# Capacitor

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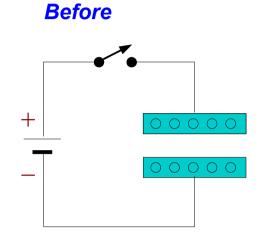
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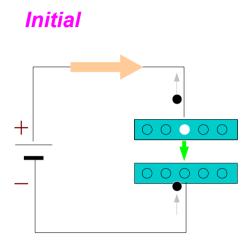
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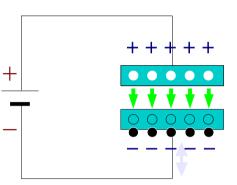
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# Charge





*Final* No more electrons to leave



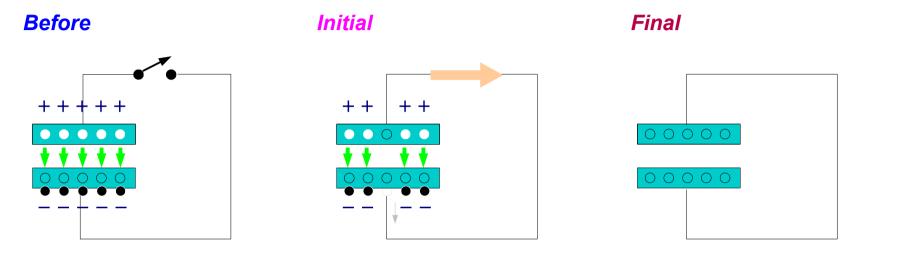
crowded electrons prevent other electrons from arriving

Energy stored in Electric Field

### Capacitor

З

# Discharge



4

No more electrons moving

### Capacitor

Sinusoid (Sine Waves)	Amplitude
$A\cos(\omega t + \theta)$	Angular Frequency
	Angular Frequency

1. Representation using Euler's Formula

$$A\cos(\omega t + \theta) = \frac{A}{2} \cdot e^{+i(\omega t + \theta)} + \frac{A}{2} \cdot e^{-i(\omega t + \theta)}$$

2. Representation using Real Part

$$A\cos(\omega t + \theta) = Re\{Ae^{i(\omega t + \theta)}\} = Re\{Ae^{i\theta} \cdot e^{i\omega t}\}$$
  

$$Ae^{i\theta} \cdot e^{i\omega t}$$
  

$$Ae^{i\theta}$$
  

$$Ae^{i\theta}$$

#### Capacitor

 $\boldsymbol{A}$ 

ω

θ

### Phase Lags and Leads

$$\frac{d}{dx} f(x) = \cos(x) \qquad \text{leads} \qquad f(x) = \sin(x)$$

$$\frac{d}{dx} f(x) = -\sin(x) \qquad \text{leads} \qquad f(x) = \cos(x)$$

$$\int f(x) \, dx = -\cos(x) + C \qquad \text{lags} \qquad f(x) = \sin(x)$$

$$\int f(x) \, dx = \sin(x) + C \qquad \text{lags} \qquad f(x) = \cos(x)$$

$$\frac{d}{dx} f(x) \qquad \text{leads} \qquad f(x) \qquad \text{by} \qquad \frac{\pi}{2}$$

$$\int f(x) \, dx \qquad \text{lags} \qquad f(x) \qquad \text{by} \qquad \frac{\pi}{2}$$

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#### References

[1] http://en.wikipedia.org/

[2] J.H. McClellan, et al., Signal Processing First, Pearson Prentice Hall, 2003