

33. (a) We use $\oint \vec{B} \cdot d\vec{s} = \mu_0 I_{\text{enclosed}}$ to find

$$\begin{aligned} B &= \frac{\mu_0 I_{\text{enclosed}}}{2\pi r} = \frac{\mu_0 (J_d \pi r^2)}{2\pi r} = \frac{1}{2} \mu_0 J_d r \\ &= \frac{1}{2} (1.26 \times 10^{-6} \text{ H/m}) (20 \text{ A/m}^2) (50 \times 10^{-3} \text{ m}) = 6.3 \times 10^{-7} \text{ T} . \end{aligned}$$

(b) From

$$i_d = J_d \pi r^2 = \varepsilon_0 \frac{d\Phi_E}{dt} = \varepsilon_0 \pi r^2 \frac{dE}{dt}$$

we get

$$\frac{dE}{dt} = \frac{J_d}{\varepsilon_0} = \frac{20 \text{ A/m}^2}{8.85 \times 10^{-12} \text{ F/m}} = 2.3 \times 10^{12} \frac{\text{V}}{\text{m} \cdot \text{s}} .$$