Moving Conductor

$$\Delta V = \varepsilon = vlB$$
$$I = \frac{\varepsilon}{R} = \frac{vlB}{R}$$
$$F_{\text{mag}} = F_{\text{pull}} = IlB = \frac{vl^2B^2}{R}$$
$$P_{\text{input}} = P_{\text{dissipated}} = I^2R = \frac{v^2l^2B^2}{R}$$
$$\Phi_m = \int \vec{B} \cdot d\vec{A}$$
$$\Phi_m = \vec{A} \cdot \vec{B} = |A||B|\cos\theta \quad \text{(uniform magnetic field)}$$

- Increasing flux: The induced magnetic field points opposite the applied magnetic field.
- Decreasing flux: The induced magnetic field points in the same direction as the applied magnetic field.
- Steady flux: There is no induced magnetic field.

$$\varepsilon_{\text{induced}} = \frac{d\Phi_m}{dt}$$
$$I_{\text{induced}} = \frac{\varepsilon_{\text{induced}}}{R}$$
$$E_{\text{inside}} = \frac{r}{2}\left|\frac{dB}{dt}\right| \quad \text{Solenoid}$$
$$\frac{V_2}{V_1} = \frac{N_2}{N_1} \quad \text{Transformers}$$

Inductors

$$L = \frac{\Phi_m}{I} \text{ henry (H)} \quad \text{Inductance}$$
$$\Delta V_L = -L\frac{dI}{dt}$$
$$U_L = L\int_0^I I dI = \frac{1}{2}LI^2$$

LC Circuits

$$I = -\frac{dQ}{dt}$$
$$Q(t) = Q_0\cos\omega t$$
$$\omega = \frac{1}{\sqrt{LC}} \qquad f = \omega/2\pi$$

LR Circuits

$$I = I_0e^{-t/(L/R)}$$
$$\tau = \frac{L}{R} \quad \text{where current has decreased to } e^{-1}$$

Right-hand rule (wire)

1. Point thumb in the direction of current
2. Point fingers in the direction of magnetic field
3. Point palm in the face of force on wire

Right-hand rule (electromagnetic waves)

1. Point index finger in the direction of electric field
2. Point middle finger in the direction of magnetic field
3. Point thumb in the direction of motion

$$X_C = \frac{1}{2\pi fC}$$

where X_C is the capacitive reactance in ohms, f is the frequency, and C is the capacitance.