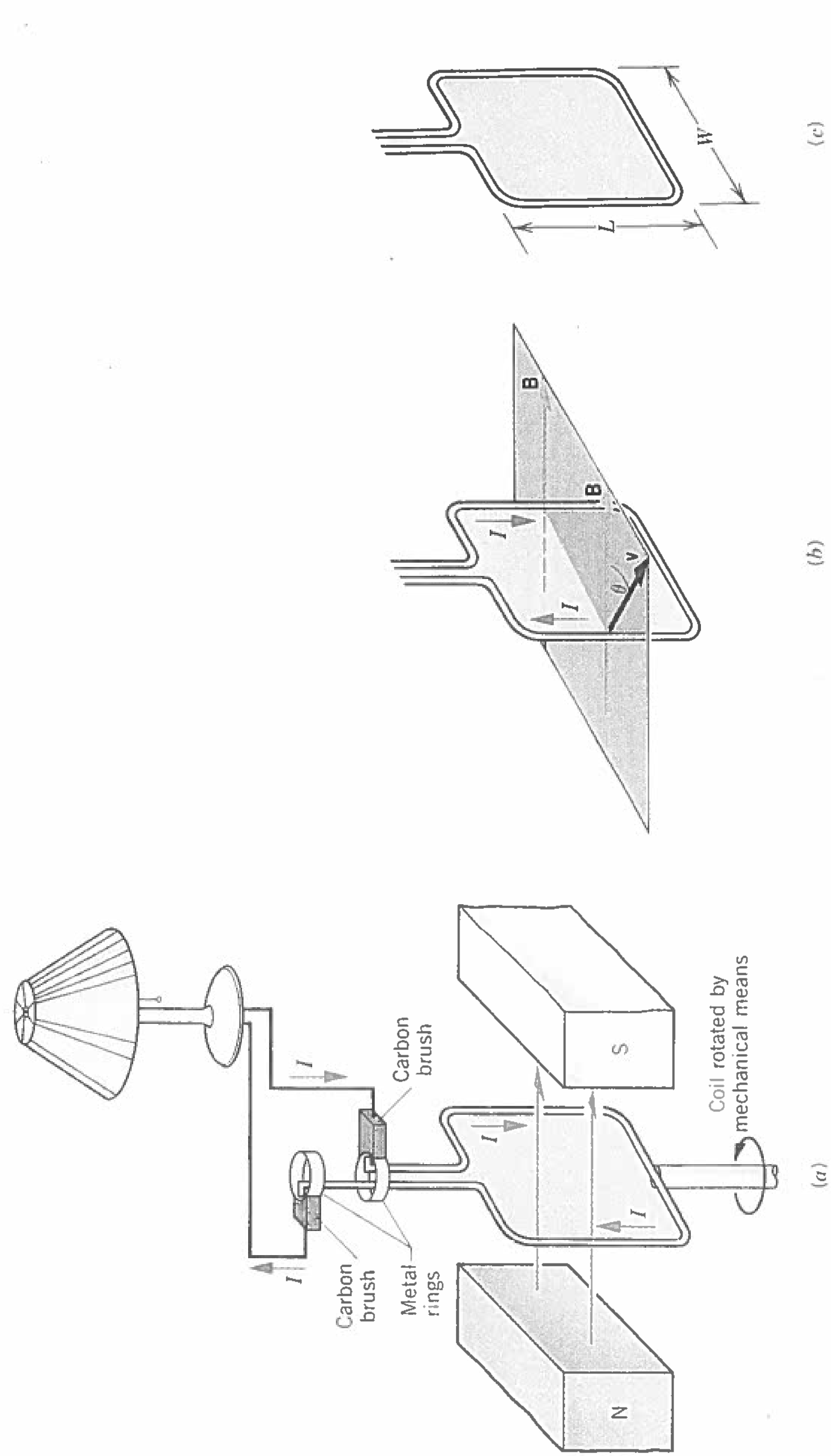
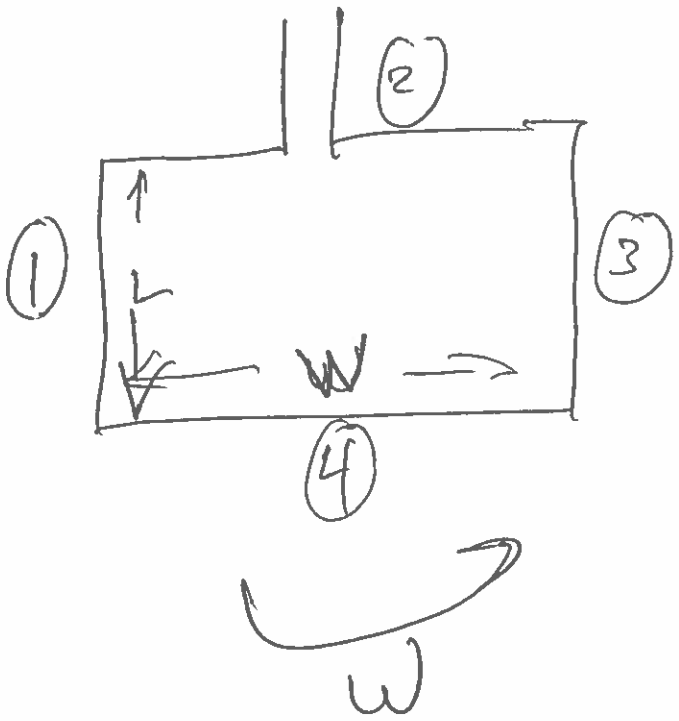
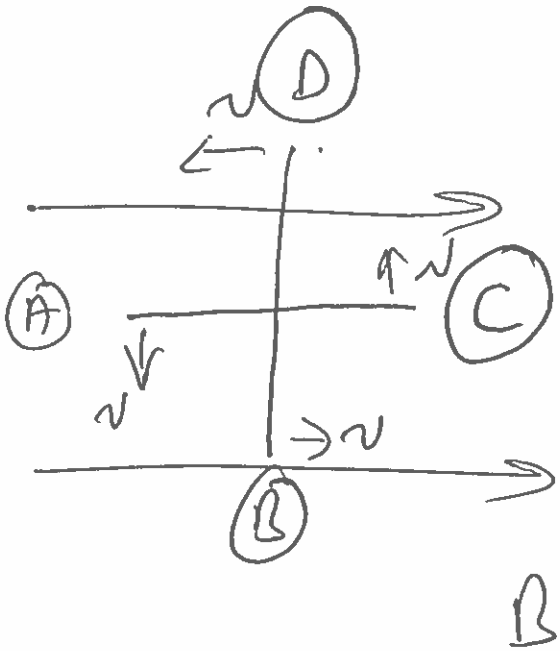


FIGURE 22.17 a, b, c



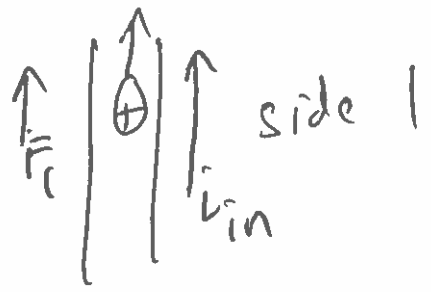
Side view

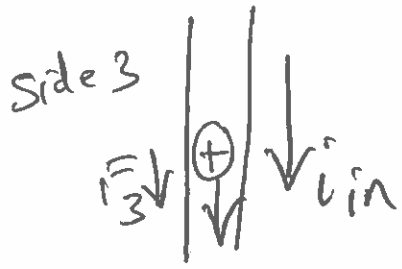


Top view

$\vec{F} = q\vec{v} \times \vec{B}$

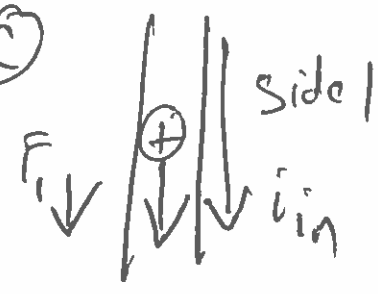
Going from A → B



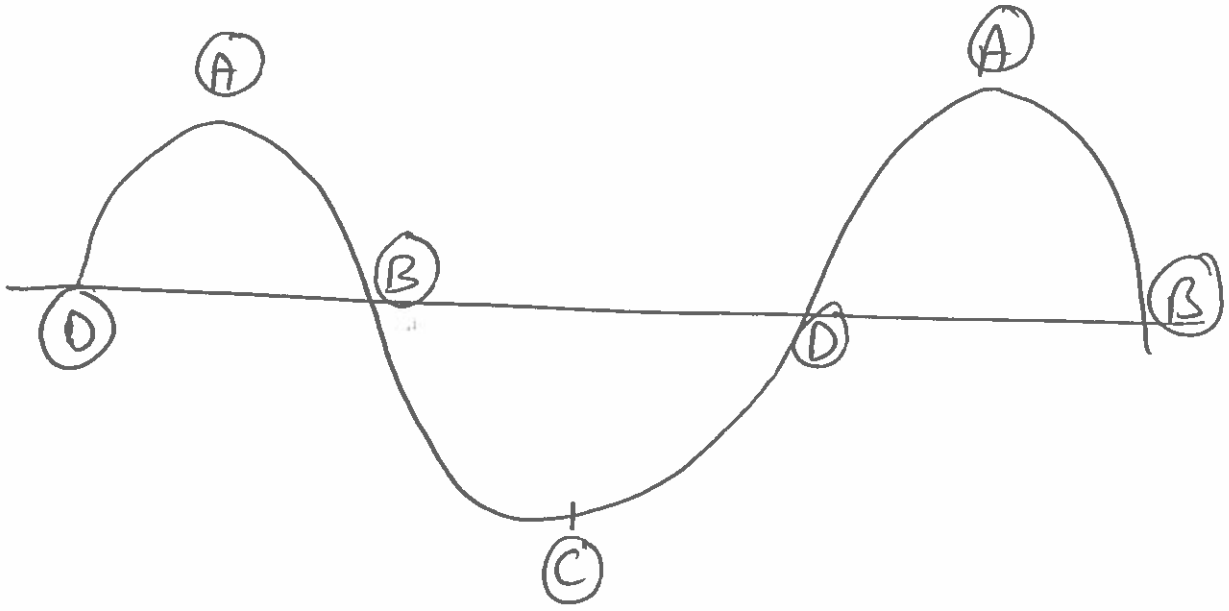


Going from A → D ⇒ clockwise current

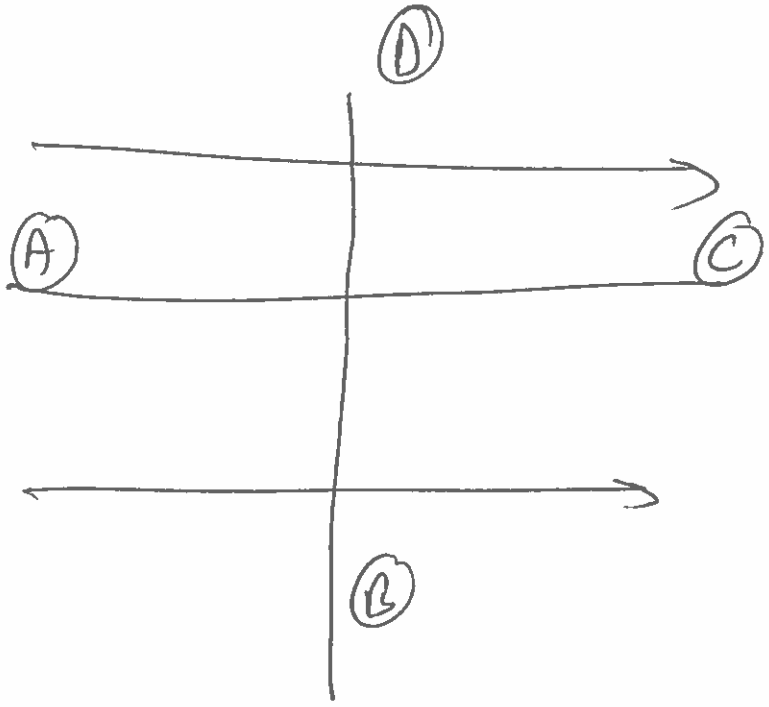
Going from B → C



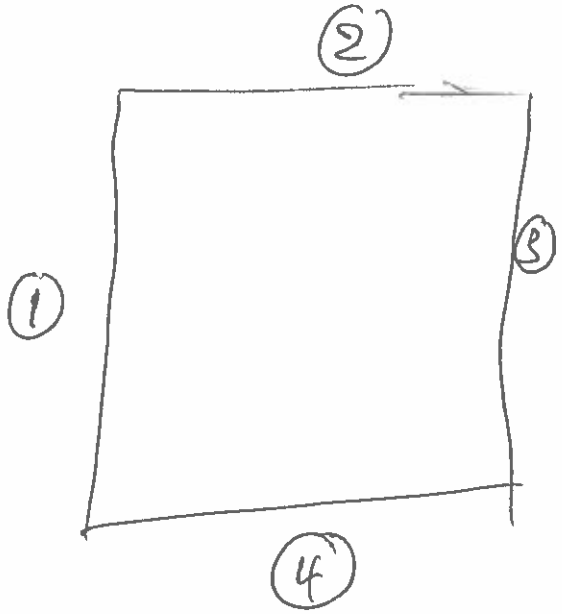
⇒ counter clockwise current



Now consider Φ_B



TOP



Side

AT (A) $\Phi_B = 0$

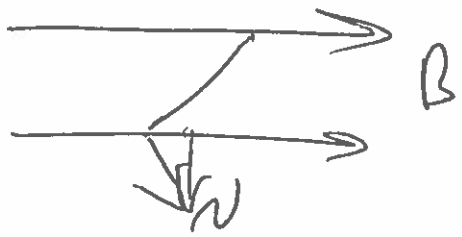
Goins from (A) to (B) $\Phi_B \uparrow$ TO RISHT

induced $\vec{B}$ MUST POINT LEFT

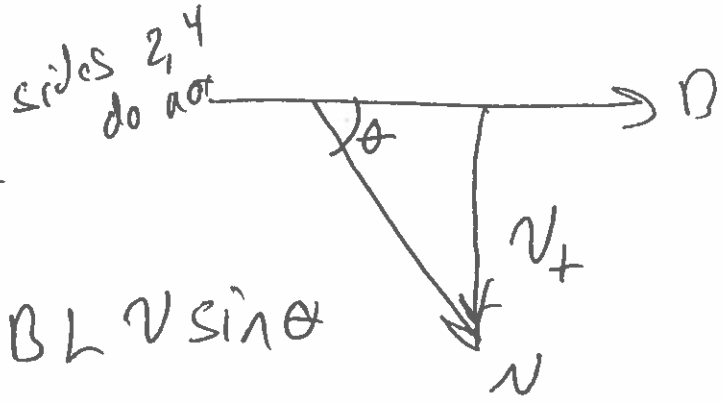
$\Rightarrow$ Clockwise current up side (1)

Approach (B) $\Delta\Phi_B$

$$\mathcal{E} = BLv_\perp$$



$$\mathcal{E} = BLv\sin\theta$$



sides 1, 3 contribute

$$\mathcal{E}_{TOT} = 2\mathcal{E} = 2BLv\sin\theta$$

$$v = R\omega = \frac{W}{2}\omega$$

$$\mathcal{E} = 2BL\frac{W}{2}\omega\sin\theta \qquad \theta = \omega t$$

$$\mathcal{E} = BL\underbrace{W}_{A}\omega\sin(\omega t)$$

$$\mathcal{E} = BAW\omega\sin\omega t \qquad N \text{ turns}$$

$$\boxed{\mathcal{E} = NBA\omega\sin\omega t = \mathcal{E}_0\sin\omega t}$$

emf covered by A Generator

$$\mathcal{E} = \mathcal{E}_0 \sin \omega t$$

$$\mathcal{E}_0 = NBA\omega \quad \text{– Peak emf}$$

from flux point of view

$$\mathcal{E} = -N \frac{\Delta \Phi_B}{\Delta t} \qquad \Phi_B = \vec{B} \cdot \vec{A} = BA\cos\theta$$

$$\mathcal{E} = -N \frac{\Delta (BA\cos\theta)}{\Delta t}$$

B, A do not change

$$\theta = \omega t$$

$$\mathcal{E} = -NBA \frac{\Delta (\cos\omega t)}{\Delta t}$$

$$\frac{\Delta (\cos \omega t)}{\Delta t} = \omega \sin \omega t$$

$$\mathcal{E} = -NBA\omega \sin \omega t$$

50 turn coil $A = 0.25\,m^2$

rotating in 0.5T Magnetic field

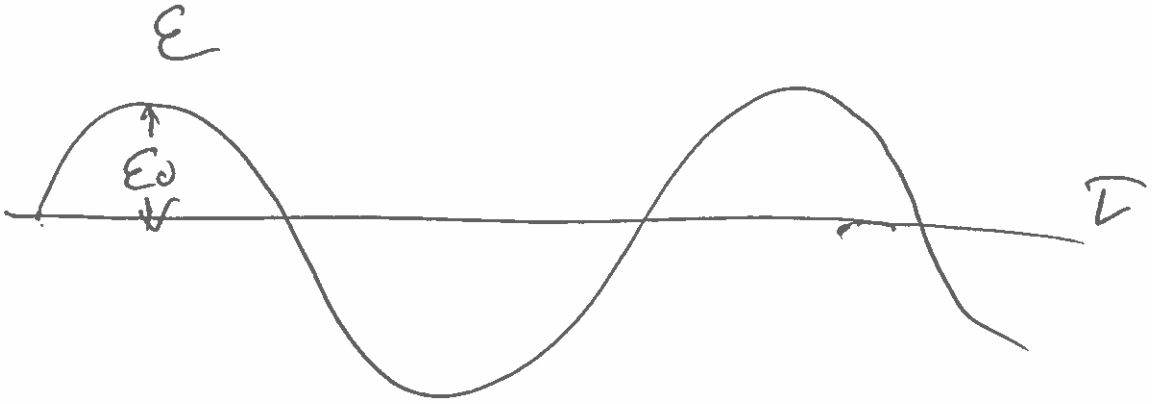
What is ω $\mathcal{E} = 120V$?

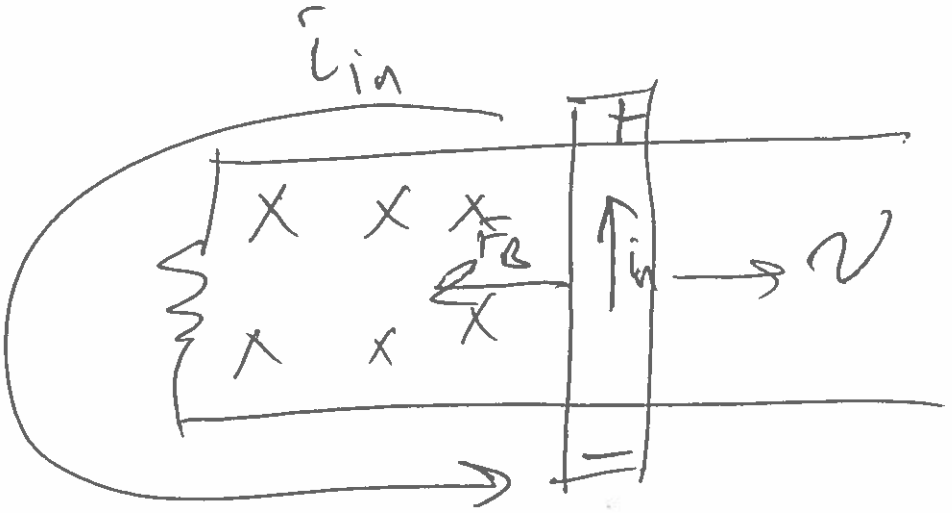
$\mathcal{E}_0 = 120V$ $\qquad$ $\boxed{\mathcal{E}_0 = NBA\omega}$

$$\omega = \frac{\mathcal{E}_0}{NBA} = \frac{120V}{(50)(0.5T)(0.25m^2)}$$

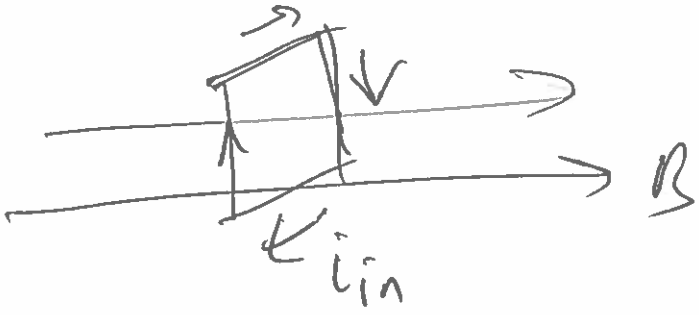
$$\omega = 19.2\ rad/s \sim 3.06\ \frac{rev}{s}$$

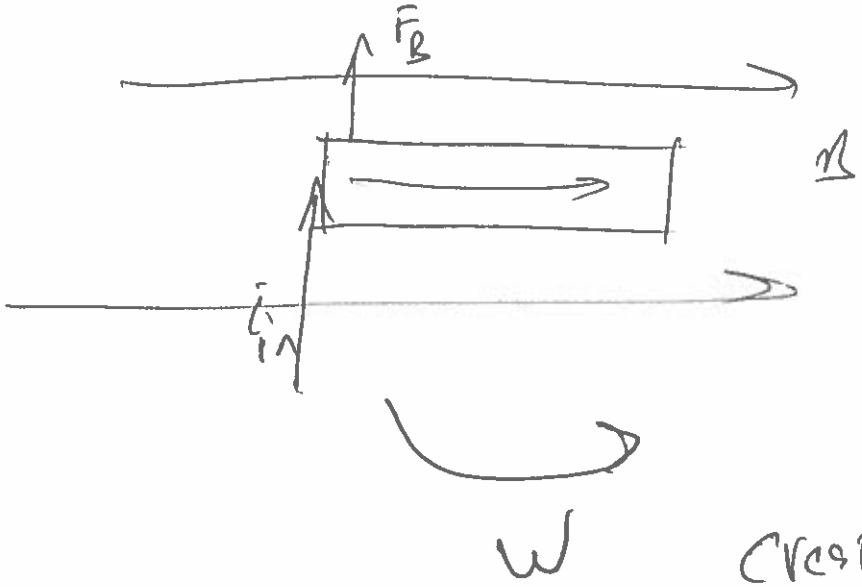
$$\mathcal{E} = \mathcal{E}_0 \sin \omega t$$

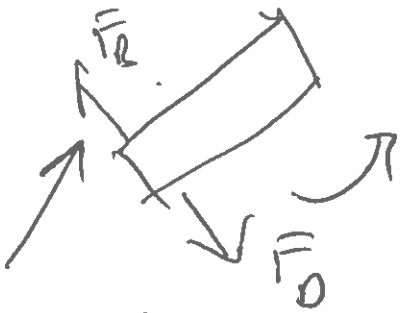




$$\vec{F} = Q\vec{v} \times \vec{B}$$







Creates as counter-torque

A coil rotating in a magnetic field if A current is flowing A counter-torque is created by induced current which opposes the torque driving the coil in the first place.

If current is not drawn for use Energy needed to rotate coil only deals with frictional sources.

But when current is used then More energy to oppose friction and now counter torques!