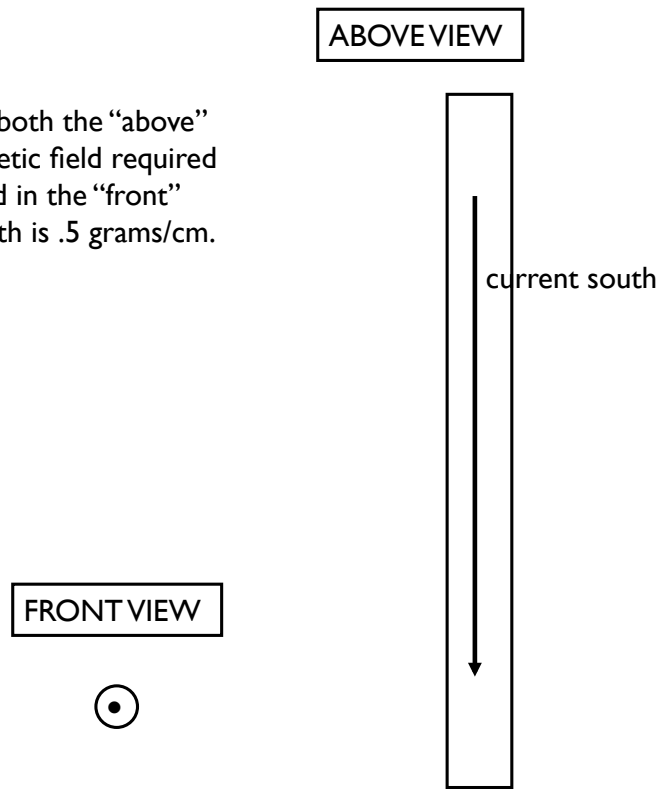# Problem 19.16

A wire carrying 2 amps as shown in both the "above" and "front" views. What is the magnetic field required to just lift the wire vertically (upward in the "front" view) if the wire's mass per unit length is .5 grams/cm.
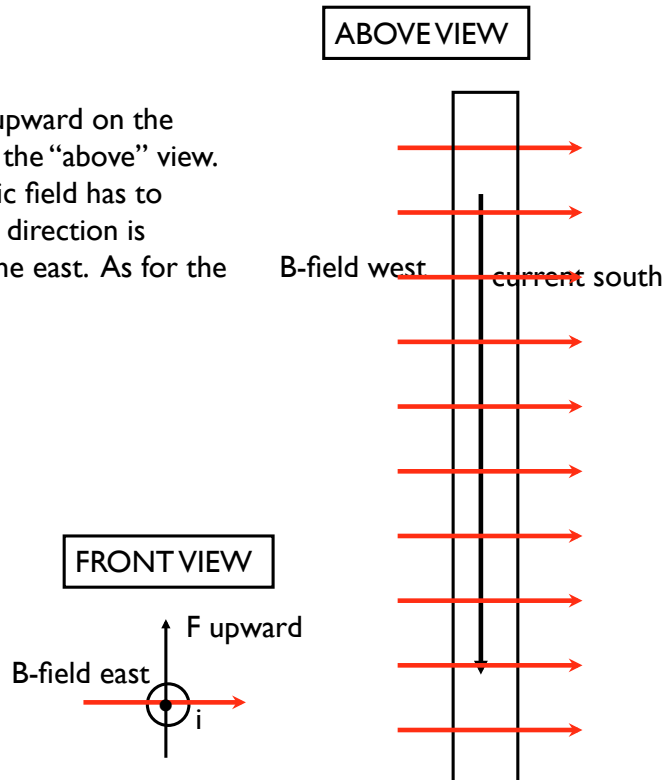
current south

FRONT VIEW

1.)

Problem 19.16

The direction of the force must be upward on the "front view" and out of the page on the "above" view. That means the current and magnetic field has to define a plane to which that upward direction is perpendicular. That direction is to the east. As for the math:

$$F = mg$$
$$= \big[(\text{mass/unit length})(\text{length})\big]g$$
$$= \big[(.5 \times 10^{-3}\text{kg/m})(\text{L})\big](9.8 \text{ m/s}^2)$$
$$= 4.9\text{L nts}$$

$$F = 4.9\text{L} = i\text{LB}\sin\theta$$
$$\Rightarrow \quad 4.9 = (2 \text{ amps})\text{B} \sin 90°$$
$$\Rightarrow \quad B = 2.45 \text{ teslas}$$

ABOVE VIEW

B-field west   current south

FRONT VIEW

F upward

B-field east

i

2.)