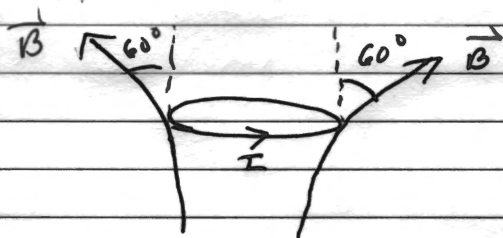


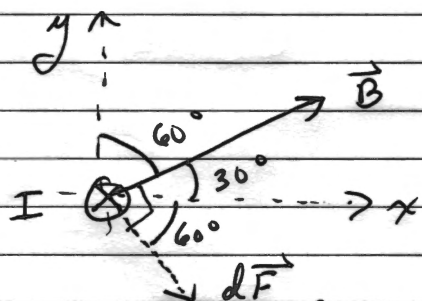
Ch. 27 #73

Voice Coil

(27.69 in 15th edition)



Consider one small segment of the coil on the right, where the current is heading into the page. $I \otimes$ and use $d\vec{F} = I d\vec{l} \times \vec{B}$



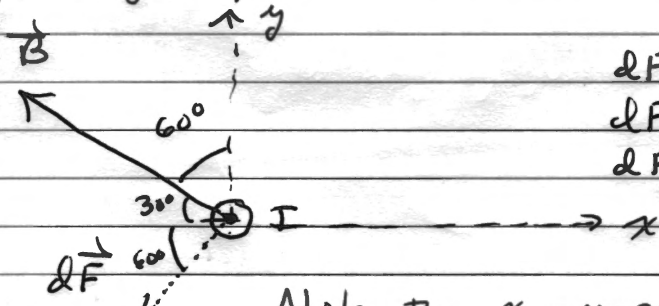
$$dF = I dl B$$

Break into components:

$$dF_x = I dl B \cos 60^\circ$$

$$dF_y = I dl B \sin(-60^\circ)$$

Similarly, look on the left where the current is coming out of the page



$$dF = I dl B$$

$$dF_x = -I dl B \cos 60^\circ$$

$$dF_y = I dl B \sin(-60^\circ)$$

Note the x-components cancel. The y-components are always negative.

$$\text{Then } \vec{F} = \left[\int_{\text{loop}} (I d\vec{l} \times \vec{B})_y \right] \hat{y} \times 50 \quad \leftarrow \text{because there are 50 loops.}$$

$$F_y = 50 \int_{\text{loop}} I dl B \sin(-60^\circ) = 50 \cdot I B \sin(-60^\circ) \int_{\text{loop}} dl$$

$$F_y = 50 I B \sin(-60^\circ) (\pi d), \text{ where } d = \text{diameter of the loop.}$$

Given $I = 0.950 \text{ A}$, $B = 0.220 \text{ T}$, $d = 1.56 \text{ cm} = 0.0156 \text{ m}$,

$$F_y = 0.512 \text{ N} \sin(-60^\circ) = \boxed{-0.444 \text{ N}}$$

since $F_x = 0$,

$$\boxed{\vec{F} = -0.444 \text{ N } \hat{y}}$$