Practice Exam # 3 – Physics 152

April 7, 2008

Be sure to include pictures, coordinate systems, etc. where reasonable. Be explicit about what arguments you are using when determining a physical quantity, (e.g. $\vec{E}$).

1. A charged particle is in a uniform magnetic field, $\vec{B}$. What conditions must be met in order for the charged particle to experience a non-zero-force due to $\vec{B}$?

2. Describe an experiment in which you can show that electrons are the particles that form the current in a metal.

3. A conventional current of $8\mu Amps$ flows through a straight wire that in the positive $x-$direction. A uniform magnetic field of $3T$ points in the positive $z-$direction. What is the force per unit length on the wire? What is the direction of the force?

4. According to Ampere's law there are two ways to create a magnetic field. What are they and how can you see this from Ampere's law?

5. One of the nice things about a capacitor is that it produces a uniform electrical field.

   (a) What is the equivalent device for magnetic fields, that is to say, what device produces a uniform magnetic field?

   (b) How would you configure and operate that device to create a magnetic field with a strength of $20mT$?

6. How would Maxwell's equations change if we discovered the existence of magnetic monopoles?

7. A square loop of wire is pulled from a uniform magnetic field of strength $50mT$ into a region of space without any magnetic field at a speed of 10m/s.

   (a) A test is performed which shows that there is no EMF produced in the loop of wire. How can this be?

(b) How can the situation be changed (keeping the strength of the magnetic field and the speed of motion constant) to cause the maximum EMF to be induced?

(c) Use Lenz' law to determine the direction that current will now flow in the loop.

8. A current $i = 100mA/st$ is sent through an inductor of radius 2cm, length $10cm$, and wire density of 20 loops/cm. How large of an induced EMF is created in the inductor?