Magnetic force $\mathbf{F}_m$	**Magnetic field** $\mathbf{B} \sim \mathbf{F}_m / q\mathbf{v}$	**Magnetic induction** **(Faraday**	**Electric induction** **(Biot-Savart-Maxwell**
$\mathbf{F}_{12} = \left(\frac{\mu_0}{4\pi}\right)\frac{q_2\mathbf{v}_2 \times \left(q_1\mathbf{v}_1 \times \hat{\mathbf{r}}_{12}\right)}{r_{12}^2}$ $= q_2\mathbf{v}_2 \times \mathbf{B}\left(\mathbf{r}_2\right)$	$\mathbf{B}\left(\mathbf{r}_2\right) = \left(\frac{\mu_0}{4\pi}\right)\frac{q_1\mathbf{v}_1 \times \hat{\mathbf{r}}_{12}}{r_{12}^2}$	**Faraday-Lenz's law:** $\varepsilon_m = \oint_c \mathbf{E} \cdot d\mathbf{l} = -\frac{d}{dt}\iint_{S_c} \mathbf{B} \cdot d\mathbf{A}$	**Ampere-Maxwell** $\oint_c \mathbf{B} \cdot d\mathbf{l} = \mu_0 I_c + \mu_0\varepsilon_0 \frac{d}{dt}\iint_{S_c} \mathbf{E} \cdot d\mathbf{A}$
$d\mathbf{F}_{12} = I_2 d\mathbf{l}_2 \times \left(\frac{\mu_0}{4\pi}\right)\frac{I_1 d\mathbf{l}_1 \times \hat{\mathbf{r}}_{12}}{\lvert\mathbf{r}_{12}\rvert^2}$ $= I_2 d\mathbf{l}_2 \times d\mathbf{B}\left(\mathbf{r}_2\right)$	$d\mathbf{B}\left(\mathbf{r}_2\right) = \left(\frac{\mu_0}{4\pi}\right)\frac{I_1 d\mathbf{l}_1 \times \hat{\mathbf{r}}_{12}}{r_{12}^2}$		**Wave equation:** ${}^2\mathbf{E} = \frac{1}{c^2}\frac{\partial^2 \mathbf{E}}{\partial t^2}$ $c = \frac{1}{\sqrt{\varepsilon_0\mu_0}}$
$\mathbf{F}_m = q\mathbf{v} \times \mathbf{B}$ *or* $d\mathbf{F}_m = I d\mathbf{l} \times \mathbf{B}$ *Cyclotron:* $mv^2/r_c = qvB$ *Velocity selection:* $v = E/B$ *Hall effect:* $\mathbf{E}_H = -\mathbf{v}_d \times \mathbf{B}$ *Motion emf:* $\varepsilon_m = B\ell v$ *Magnetic dipole:* $\mathbf{m} = IA\hat{\mathbf{n}}$ *Torque on* $\mathbf{m}$*:* $\tau = \mathbf{m} \times \mathbf{B}$	$\mathbf{B}\left(\mathbf{r}_2\right) = \oint_c \left(\frac{\mu_0}{4\pi}\right)\frac{I_1 d\mathbf{l}_1 \times \hat{\mathbf{r}}_{12}}{r_{12}^2}$ *Straight segment* *Circular loop (full and broken)* *Solenoid:* $\mathbf{B} = \mu_o n I$ *Combinations of them* $\mathbf{B} = \mathbf{B}_1 + \mathbf{B}_2 + \mathbf{B}_3 +$	**Motion emf:** $\varepsilon_m = B\ell v$ *Flip coil* *Eddy current* *sliding rods on rails* **Back emf:** $\varepsilon_m = L\frac{dI}{dt}$ *Solenoid:* $L = \mu_0 n^2 A\ell$ *LR circuits:* $\varepsilon_m = L\frac{dI}{dt}$	**Poynting Vector of an EM wave: (intensity)** $\mathbf{S} = \frac{1}{\mu_0}\mathbf{E} \times \mathbf{B}$
	Ampere's law $\oint_c \mathbf{B} \cdot d\mathbf{l} = \mu_0 I_c + \mu_0\varepsilon_0 \frac{d}{dt}\iint_{S_c} \mathbf{E} \cdot d\mathbf{A}$		