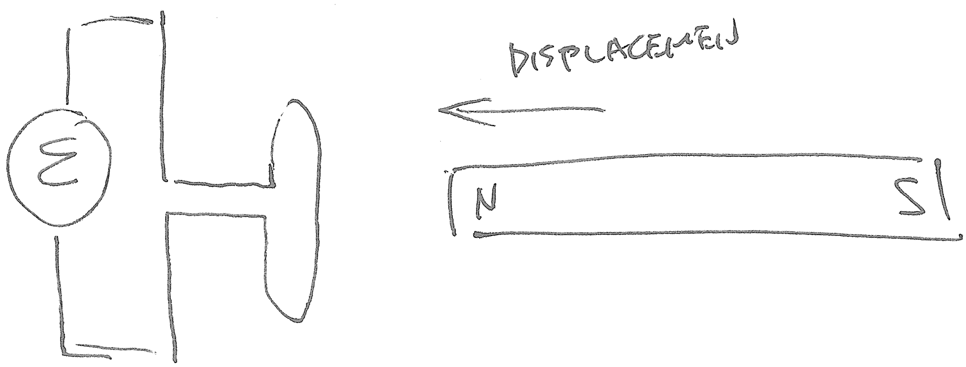
$$\Phi_B = \int \vec{B} \cdot d\vec{A}$$



$$\mathcal{E} = -\frac{d\Phi_B}{dt}$$ ← FARADAY'S LAW

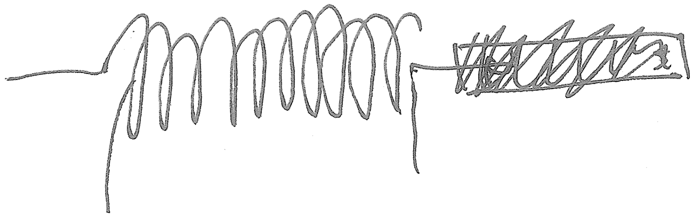
B = 0T AT 0sec

B = 1T AT 1sec

$$\mathcal{E} = -\frac{d}{dt}\Phi_B \; (T\,m^2/sec)$$

$$= -1 \text{ VOLT}$$

200 COILS



$B = 0\,T \quad t = 0$ sec

$B = 1\,T \quad t = 1$ sec

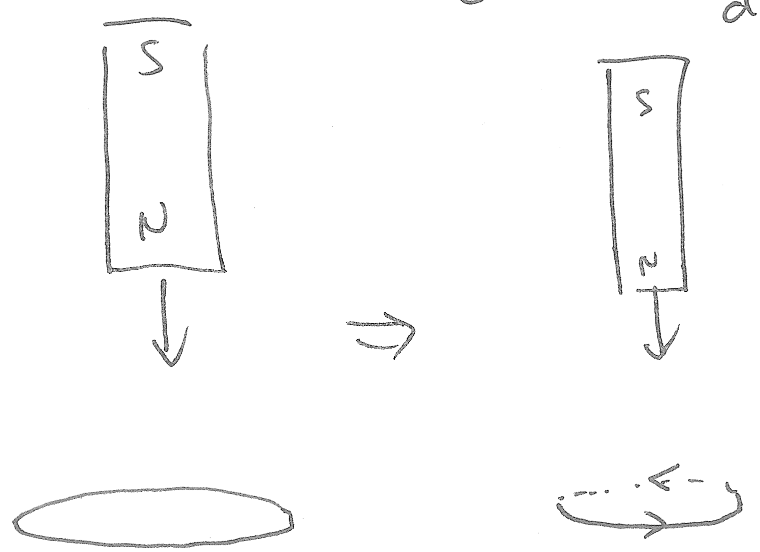
CROSS SECTIONAL AREA = $1\,m^2$

$\mathcal{E} = -200$ VOLTS

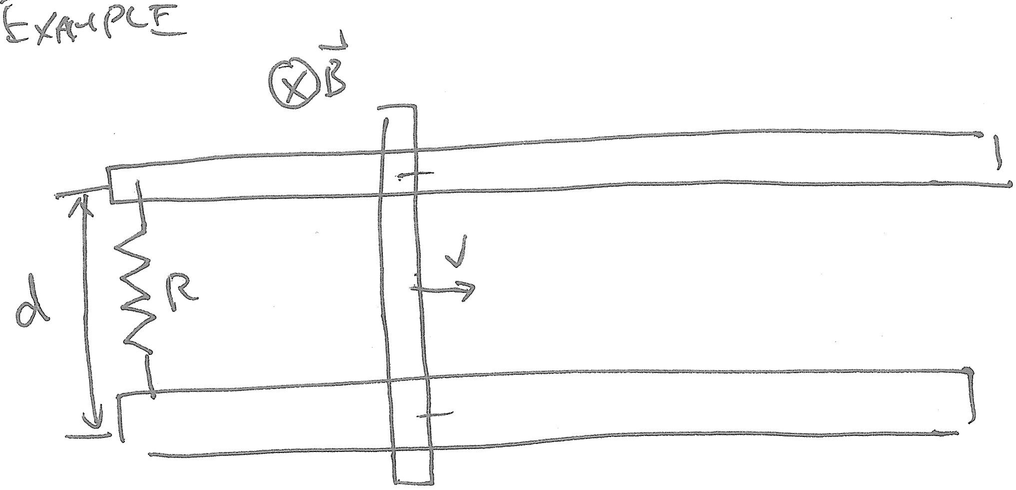
FOR SOLENOID

$$\mathcal{E} = -N \frac{d\Phi_B}{dt}$$

Φ_B : FLUX THRU THE COIL (SINGLE LOOP)



EXAMPLE



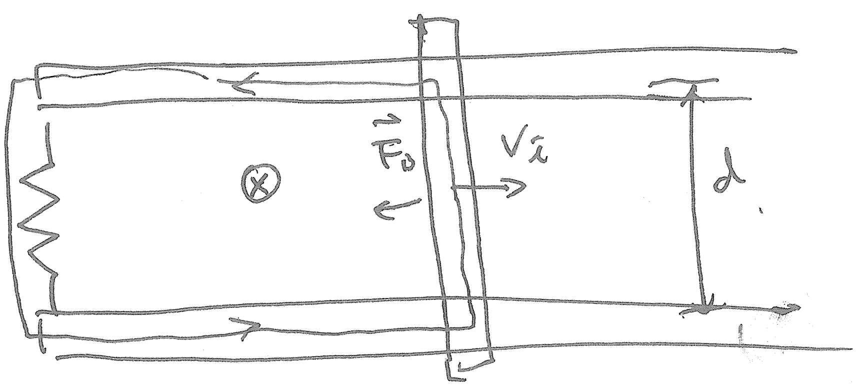
VOLTAGE ON SLIDING METAL BAR

$$\mathcal{E} = B d V$$

$$R \Rightarrow \quad I = \frac{B d v}{R}$$

POWER LOSS : $P = I^2 R = I \mathcal{E}$

$$= \frac{B^2 d^2 v^2}{R^2} \cdot R = \frac{B^2 d^2 v^2}{R}$$



$$\vec{F} = I \vec{L} \times \vec{B}$$

$$P = I^2 R = -P_{BAR}$$

$$P = \frac{B^2 d^2 v^2}{R} = -\frac{d}{dt}\left(\frac{1}{2} m v^2\right)$$

$$\frac{B^2 d^2 v^2}{R} = -m v \frac{dv}{dt}$$

$$F = ma = m\frac{dv}{dt} = -IdB$$

BUT WE KNOW $I = \frac{Bdv}{R}$

$$F = m\frac{dv}{dt} = -\frac{Bdv}{R}\cdot dB$$

$$= -\frac{B^2 d^2 v}{R}$$

$$m\frac{dv}{dt} = -\frac{B^2 d^2 v}{R}$$

$$\boxed{\frac{dv}{dt} = -\frac{B^2 d^2}{mR} v}$$

$$\frac{dv}{v} = -\frac{B^2 d^2}{mR} dt$$

$$V(t) = V_i e^{-t/t_0}$$

$$t_0 = \frac{mR}{B^2 d^2}$$