

Ch. 13 Prob 56

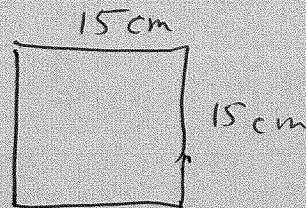
$$N = 20 \text{ turns}$$

$$B = 0.050 \text{ T}$$

$$l = 15 \text{ cm}$$

$$A = l^2 \\ = (0.15 \text{ m})^2$$

$$A = 0.0225 \text{ m}^2$$



$$\mathcal{E}_{\text{max}} = 30.0 \text{ mV}$$

Find the angular velocity, ω , of the coil.

From Faraday's law

$$\mathcal{E} = \frac{-N d\Phi}{dt} = \frac{-N d(BA \cos \theta)}{dt}$$

With $N, B, + A$ constant, then

$$\mathcal{E} = -NBA \frac{d \cos \theta}{dt} = -NBA \left(-\sin \theta \frac{d\theta}{dt} \right)$$

but $\omega = \frac{d\theta}{dt}$, so

$$\mathcal{E} = NBA \omega \sin \theta$$

$$\mathcal{E}_{\text{max}} = NBA \omega$$

solving for ω gives

$$\omega = \frac{\mathcal{E}_{\text{max}}}{NBA} = \frac{30.0 \times 10^{-3} \text{ V}}{(20)(0.050 \text{ T})(0.0225 \text{ m}^2)}$$

$$\omega = 1.33 \text{ rad/s}$$