Physics 1302, Exam 1 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 Gauss's Law *will not* be covered on this exam (or the final exam either), so you are not responsible for that topic.

- Explain the difference between the electric force (given by Coulombs law) and the electric field.
- Calculate the total force acting on a point charge by other point charges, and the electric field produced by a collection of point charges, in one and two dimensions.
- Describe the differences between, and the relationships between the electric field, electric potential, and electric potential energy.
- Solve conservation of energy problems involving differences in electric potential.
- Calculate the potential produced by a collection of point charges.
- Explain what happens to electric field lines and the electric potential at the surface of and inside a conductor.
- Solve basic problems concerning capacitors.

Exam 1 Multiple Choice Problems

Sample **Dr. Andersen**

1. Three electric charges are laid out along the the x-axis; a charge of $+1.0\ \mu C$ is at the origin, a charge of $+2.0\ \mu C$ is at a $x = 1.0\ m$, and a charge of $+3.0\ \mu C$ is at $x = 2.0\ m$. What is the magnitude of the force acting on the $+1.0\ \mu C$ charge?

   (a) $0.018\ N$.

   (b) $0.025\ N$.

   (c) $0.011\ N$.

   (d) $0.0067\ N$.

   (e) $0.051\ N$.

2. A proton is 10 cm from the surface of a uniformly charged sphere that carries a charge of $-10.\ \mu C$ on its surface, and has a radius of 15 cm. The magnitude of the force exerted on the proton by the sphere is:

   (a) $6.4 \times 10^{-13}\ N$.

   (b) $1.4 \times 10^{-12}\ N$.

   (c) $9.0 \times 10^{-14}\ N$

   (d) $2.3 \times 10^{-13}\ N$.

   (e) $5.4 \times 10^{-12}\ N$.

3. What is the magnitude of the potential difference necessary to stop a proton traveling at 10 % the speed of light ($c \approx 3 \times 10^8\ m/s$.)?

   (a) $150\ V$.

   (b) $250\ V$.

   (c) $1200\ V$.

   (d) $9000\ V$.

   (e) $470,000\ V$.

4. A region of space has an electric potential that is constant throughout the region, and has a value of 250,000 Volts. What else *must* be true about this region?

   (a) The electric field in this region is very strong.

   (b) The region occurs in the interior of a conductor.

   (c) The electric field in this region is zero.

   (d) A positive charge placed in this region would feel a strong force expelling it from this region.

   (e) A negative charge placed in this region would feel a strong force expelling it from this region.

5. The concept of a field came about in electricity and magnetism in order to eliminate what conceptual difficulty?

   (a) "Action at a distance."

   (b) Why the electrical force was so much stronger than the gravitational force.

   (c) The need for a force to be described by a vector.

   (d) Why the electrical force could be either attractive or repulsive.

   (e) Why the magnetic field acted only on moving charges.

6. At the surface of of an isolated conductor:

   (a) The electric potential will be the largest where the surface is the "pointiest".

   (b) Equipotentials will be perpendicular to the surface at every point.

   (c) The total charge *must* be zero.

   (d) The electric field will be parallel to the surface at every point.

   (e) The electric field will be perpendicular to the surface at every point.

Exam 1 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 100 mF capacitor is charged until the potential difference between its plates is 120 V. (a) What is the magnitude of the charge stored on each of its plates? (b) How much energy is stored in the capacitor? (c) If instead the capacitor had been charged until the potential difference between its plates was 240 V, how many times larger or smaller would the energy stored on the capacitor be than in part (b)?

2.) A proton and an electron form two corners of an equilateral triangle with sides of length $3.0 \times 10^{-6}\ m$. What is the magnitude of the electric field at the third corner of the triangle?