PHYS 231 - Intro. to Electronics   Sept. 3, 2025

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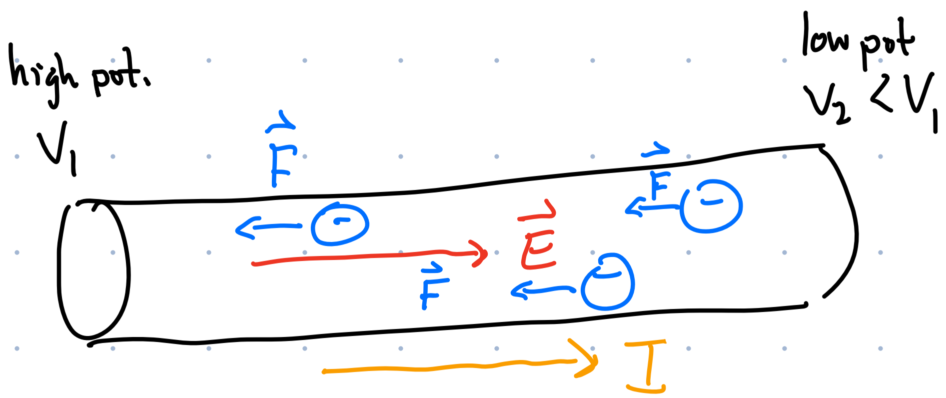
https://cmps-people.ok.ubc.ca/jbobowsk/phys231.html

Consider a conductor w/ a pot. diff ΔV across it.



Recall that $\vec{E}$ point from high to low pot./volt.

Cross conductor from left to right.

$$V_2 - V_1 < 0 \quad (\text{negative})$$

$\boxed{\text{Get a negative change in voltage when cross conductor in dir'n of } I}$

In this case, $\Delta V = V_2 - V_1 = -IR$

resistance.

Cross conductor from right to left.

$$V_1 - V_2 > 0 \quad (\text{positive})$$

$\boxed{\text{Get a positive change in volt. when cross conductor anti-parallel to } I}$

$$\Delta V' = V_1 - V_2 = +IR$$

Relationship between electric field $\vec{E}$ and volt. <u>differences</u>.

$$\Delta V = -\int_1^2 \vec{E}\cdot d\vec{l}$$

To see the origins of this relationship, mult. both sides by charge q of pt. charge.

$$\underbrace{q\,\Delta V}_{\Delta U = -\Delta K} = -\int_1^2 (\underbrace{q\vec{E}}_{\vec{F}})\cdot d\vec{l}$$

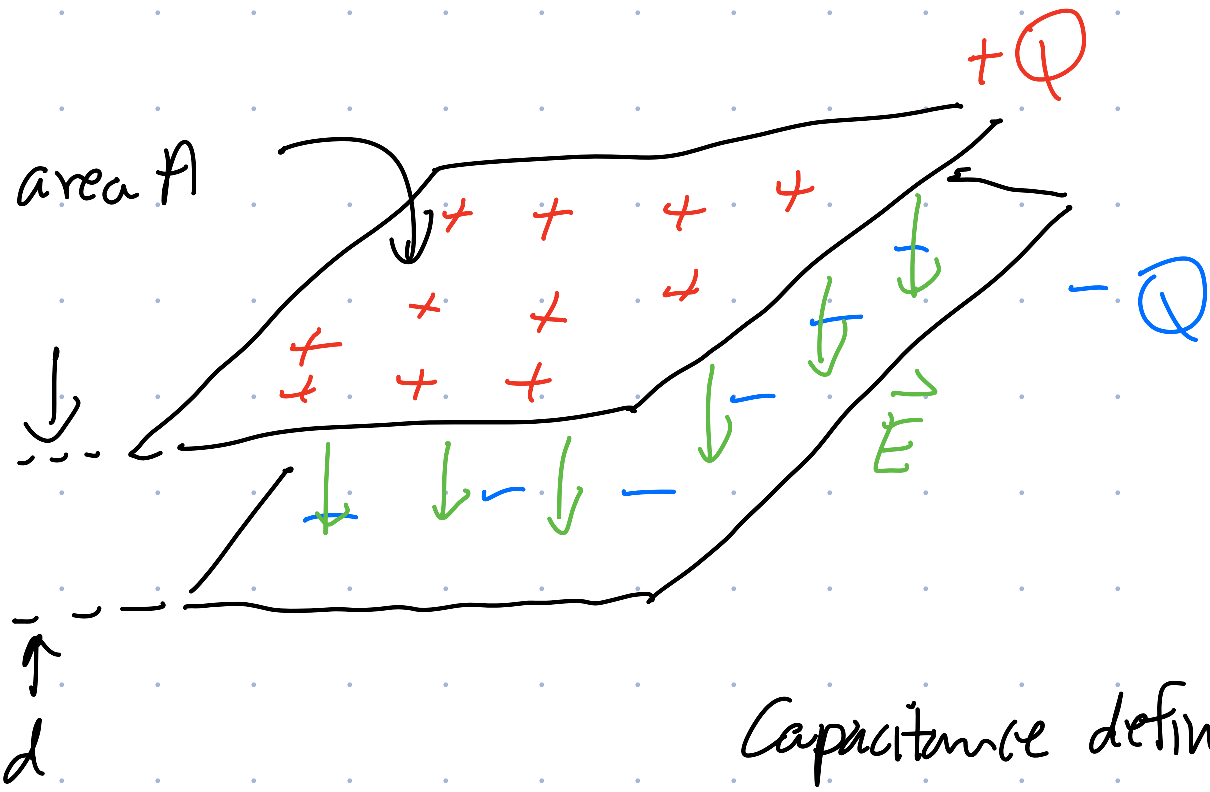
change in P.E.

$\vec{E}$-force is conservative. $\therefore$ Mechanical energy is conserved $\quad \Delta U + \Delta K = 0$

$$\Rightarrow \Delta U = -\Delta K$$

$$\therefore \Delta K = \int_1^2 \vec{F}\cdot d\vec{l}$$ Work-K.E. Theorem.

Parallel Plate Capacitor



Capacitance defined to be

$$C = \frac{Q}{|\Delta V|}$$

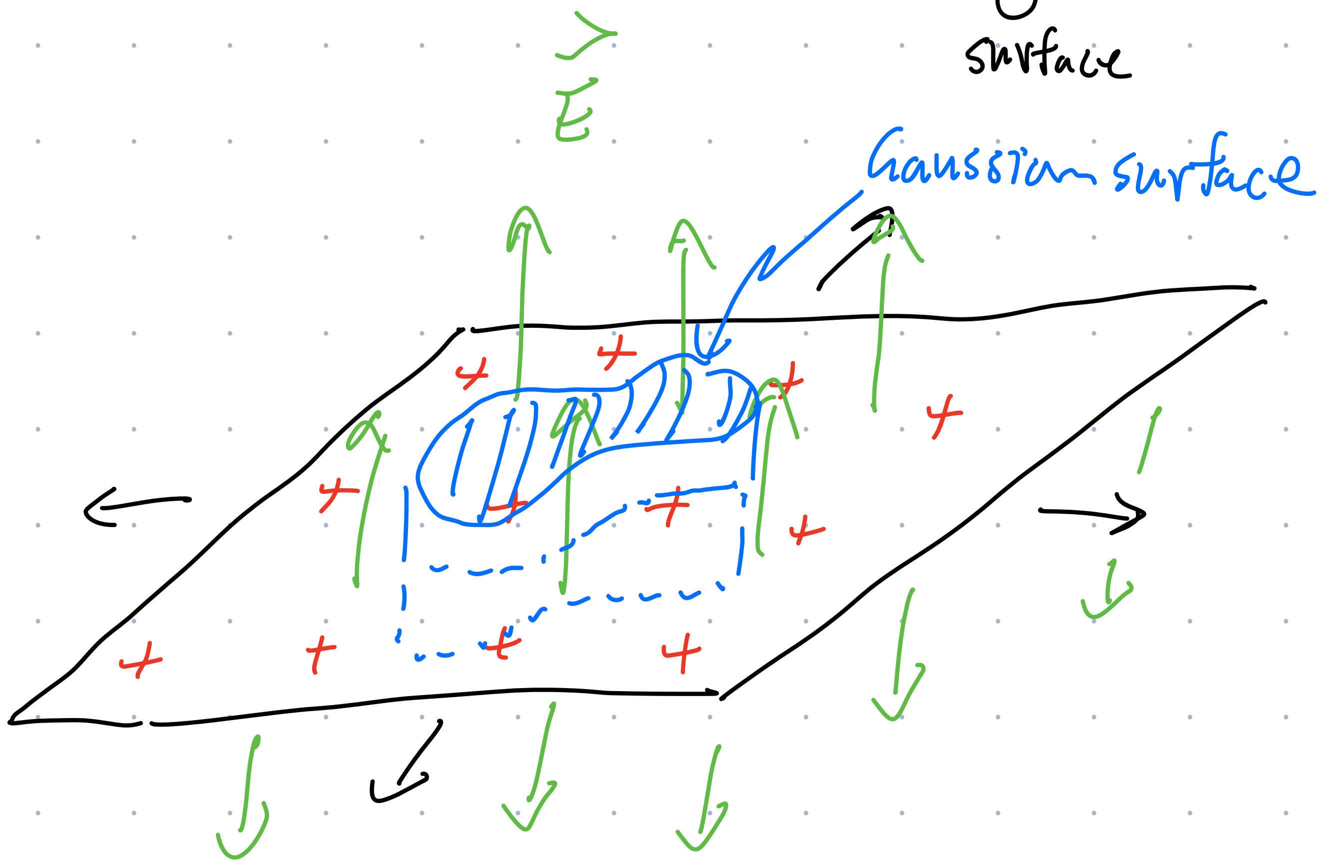
① calc. $\vec{E}$ between plates

② calc. $\Delta V = -\int \vec{E} \cdot d\vec{l}$ from one plate to the other

③ Find $C = \frac{Q}{|\Delta V|}$

We can find $\vec{E}$ of a large uniformly-charged plate using Gauss's law:

$$\oint_{\text{surface}} \vec{E} \cdot d\vec{A} = \frac{q_{encl}}{\varepsilon_0}$$

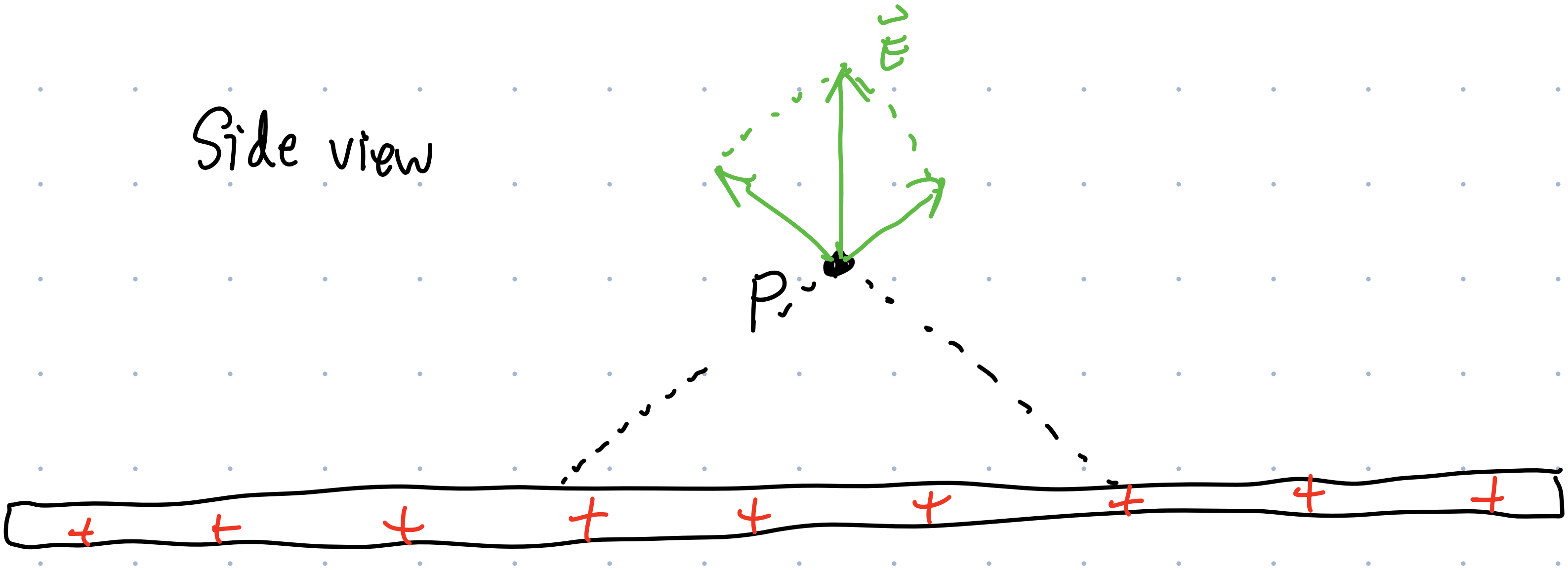


Find $E = \dfrac{\sigma}{2\varepsilon_0}$

for a uniformly charge surface.

where σ is the charge per unit area: $\sigma = \dfrac{Q}{A}$.

Side view



By symmetry, for points close to large charged surface, $\vec{E}$ will always be $\perp$ to surface.