Electromagnetic Induction

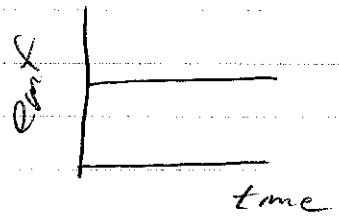
(1) $\Phi = BA\cos\theta$

$= (0.078)\left(\pi (.1)^2\right)\cos 25$

$= \underline{2.2 \times 10^{-3}\ \text{Wb}}$

(2) - emf is proportional to the rate of change of magnetic flux

- since the rate of change (slope) is constant, the emf produced will be constant.



(3) $\mathcal{E} = -N\dfrac{\Delta\Phi}{\Delta t}$ $\qquad \Phi = BA\cos\theta$

$= -N\dfrac{(BA\cos\theta_2 - BA\cos\theta_1)}{\Delta t}$

$= \dfrac{-950(8.56 \times 10^{-5})(\pi(.06)^2)(\cos 45 - \cos 0)}{.1}$

$= \underline{2.7 \times 10^{-3}\ \text{V}}$

(4) $\mathcal{E} = -N\dfrac{\Delta\Phi}{\Delta t}$ $\qquad \Phi = BA\cos\theta$

$= -\dfrac{NBA\cos\theta}{\Delta t}$ $\qquad \dfrac{B}{\Delta t} = 0.94\ \text{T/s}$

$= -200(.94)(\pi(.01)^2)\cos(0)$

$= \underline{5.9 \times 10^{-2}\ \text{V}}$

(5) - current flowing in the outside coil produces a magnetic field pointing into the page (right-hand rule)
- this magnetic field is increasing because the current is increasing.
- Lenz's law states that the generated emf "opposes the change"
- therefore the current (or emf) produced must create a magnetic field pointing out of the page.
- using the right-hand rule again, the current would be traveling in a <u>counter-clockwise</u> direction

(6) - as the current increases, the magnetic field produced around the wire increases
- this magnetic field is into the page
- according to Lenz's law, the induced current needs to produce a magnetic field out of the page (opposing the change)
- therefore the current through loop must be counter-clockwise, meaning the current will flow to the left through the resistor