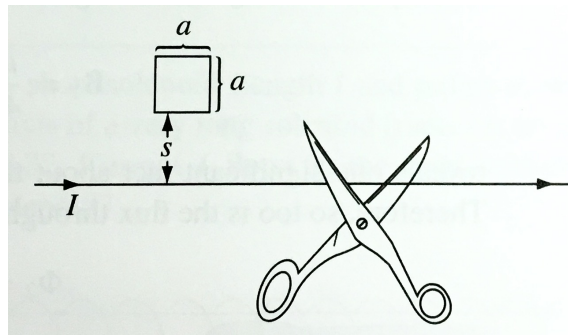


PH632 – Winter 2016
Homework #5
Due Friday Feb 19 at 5pm

1. Square loop near a wire

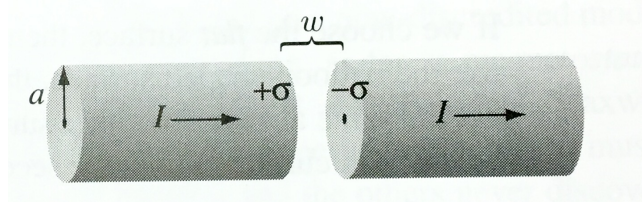
A square loop, side a , resistance R , lies a distance s from an infinite straight wire that carries current I . Now someone cuts the wire, so I drops to zero. In what direction does the induced current in the square loop flow, and what total charge passes a given point in the loop during the time this current flows? If you don't like the scissors model, turn the current down gradually:

$$I(t) = \begin{cases} (1 - \alpha t)I & \text{for } 0 \leq t \leq 1/\alpha \\ 0 & \text{for } t > 1/\alpha \end{cases}$$



2. Displacement current

A fat wire, radius a , carries a constant current I , uniformly distributed over its cross section. A narrow gap in the wire, of width $w \ll a$, forms a parallel plate capacitor, as shown below. Find the magnetic field in the gap at a distance $s < a$ from the axis.



BONUS: Extend your result to an alternating current, $I_0 \sin \omega t$. At low frequencies, the E-field in the gap is $E_0 \cos \omega t$. As high frequencies, a small correction term should be added to $E_0 \cos \omega t$. The correction term has a magnitude of $\sim (\omega a/c)^2 E_0$. Calculate this correction term.

3. Old comp exam problem (attached)

4. Old comp exam problem (attached)