Midterm Exam No. 02 (2014 Summer)

PHYS 203B: College Physics

Date: 2014 Jul 3

(Name) (Signature)

1. (**10 points.**) A charge of $-7.1\,\mu$C is traveling at a speed of $7.1 \times 10^6\,$m/s in a region of space where there is a uniform magnetic field of magnitude $1.3 \times 10^{-4}\,$T. What is the magnitude of the magnetic force acting on the charge if the angle between the velocity of the charge and the field is $50°$.

2. (**10 points.**) A magnetic field has a magnitude of $1.20 \times 10^{-3}\,$T, and an electric field has a magnitude of $4.40 \times 10^3\,$N/C. Both fields point in the same direction. A positive $1.8\,\mu$C charge moves at a speed of $3.00 \times 10^6\,$m/s in a direction that is perpendicular to both fields. Determine the magnitude of the net force that acts on the charge.

3. (**10 points.**) A 1.5 m long straight wire carries a current of 0.66 A. This wire makes an angle of $58°$ with respect to a magnetic field of magnitude $5.60 \times 10^{-5}\,$T. What is the magnitude of the magnetic force experienced by the wire?

4. (**10 points.**) A wire has a length of $4.80 \times 10^{-2}\,$m and is used to make a circular coil of one turn. There is a current of 4.40 A in the wire. In the presence of a 1.50 T magnetic field, what is the maximum torque that this coil can experience?

5. (**10 points.**) A square loop of wire consisting of a single turn is perpendicular to a uniform magnetic field. The square loop is then re-formed into a circular loop, which consists of two turns and is also perpendicular to the same magnetic field. The magnetic flux that passes through the square loop is $3.9 \times 10^{-3}\,$Wb. What is the flux that passes through the circular loop?
   Caution: Note that the circular loop has two turns.

6. (**10 points.**) The coil of a generator has a radius of 0.20 m. When this coil is unwound, the wire from which it is made has a length of 5.4 m. The magnetic field of the generator is 0.29 T, and the coil rotates at an angular speed of 30 rad/s. What is the peak emf of this generator?

7. (**20 points.**) Figure 1 shows a conducting a rod being pulled along horizontal, frictionless, conducting rails at a constant speed v. A uniform magnetic field $\mathbf{B}$ fills the region in which the rod moves. Assume $L = 10\,$cm, $v = 4.0\,$m/s, $B = 1.4\,$T, and $R = 0.40\,\Omega$.

(a) Is the magnetic flux in the loop increasing or decreasing?

(b) What is the direction of the induced current in the loop?

(c) Determine the magnitude of the induced current in the loop.

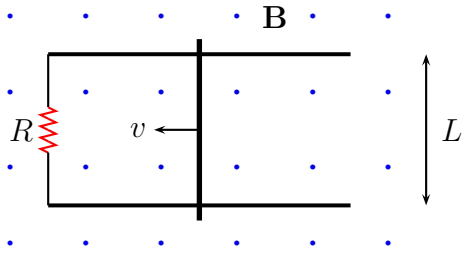

Figure 1: Problem 7

8. (**20 points.**) Figure 2 shows five snapshots of a rectangular coil being pushed across the dotted region where there is a uniform magnetic field directed into the page. Outside of this region the magnetic field is zero. Determine the direction of induced current in the loop at each of the five instances in the figure.

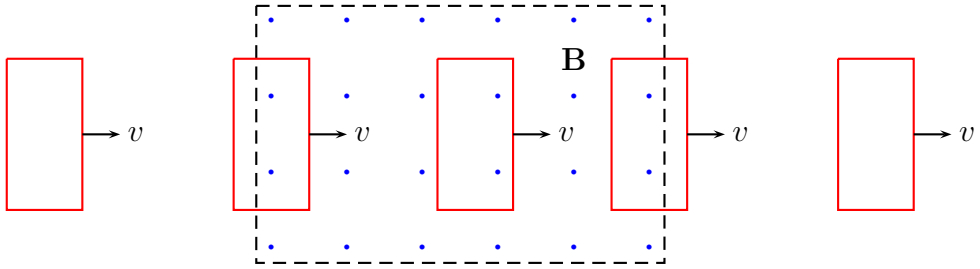

Figure 2: Problem 8