Quiz 7 – PH242 Name________________ ☐ **Pledged**

The circuit on the right has a current which is steadily increasing at a rate of $.12A/s$.

(A) Explain why wire 2 and wire 4 will be the only wire segments to induce a current on the smaller left rectangular loop. The B fields of ① and ③ do not intersect loop

(B) Which wire will induce a larger current? Why? wire ④ its closest

(C) Are the two induced currents in the same or opposite direction (explain all work) see below

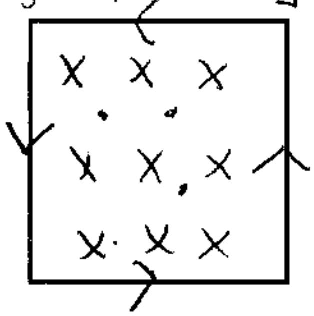
(D) Assume the magnetic flux from wire 2 is $|\Phi_B| = (1.0m)\frac{\mu_0 I}{2\pi}$
Assume the magnetic flux from wire 4 is $|\Phi_B| = (1.5m)\frac{\mu_0 I}{2\pi}$
Now find $\mathcal{E}$ for the loop (Hint: separate what is constant over time and what is changing over time)

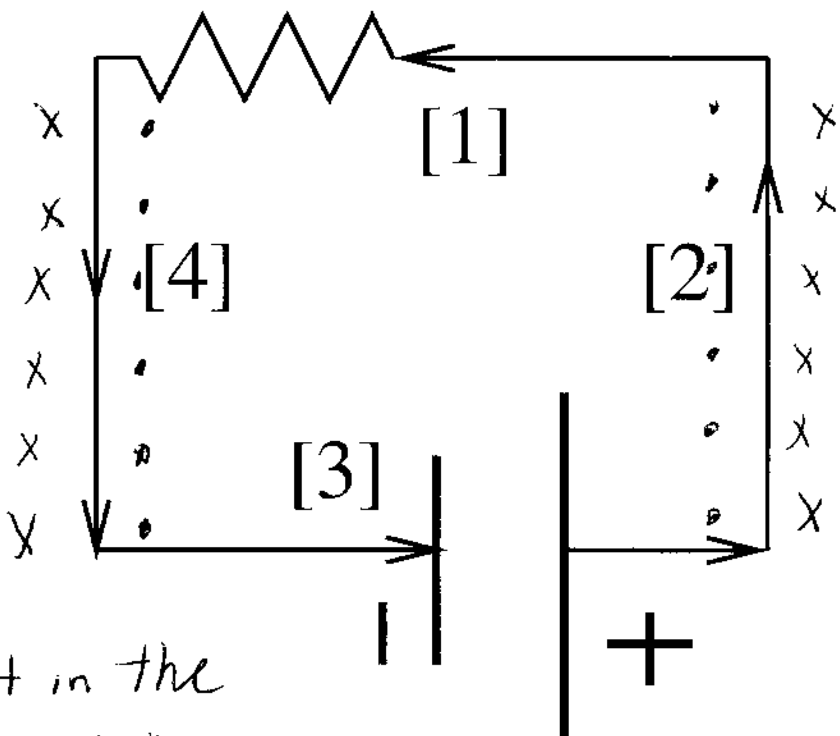
Equations

$B_{wire} = \frac{\mu_0 I}{2\pi r}$ $\Phi_B = \int \vec{B} \cdot d\vec{A}$ $\mathcal{E} = -\frac{d\Phi_B}{dt}$ $\mu_0 = 4\pi \times 10^{-7} Tm/A$

Remember that "X" means into the paper and "O" means out of paper

so in the loop
"x"'s from [4]
"•"'s from [2]





The 'X's are stronger and growing so the induced current in the loop needs to produce "•"s to resist change so CCW

d) $\mathcal{E} = -\frac{d}{dt}\Phi_B = -\frac{d}{dt}\left(\frac{1.5\mu_0 I}{2\pi} - \frac{1.0\mu_0 I}{2\pi}\right)$

$= -\frac{.5\mu_0}{2\pi}\frac{d}{dt}(I) = -\frac{.5\mu_0}{2\pi}(.12A/s)$