Physics 1302, Exam 2 Review

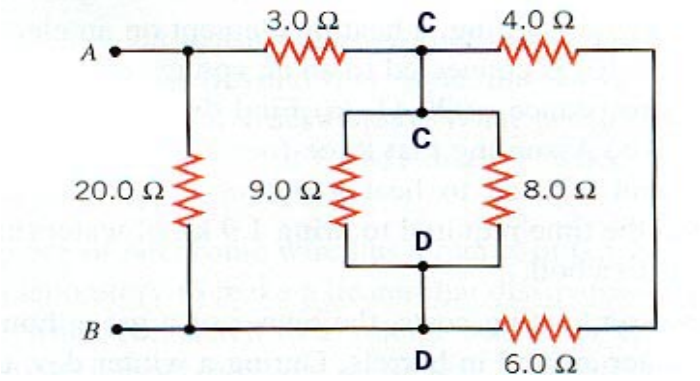
The following is a list of things you should *definitely* know for the exam, however, the list *is not* exhaustive. You are responsible for all the material covered in the assigned readings, lectures, and homework assignments. Note that we did not cover Ampére's Law, so you are not responsible for that topic.

- Explain what is meant by electric current.
- Describe the physical basis for Kirchhoff's rules for circuits.
- Use Kirchhoff's rules to solve for unknown currents or voltages in a DC circuit.
- Reduce combined parallel/series blocks of resistors and capacitors to a single equivalent resistance or capacitance.
- Determine the magnetic force (magnitude and direction) acting on a charge moving in a magnetic field.
- Describe the general motion of a charged particle in an area of constant (or nearly constant) magnetic field. Calculate basic quantities associated with the motion, including the gyro-radius and gyro-period.
- Determine the strength and direction of magnetic fields produced by simple current distributions (e.g. long straight wire or solenoid), and determine the direction of the field.
- Determine the total magnetic field at a specified point, given 2 or more fields produced by simple current distributions.
- Use Faraday's law to solve for induced EMF's for simple loops.
- Use Lenz's law to determine the direction of induced current flow in above problems.
- Solve basic problems involving motional EMF's.
- Solve basic transformer problems.

Exam 2 Multiple Choice Problems

Sample **Dr. Andersen**

1. What is the equivalent resistance between points A and B in the following network of resistors?



   (a) 4.6 Ω.

   (b) 3.8 Ω.

   (c) 4.4 Ω.

   (d) 8.3 Ω.

   (e) 12 Ω.

2. A 1.0 μF capacitor and a 3.0 μF are combined in a series. The equivalent capacitance of this combination is:

   (a) 0.75 μF

   (b) 1.0 μF

   (c) 0.25 μF

   (d) 4.0 μF

   (e) 1.3 μF

3. You are going to make a resistor out of Samarium, which has a resistivity of $9.4 \times 10^{-7}\ \Omega m$, in the shape of a cube. If you want the resistance between two opposing faces of the resistor to be 1.0 Ω, what should the length of the side of your cube be?

   (a) $9.8 \times 10^{-3}\ m$.

   (b) $8.8 \times 10^{-13}\ m$.

   (c) $9.4 \times 10^{-7}\ m$.

   (d) $9.7 \times 10^{-4}\ m$.

   (e) $1.1 \times 10^{-7}\ m$.

4. A 5.0 Ω resistor that is initially attached across the terminals of a 9.0 V battery is replaced by a 15 Ω resistor. Which of the following will be true?

   (a) Three times as much charge will collect on the second resistor as the first.

   (b) The current through the first resistor will be 1/3 that of the second.

   (c) The power dissipated by the two resistors will be the same.

   (d) The voltage across the two resistors will be the same.

   (e) The current through the two resistors will be the same.

5. A proton is traveling northward in a region where the magnetic field points from the east to the west. The direction of the force acting on the proton is:

   (a) Upward.

   (b) Downward.

   (c) Northward.

   (d) Westward.

   (e) Southward.

6. A loop of wire is oriented horizontally, and has a magnetic field pointing downward through the plane of the loop. If the intensity of the field begins to increase, the direction of the induced current (as seen from above the loop), will be:

   (a) Clockwise.

   (b) Counterclockwise.

   (c) A current would be induced in this case, but the direction would be random.

   (d) No current would be induced in the wire in this case.

7. How many turns should a 10 cm long solenoid have if it is to generate a 1.5×10^{-3} T magnetic field on a 1.0 A current?

   (a) 12

   (b) 15

   (c) 119

   (d) 1194

   (e) 3183

8. The primary coil of a transformer has 100 turns and its secondary coil has 400 turns. If the current in the secondary is 2 A, what is the current in its primary coil?

   (a) 2 A

   (b) 8 A

   (c) 1/2 A

   (d) 1/4 A

   (e) 4 A

9. Two long straight wires carry currents of 4.00 A and 6.00 A. If the distance between the wires is 0.400 m. What is the force per unit length between the wires?

   (a) 2.00 $\mu N/m$

   (b) 5.00 $\mu N/m$

   (c) 12.00 $\mu N/m$

   (d) 16.00 $\mu N/m$

   (e) 38.00 $\mu N/m$

10. In general, a charged particle moving in a magnetic field:

   (a) will speed up due to the action of the field.

   (b) will slow down due to the action of the field.

   (c) will follow a circular trajectory around the field lines.

   (d) will spiral along the field lines.

Exam 2 Worked Problems

Sample Dr. Andersen

Both problems are worth 15 points, and will be graded in a manner similar to the assigned homework problems in the book; up to 6 points possible for the description of your solution method, up to 6 points for your algebra and other work *(available only if you receive the full 6 points for the description)*, and three points for the correct answer *(available only if you receive the full 6 points for your work)*, including units.

1.) A square loop of wire has sides of length 20 cm. The loop is placed in a magnetic field with a strength 0.2 T, and is initially oriented so the plain of the loop makes an angle of 20° with respect to the field lines. If the loop is rotated such that the plane of the loop is perpendicular to the field lines in a time of 0.5 seconds, what is the average EMF induced in the coil?

2.) Two long, straight, parallel wires have currents of 2 A running through them in the same direction. If the wires are separated by 10 cm, what is the total strength and direction of the magnetic field produced by both currents at a point midway between the two wires?