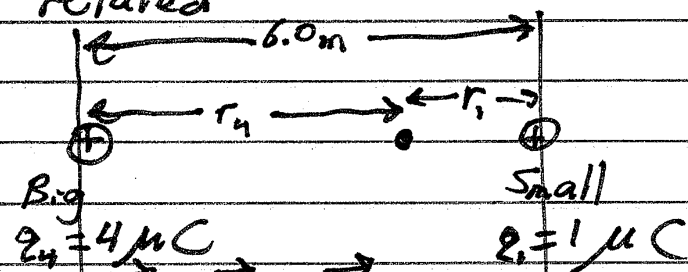
Phys 2426 2015-09-10 Lec 5

SMTE-0095 Due Fri! Register Today!

HW1 #16 -related



Everywhere; $\vec{E} = \vec{E}_4 + \vec{E}_1$

For $\vec{E} = 0$: $\vec{E}_4 = -\vec{E}_1$

Opposite: $\hat{E}_4 = -\hat{E}_1$

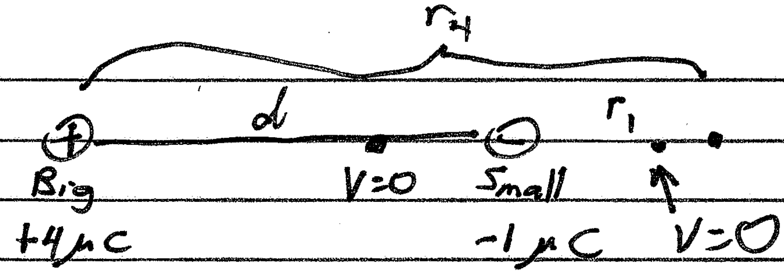
Equal : $|E_4| = |E_1|$

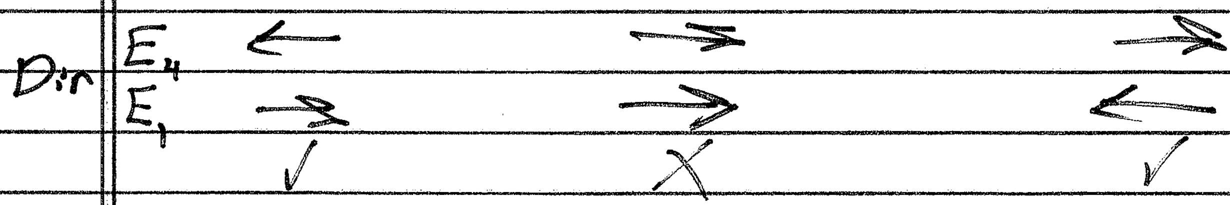
$\hat{E}_4$	←	→	→
$\hat{E}_1$	←	←	→
Opposite?	✗	✓	✗

$$\frac{k|q_4|}{r_4^2} = \frac{k|q_1|}{r_1^2} \qquad r_1 + r_4 = (6.0\ m)$$

$$q_4 r_1^2 = q_1 r_4^2$$
$$4 r_1^2 = r_4^2$$
$$2 r_1 = r_4$$

(2)





Close to small?

X ✓

$$\frac{k|q_4|}{r_4^2} = \frac{k|q_1|}{r_1^2} \qquad d + r_1 = r_4$$

Potential? $V = \frac{kq}{r}$

"Close to the small charge" is our only restriction.

"Small x" $r_4 + r_1 = d$ $\quad \frac{q_4}{r_4} = \frac{q_1}{r_1}$

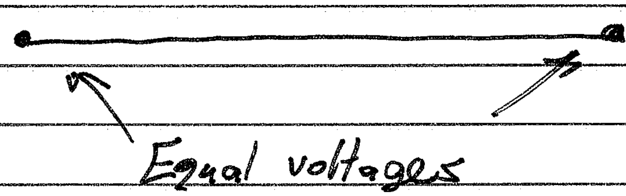
"Large x" $d + r_1 = r_4$ $\quad \frac{q_4}{r_4} = \frac{q_1}{r_1}$

Voltage in Circuits

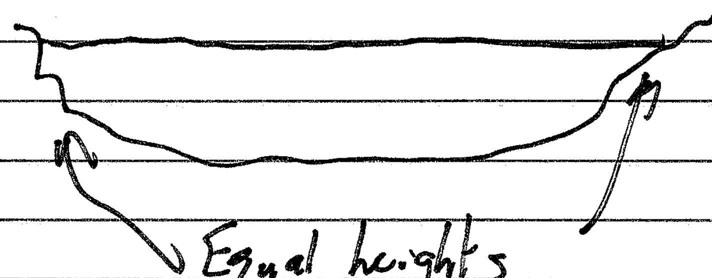
- Voltage is not "stuff"
- Voltage does not move or flow.
- Absolute voltages don't matter, only relative voltages. (ΔV)

Wires – $\vec{E} = 0$ in a conductor

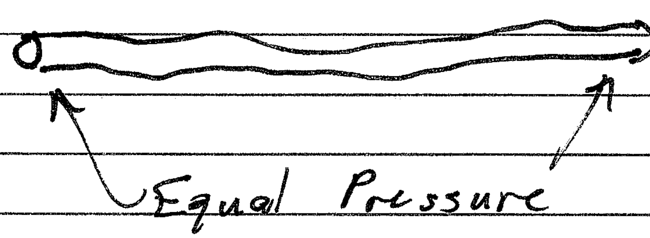
$$\Delta V = -\int \vec{E} \cdot d\vec{l} = 0$$



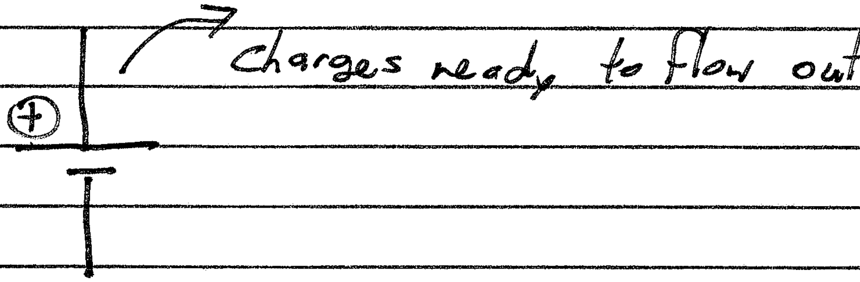
Height Analogy



Pressure (Airhose)

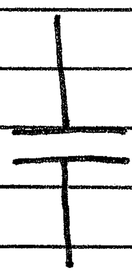


Batteries - Generate a specific ΔV



Schematic Symbol
for battery

Capacitor - Storage tanks for charge



Capacitor

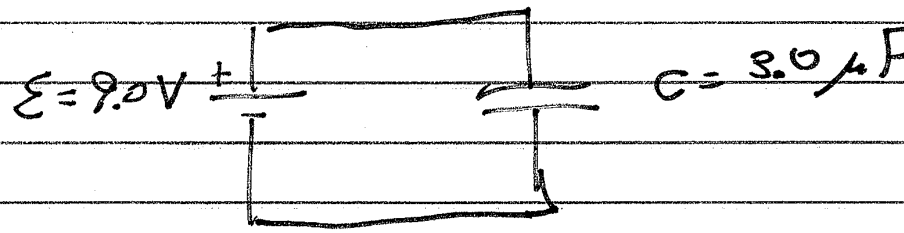
$$Q = CV$$

$V = \Delta V$ from one side to the other
Q = charge of one plate
(other plate has $-Q$)

C = capacitance in farads (F)

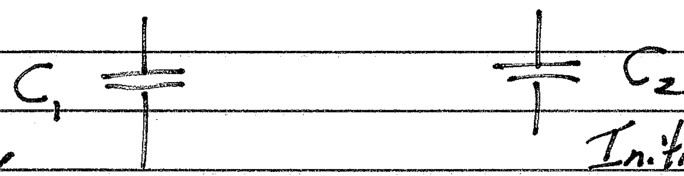
$$C = K \varepsilon_0 A / d$$

Charging a Capacitor



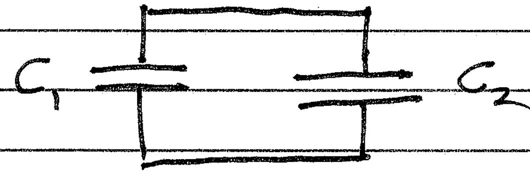
$$Q = CV$$
$$= (3.0\,\mu F)(9.0\,V)$$
$$= 27.0\,\mu C$$

Using a cap to charge a cap



Initially Q_1, V_1

Initially $Q_2 = 0$, $V_2 = 0$



Final: $V_1 = V_2$ $\qquad Q_1 + Q_2 = \text{const}$

$$C_1 V_1 = Q_1$$
$$C_2 V_2 = Q_2$$