Capacitor

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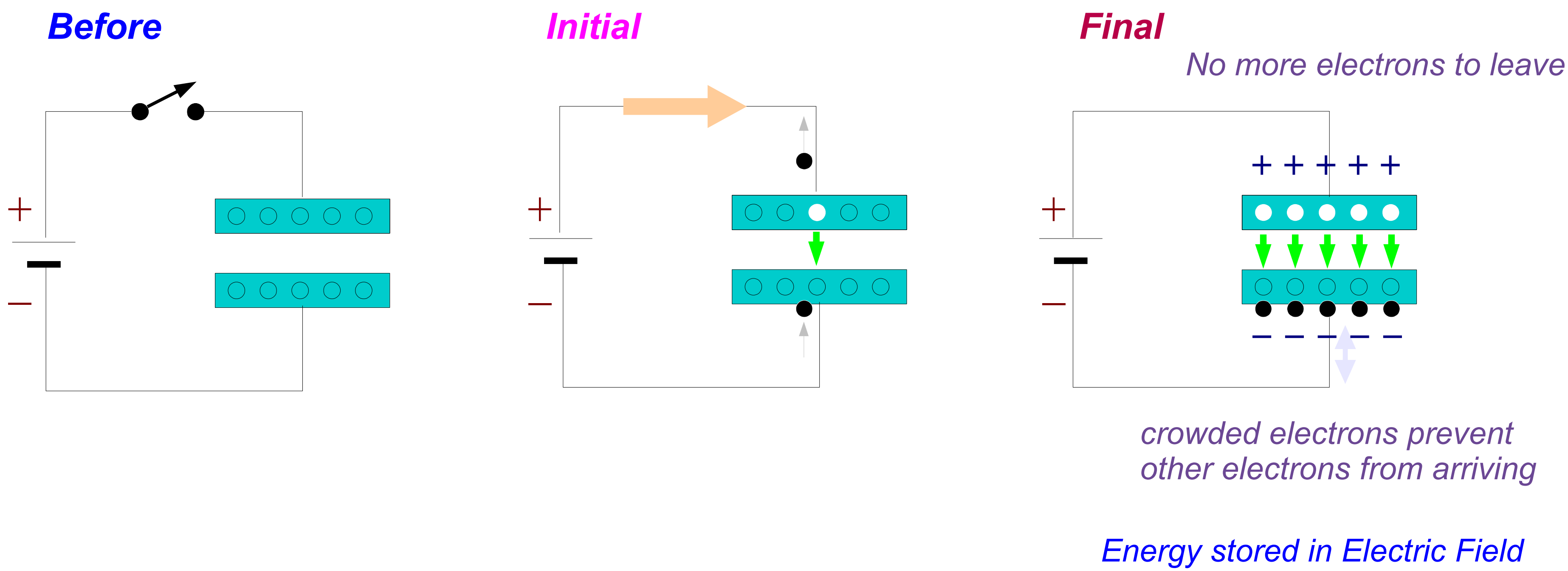
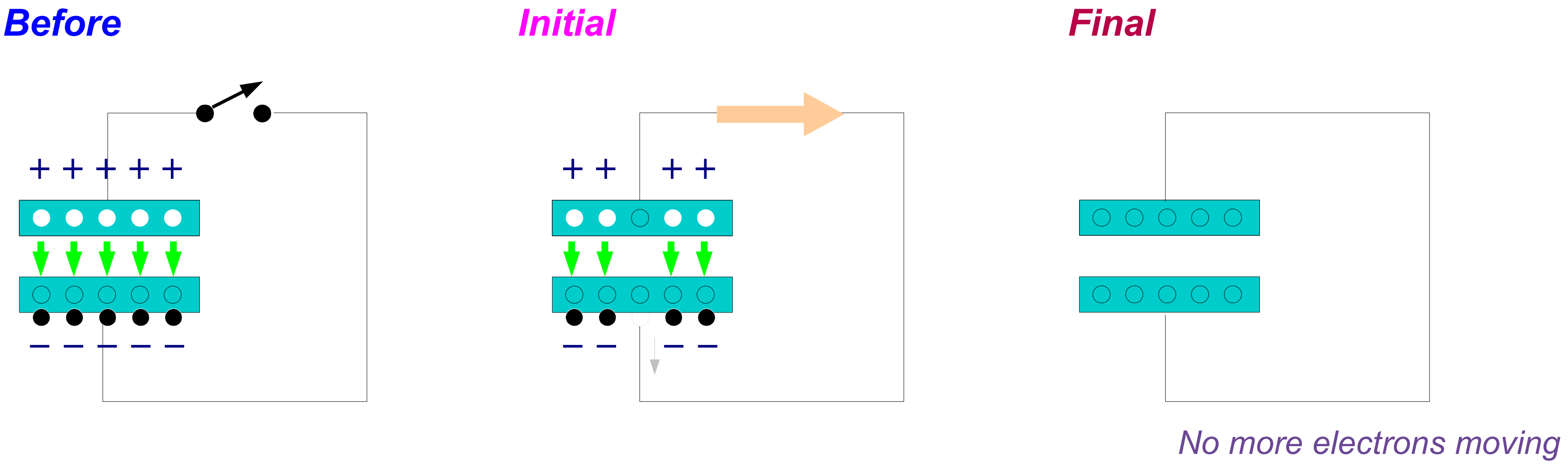
Charge



Before
Initial
Final
No more electrons to leave
+
−
+ + + + +
− − − − −
crowded electrons prevent
other electrons from arriving
Energy stored in Electric Field

Discharge



Phasor

Sinusoid (Sine Waves)

$$A\cos(\omega t + \theta)$$

- *Amplitude* A
- *Angular Frequency* ω
- *Angular Frequency* θ

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

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

➡ $A\, e^{i\theta}\cdot e^{i\omega t}$

➡ $A\, e^{i\theta}$

➡ $A \measuredangle \theta$

Phase Lags and Leads

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

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

$$\int f(x)\,dx = -\cos(x) + C$$ **lags** $$f(x) = \sin(x)$$

$$\int f(x)\,dx = \sin(x) + C$$ **lags** $$f(x) = \cos(x)$$

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

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

References

[1] http://en.wikipedia.org/
[2] J.H. McClellan, et al., Signal Processing First, Pearson Prentice Hall, 2003