PHYS 205-Section 03
Electricity and Magnetism - Winter 2018
Assignment 5 – Due on April 6th

Instructions

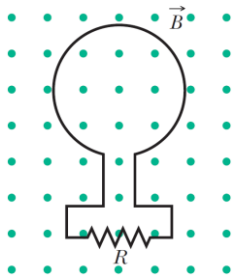
You should hand in your answers, written or typed in standard letter sized papers, in class on the due date (to be posted with the assignment). Make sure to clearly indicate:

1. Your class (PHYS 205/03)
2. The sequence number of the actual assignment (Assignment # 2)
3. The name of your instructor (Nima Nateghi)
4. Your name
5. Your student ID#
6. The due date (Feb. 9th)

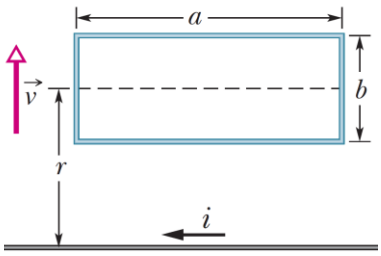
In case of multiple pages **you should staple the pages together** properly. We are not held responsible for lost pages of home works due to inadequate grouping of pages.
In case of **late submission**, drop your assignment in the physics department's dropbox (SP building, 3rd floor). There will be a 20% late submission penalty for each day after the due date. No electronic submission will be accepted. After the answers are posted, not assignments will be accepted (under no circumstances).

Problems

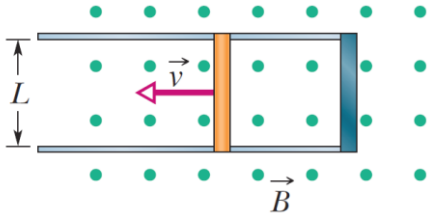
1. In the figure, the magnetic flux through the loop increases according to the relation $\Phi_B = 6t^2 + 7t$, where Φ_B is in milliwebers and t is in seconds.
   (a) What is the magnitude of the emf induced in the loop when $t = 2\ s$? **(3 points)**
   (b) Is the direction of the current through R to the right or left? **(2 points)**



2. In the figure, a rectangular loop of wire with length $a = 2.2\ cm$, width $b = 0.8\ cm$, and resistance $R = 0.40\ m\Omega$ is placed near an infinitely long wire carrying current $i = 4.7\ A$. The loop is then moved away from the wire at constant speed $v = 3.2\frac{mm}{s}$. When the center of the loop is at distance $r = 1.5b$, what are
   (a) the magnitude of the magnetic flux through the loop? **(3 points)**
   (b) the current induced in the loop? **(2 points)**



3. In the figure, a metal rod is forced to move with constant velocity $\vec{v}$ along two parallel metal rails, connected with a strip of metal at one end. A magnetic field of magnitude $B = 0.350\ T$ points out of the page.
   a) If the rails are separated by $L = 25\ cm$ and the speed of the rod is $55\ \frac{cm}{s}$, what emf is generated? **(2 points)**
   b) If the rod has a resistance of $18\ \Omega$ and the rails and connector have negligible resistance, what is the current in the rod? **(2 points)**
   c) At what rate is energy being transferred to thermal energy? **(2 points)**



4. In the figure, a long rectangular conducting loop, of width L, resistance R, and mass m, is hung in a horizontal, uniform magnetic field $\vec{B}$ that is directed into the page and that exists only above line aa. The loop is then dropped; during its fall, it accelerates until it reaches a certain terminal speed v_t. Ignoring air drag, find an expression for v_t. **(4 points)**