

Physics 201 Sample Midterm III, 2012 Spring

May 3, 2012

Also: see problems attached at the end of the quantum notes for example questions concerning that subject.

1. A. A charge of 0.987 mC moves to the right at 213 m/s in an electric field, pointing up the page with a strength of 312 N/C, and a magnetic field of strength 0.567 T, pointing out of the page. Find the net force on the charge. Include direction.

1. B. A wire carries 0.123 A to the right and has a mass per unit length of 0.0432 grams per centimeter. Indicate the magnitude and direction of magnetic field needed to counteract the force of gravity on the wire. Recall  $g=9.8\text{m/s}^2$ .

2. A conductive U-shaped metal bar, 5.5 cm wide, has a conductive rail sliding to the right at 15.5 m/s as indicated below. It sits in a magnetic field pointing into the page of strength 0.234 T. Find the voltage induced in the loop and the direction of current flow using Faraday's and Lenz' Laws.

3.A. In Faraday's law, to get a nonzero voltage, at least one of three different things could change. List them and give an example of each. In each of your examples, ensure only one of the three is varying.

3.B. In each of the figures below, indicated the direction of the magnetic force on each charge below. Take special note of the sign of each charge.

4. Consider the RC circuit below. At  $t=0$ , the switch is closed. The capacitor is initially uncharged. Describe the current versus time before and after  $t=0$ . You may use words or a graph or an equation.

5. Use ampere's law to find the magnetic field both inside and outside a solid current carrying wire of radius  $a$  carrying a total current  $I$ , uniformly distributed throughout the cross sectional area of the wire. Sketch the direction of the field.

6. Miscellenious

A. For a vector cross product,  $\vec{C} = \vec{A} \times \vec{B}$ , if A and B are in the plane of the paper, what can we say about the direction of C? If A and B are parallel? If they are not parallel (but in the plane)?

B. Sketch the magnetic field near the loop of wire with current indicated below.

C. The north pole of a magnet is inserted into the loop of wire, below, from above the page downward. By Lenz' Law, what is the direction of the induced current in the loop?

D. Sketch the magnetic field near this long thin wire carrying current, below.