1) \( B(\xi, \phi) = \frac{\mu_0 I}{2\pi s} \phi \)

\[
\Phi_s = 2 \int_a^{s-a} ds \frac{\mu_0 I}{2\pi s} = \frac{\mu_0 I}{\pi} \ln \left( \frac{d-a}{d} \right)
\]

\[
L/d = \frac{\mu_0}{\pi} \ln \left( \frac{d-a}{a} \right)
\]

\[
L/d = \frac{\mu_0}{\pi} \ln \left( \frac{200}{10} \right) \approx 2.3
\]

2) (a) \( C/l = \frac{\varepsilon_0 \omega}{\lambda} \)

(b) \( \frac{B}{B_0} = \frac{I \times (d \times 1)}{\omega} \)

(c) \( V = \left( \frac{4C}{\varepsilon_0 \omega^2} \right)^{1/2} = \frac{1}{2} \mu_0 c^2 \)

(d) \( V_{\text{dielectric}} = \frac{1}{\varepsilon_{\mu_0}} \)

3) (a) \( \tilde{E}_c(r, \theta, \phi, t) = \frac{\sigma R^2}{\varepsilon_0 r^2} \hat{r} \quad \frac{r}{r>R} \quad 0 \quad \text{otherwise} \)

(b) \( \hat{A} = \frac{\mu_0 \sigma R^2}{3} \sin \theta \hat{\phi} \)

\[
\mathbf{E}_F = -\frac{\mu_0 \sigma R^2}{3} \sin \theta \hat{\phi} \quad \begin{cases} \frac{r}{r<R} \\ \frac{r^2}{r>R} \end{cases}
\]

\[
\mathbf{E} = \begin{cases} -\frac{\mu_0 \sigma R^2}{3} \sin \theta \hat{\phi} & r<R \\ \frac{\sigma R^2}{\varepsilon_0 r^2} - \frac{\mu_0 \sigma R^4}{3 r^2} \sin \theta \hat{\phi} & r>R \end{cases}
\]
4) \[ \dot{E} = -\frac{V_0}{d} \cos(2\pi ft) \]

\[ I_{\text{conduction}}/A = \frac{1}{p} \dot{E} = -\frac{V_0}{p d} \cos(2\pi ft) \]

\[ I_{\text{displacement}}/A = \varepsilon \frac{\partial \dot{E}}{\partial t} = \frac{\varepsilon_0 (1+\kappa_E) 2\pi f V_0}{d} \sin(2\pi ft) \]

\[ I_{\text{rms}}^{\text{conduction}}/A = \sqrt{\langle I^2 \rangle} = \frac{1}{\sqrt{2}} \frac{V_0}{p d} \]

\[ I_{\text{rms}}^{\text{displacement}}/A = \frac{1}{\sqrt{2}} \frac{\varepsilon_0 (1+\kappa_E) 2\pi f V_0}{d} \]

\[ \frac{I_{\text{rms}}^{\text{conduction}}}{I_{\text{rms}}^{\text{displacement}}} = \frac{1}{2\pi f \varepsilon_0 (1+\kappa_E) p} \approx 48 \]