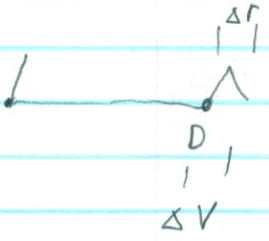
10-31-2006

$J = \frac{I}{2\pi r^2}$ (you want to be far from the strike)

since $J = \sigma E = \frac{E}{\rho} \Rightarrow E = \rho_{gr} J = \boxed{\frac{\rho_{gr} I}{2\pi r^2} = E} = E(r)$

the potential difference



$$\Delta V = -\int \vec{E} \cdot d\vec{s} = -\int \vec{E}_r \cdot d\vec{r}$$

$$= -\int_D^{D+\Delta r} E\, dr = -\frac{\rho_{gr} I}{2\pi} \int_D^{D+\Delta r} \frac{dr}{r^2}$$

$$= -\frac{\rho_{gr} I}{2\pi} \left[\frac{-1}{r}\right]_D^{D+\Delta r} = \frac{\rho_{gr} I}{2\pi} \left[\frac{1}{D+\Delta r} - \frac{1}{D}\right]$$

$$= \frac{\rho_{gr} I}{2\pi} \left[\frac{D - D - \Delta r}{(D+\Delta r) D}\right] = \boxed{-\frac{\rho_{gr} I}{2\pi} \frac{\Delta r}{D(D+\Delta r)} = \Delta V}$$

$$I_p = \frac{|\Delta V|}{R} = \boxed{\frac{\rho_{gr} I}{2\pi R} \frac{\Delta r}{D(D+\Delta r)} = I_p}$$

$$= \frac{(100\ \Omega \cdot m)(100{,}000\ A)}{2\pi\ (4.00\ \Omega)} \frac{0.5\,m}{(60m)(60+0.5)} = \boxed{54.8\ mA}$$

$\times 1000$

↑ involuntary muscle contraction → collapse, but not die

Step one foot on the other → $\Delta r = 5\,cm = 0.05\,m$

$I_p = 5.5\ mA$

$\boxed{I_{row} = 162\ mA}$ fatal for the row