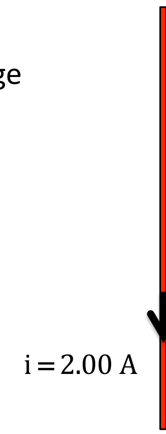
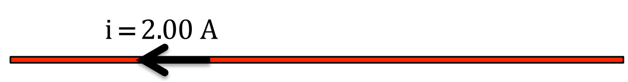
Problem 29.35

a.) Gravity is pulling down, which means we need a magnetic force upward. Using $i\vec{L}x\vec{B}$ to produce a force that is upward, given the direction of the current, means we need a *magnetic field* that is out of the page. If the current is defined as being to the south, the B-fld must be toward the east (think of a compass on a map).

(Not to beat a dead horse, but if this isn't clear, think about rotating the wire so "southward" is toward the bottom of the page (see sketch to the right), and you are looking at the wire from above. In that case, gravity is into the page, the magnetic force counteracting gravity is out of the page and the B-fld required to do that has to be toward the right. On a map, that would be eastward!)





b.) As for the magnitude, this is really a N.S.L. problem:

$$\sum F_y :$$

$$-iLB\sin 90^o \text{ (}=1\text{)} + mg = ma \text{ (}a=0\text{)}$$

$$\Rightarrow \quad B = \left(\frac{m}{L}\right)\frac{g}{i}$$

But "m/L" is just the linear mass density, so we can write:

$$B = \left(\frac{m}{L}\right)\frac{g}{i}$$

$$= \left[\left(0.500 \text{ g/cm}\right)\left(\frac{1 \text{ kg}}{1000 \text{ g}}\right)\left(\frac{100 \text{ cm}}{\text{m}}\right)\right]\left(\frac{9.8 \text{ m/s}^2}{2.00 \text{ A}}\right)$$

$$= .245 \text{ T}$$