PHYS 301
Electricity and Magnetism

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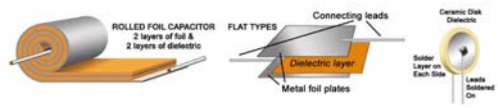
Fall 2019

Today!

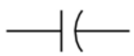
- Capacitors
- Magnetic fields

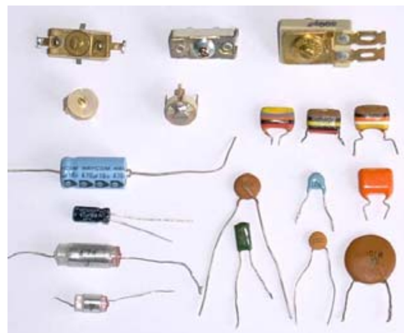
Capacitance



- Purely geometrical quantity!
- Relates **charge** to **electric potential**:

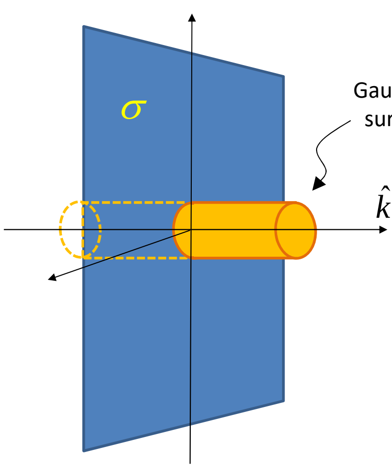
$$C = \frac{Q}{\Delta V}$$





Gauss' Law:

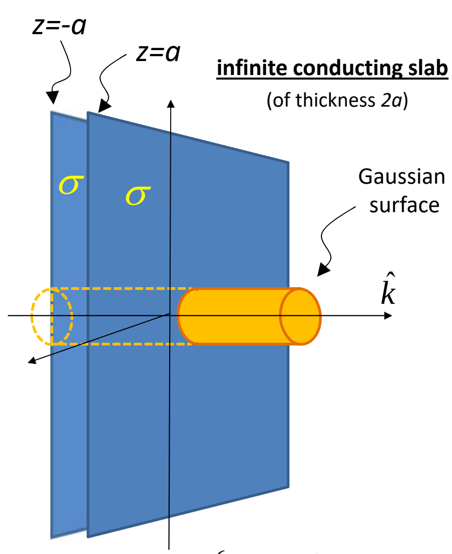
infinite sheet



$$\vec{E} = \begin{cases} +\sigma/2\varepsilon_o \hat{k}, \text{ for } z>0 \\ -\sigma/2\varepsilon_o \hat{k}, \text{ for } z<0 \end{cases}$$

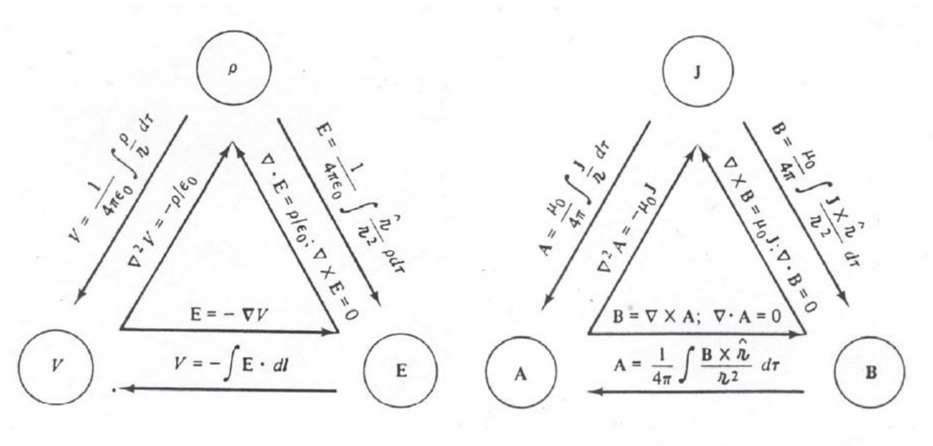
infinite conducting slab

(of thickness $2a$)



$$\vec{E} = \begin{cases} +\sigma/\varepsilon_o \hat{k}, \text{ for } z>a \\ -\sigma/\varepsilon_o \hat{k}, \text{ for } z<-a \end{cases}$$

electrostatics **magnetostatics**



magnetostatics

- Current …
  - *conventional current flow* = the flow of positive charges
  - A comparative name/symbol "hierarchy" between charges and currents:

	electrostatics	**magnetostatics**	
q	*charge*	*no magnetic monopoles!*	
λ	*line charge (density)*	$I = \dfrac{dq}{dt} = \lvert \lambda \vec{v} \rvert = \int \vec{J} \cdot d\vec{A}$	*"current"*
σ	*surface charge (density)*	$\vec{K} = \sigma \vec{v}$	*"surface current (density)"*
ρ	*(volume) charge density*	$\vec{J} = \rho \vec{v}$	*"current density"*