✭ Faraday's Law ✭

REMINDERS

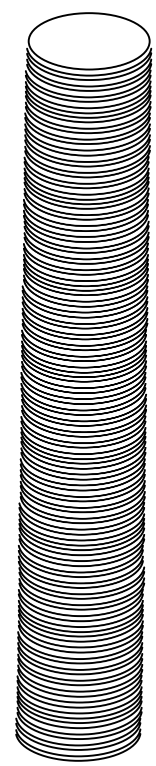
1) Faraday's Law is $\nabla \times \vec{\mathbf{E}} = -\dfrac{\partial \vec{\mathbf{B}}}{\partial t}$

By Stokes theorem (**do you remember how this goes?**) this is equivalent to

$$\oint \vec{\mathbf{E}} \cdot d\vec{\mathbf{l}} = -\frac{d\Phi_{mag}}{dt}$$

2) A useful result from Phys 3310 (which can be derived from the above - **do you remember how?**) says that for an infinite solenoid centered on the z-axis, with n turns/length, and current I through each turn:

$$\vec{\mathbf{B}} = \begin{cases} 0 & \text{(outside the solenoid)} \\ \mu_0 n I\,\hat{z} & \text{(inside the solenoid)} \end{cases}$$

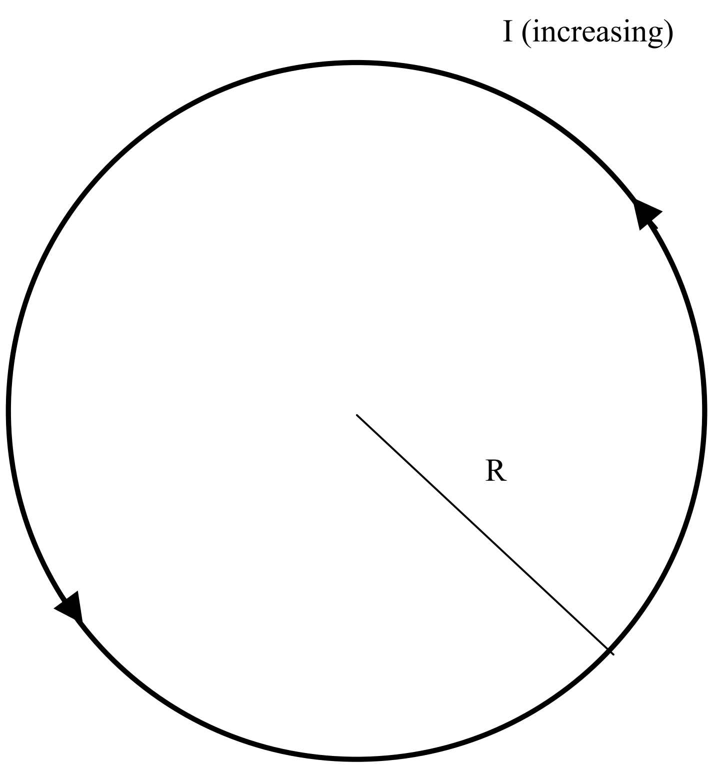


You'll need this for the questions on the back...

© University of Colorado - Boulder
Contact: Steven.Pollock@Colorado.EDU

(B) Suppose the current I in the solenoid is increasing at a steady rate I(t) = C t, where C is a constant. Where do you think there is there an E-field? (Inside the solenoid? Outside? Everywhere? Nowhere?) What do you think the E-field pattern looks like?
For now, just use your intuition, we'll check with calculations in a second. (But jot your initial ideas down here)

(C) Use Faraday's Law in integral form to compute the electric field at an arbitrary point inside the solenoid. (Specify the loop you chose for the integral.)



Top View of Solenoid

© University of Colorado - Boulder Contact: Steven.Pollock@Colorado.EDU