



**2) [25 points]** A DC power line is strung 10 meters above the ground and aligned with the earth's magnetic field. When we hold a magnetic compass on the ground below the power line we see it points 10 degrees away from the the direction of the earth's magnetic field.

$$B_{earth} = 5.0 \times 10^{-5} T$$

1. Determine the current in power line.

2. Determine the angular deflection of the compass 2 meters below the powerline.

**3) [25 points]** A massless 3 meter long bar has  $+1 \text{ mC}$  charge "glued" to one side and  $+1 \text{ mC}$  charge glued to the other. We begin to rotate the bar at a frequency of  $10 \text{ Hz}$  around a pivot point 1 meter from the  $+1 \text{ C}$  end.

1. Determine the current generated by each moving charge.

2. Determine the total magnetic moment of the contraption.

3. Determine the magnetic field at the center.

4) [25 points] A coaxial cable consists of a tubular inner conductor of radius  $a$  surrounded by a tubular outer conductor of radius  $b$ . The two carry equal currents but in opposite directions. The current density is distributed uniformly over each conductor.

1. Determine the magnetic field in the three regions:  $r < a$ ,  $a < r < b$  and  $r > b$ .

2. Graph  $B(r)$ .