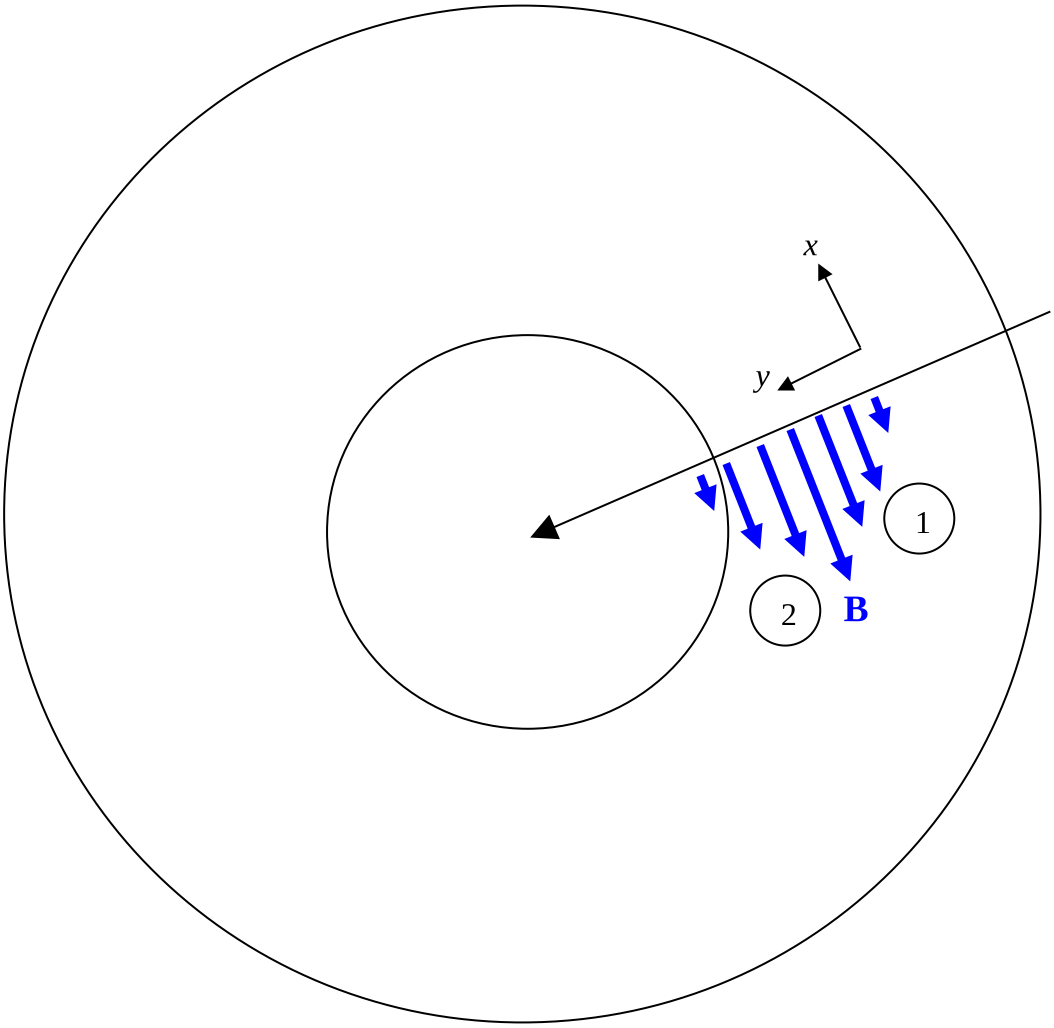
Minigroupwork 5, solutions, 2016



$$j_z = -\frac{1}{\mu_0}\frac{\partial B_x}{\partial y}$$

Current sheet 1:

$\frac{\partial B_x}{\partial y} < 0 \quad \Rightarrow \quad j_z > 0$ which means it is an upward current, which is consistent with the statistical result.

$$\Delta B_x \approx \frac{15\,\text{mm}}{22\,\text{mm}} \cdot 1000 \cdot 10^{-9} = 6.8 \cdot 10^{-7}\,\text{T}$$

$$\Delta y \approx \frac{10\,\text{mm}}{10\,\text{mm}} \cdot \frac{2^\circ}{360^\circ} 2\pi\left(R_E + 800\,\text{km}\right) = 250 \cdot 10^3\,\text{m}$$

Then

$$j_z \approx -\frac{1}{\mu_0}\frac{\Delta B_x}{\Delta y} = 2.2 \cdot 10^{-6}\,\text{Am}^{-2}$$

<u>Current sheet 2</u>

$\frac{\partial B_x}{\partial y} > 0 \quad \Rightarrow \quad j_z < 0$ which means it is an downward current, which is consistent with the statistical result.

$$\Delta B_x \approx \frac{18\,\text{mm}}{22\,\text{mm}} \cdot 1000 \cdot 10^{-9} = 8.2 \cdot 10^{-7}\,\text{T}$$

$$\Delta y \approx \frac{10\,\text{mm}}{10\,\text{mm}} \cdot \frac{2^\circ}{360^\circ} 2\pi\left(R_E + 800\,\text{km}\right) = 250 \cdot 10^3\,\text{m}$$

Then

$$j_z \approx -\frac{1}{\mu_0}\frac{\Delta B_x}{\Delta y} = -2.6 \cdot 10^{-6}\,\text{Am}^{-2}$$