

Sample Exam 1

Phy122 Electricity and Magnetism
July 8 2010

Name: _____

You have until 11:45 to complete this exam. You are allowed one index card for formulas and notes. You may have a calculator (but it probably won't help you) but no cell phones or other electronic devices are allowed. Please ask me if any questions come up during the test. I hope you do well!

1. Multiple Choice. [20 Points]

Circle the correct answers.

- (a) A charge is inside a spherical balloon. As the balloon expands, what happens to the total flux going through the balloon?
- The flux decreases
 - The flux increases
 - The flux remains the same
 - It is impossible to tell from the information given.
- (b) A point charge q is placed at the center of the cavity of a conducting shell of radius R . What is the field outside the shell, at a distance r ?
- 0
 - kq/R^2
 - kq/r^2
 - $kq/(4\pi R^2)$
- (c) Two negative point charges are separated by a distance d . The electric field is strongest:
- directly between the two charges
 - everywhere along the line that separates the two charges (perpendicular to the line that connects them)
 - along the line that connects the charges, but not in the region between them.
 - just below either of the charges.
- (d) Two charged bugs exert a force of 2 N on each other. What will be the force if they walk toward each other so that they are only one-quarter as far apart?
- 1/8 N
 - 1/2 N
 - 8 N
 - 32 N

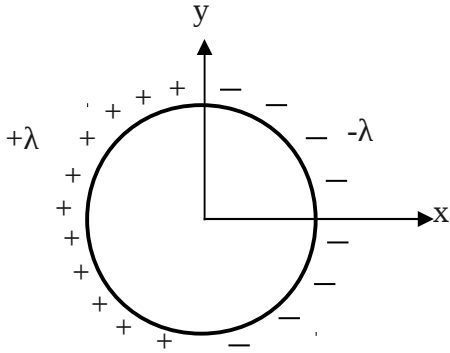
2. **Infinite Pancakes** [30 points]

- (a) Two infinite planes are placed on top of one another with a layer of air between them so that they are separated by a distance d . The bottom plane has charge per unit area of 2σ , while the top plane has charge per unit area of σ . Find the Electric field in the space between the two plates
- (b) What is the potential difference between the plates?
- (c) A charge Q is embedded in the bottom plate. What is the electric field above the two plates and directly above that charge?

3. **A Fancy Ring** [30 of points]

A thin ring of charge of radius R sits in the x - y plane. One half of the ring is negatively charged with uniform density $-\lambda$, and the other half is positively charged with a uniform density $+\lambda$, as shown.

- (a) Find the electric field in the center. [Hint: remember that a small arc length $ds=r d\theta$]
- (b) Find the electric potential at the center.



4. There will be an additional question on the exam [20 points]