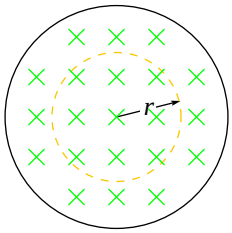
Induced electric field in a huge magnet



Apply Faraday's law to the dashed line:

$$\begin{aligned}
\oint \vec{E}\cdot d\vec{\ell} &= -\frac{d\Phi_B}{dt} \\
E(2\pi r) &= -\frac{dB}{dt}(\pi r^2) \\
E &= \frac{r}{2}\frac{dB}{dt} \\
&= \frac{5.0\text{ mm}}{2}\frac{54\text{ T}}{40\text{ ms}} \\
&= 3.4\text{ N/C}
\end{aligned}$$

Notice that we'd get the same magnitude of induced $\vec{E}$ by turning on the magnet (0 to 54 T in 40 ms), by turning off the magnet (54 to 0 T in 40 ms), or by a field reversal (54 to -54 T in 80 ms). The important thing is not $\vec{B}$, but change in $\vec{B}$.

Grading: Any sort of start off (figure, quote Faraday's law, other): 3 points
Derive the formula $E = (r/2)dB/dt$: 3 points
Number 3.4: 2 points
Two significant figures: 1 point
units N/C: 1 point