Capacitors

Devices used to store charge

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Useful to deliver large short “pulse” of charge

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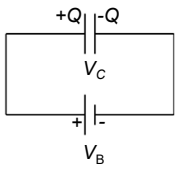
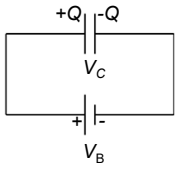
Amount of charge depends on capacitor design and applied voltage



Capacitance

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



Finding Capacitance

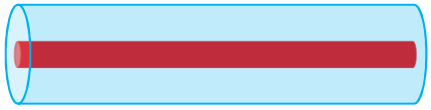
- Determine $\vec{E}$ usually using $\oint \vec{E} \cdot d\vec{A} = \frac{q_{enc}}{\epsilon_0}$
- Determine ΔV using $\Delta V = -\int \vec{E} \cdot d\vec{s}$
- Determine C using $C = \left|\frac{Q}{\Delta V}\right|$

Example: A parallel plate capacitor

Example: Parallel plates of dimensions, 3 cm x 4 cm are separated by a distance of 0.5 mm. The plates are connected to a battery with a potential difference of 12 V.

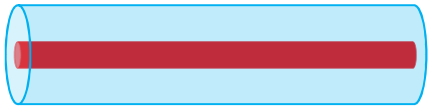
a. Determine the capacitance of the plates.
b. Determine the electric field between the plates.
c. Determine the charge on the plates.

Example: A coaxial cable capacitor



Example: A coaxial cable capacitor

$$\frac{C}{L} = \frac{2\,\pi\epsilon_0}{\ln\left(\frac{b}{a}\right)}$$



An Application: Determining the distance to the damaged section of a buried cable.

Example: Concentric spheres

Example: Isolated sphere