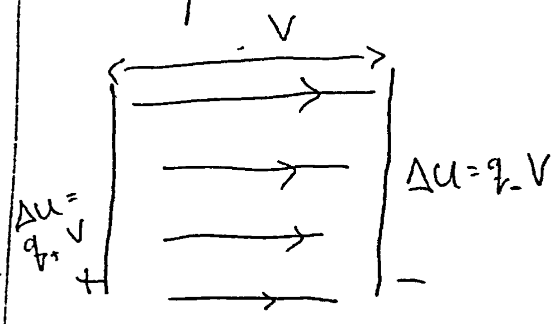
(+) Q_1 (+) Q_2

$$\Delta U = Q_2 V = \frac{kQ_1 Q_2}{r}$$



(−) Q_1 (+) Q_2

$$\Delta U = Q_3 V = -\frac{kQ_1 Q_3}{r}$$



high Potential (energy) ⊕ low Potential (energy)

low Potential energy ⊖ high Potential energy

⊕ : proton, m_p, q_p

⊖ : electron, m_e, q_e

$V = 100$ volt

Key: V and $\vec{E}$ c
generally n
0 at th
same tim

$\vec{E}$ is a vect
V is a scal

$K = \frac{1}{2}mv^2$

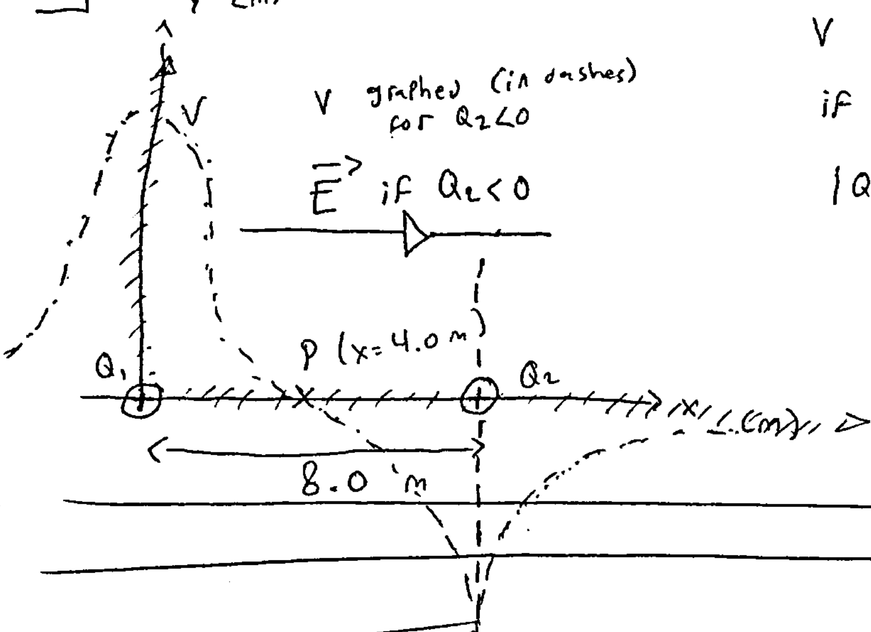
$\Delta U_p = q_p V$
$\Delta U_e = q_e V$
charges of same magnitude,

$K_p = \Delta U_p = \frac{1}{2}m_p v_p^2$

$K_e = \Delta U_e = \frac{1}{2}m_e v_e^2$

final speeds v_p, v_e will be different.

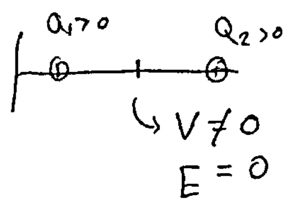
ex



V at P_1? ⟹ $V = V_1 + V_2 = \frac{kQ_1}{d/2} + \frac{kQ_2}{d/2}$

if $Q_2 < 0$: $V = V_1 + V_2 = \frac{kQ_1}{d/2} + \frac{k(-Q_2)}{d/2} = 0$

$|Q_1| = |Q_2|$



$Q_1 = Q_2$