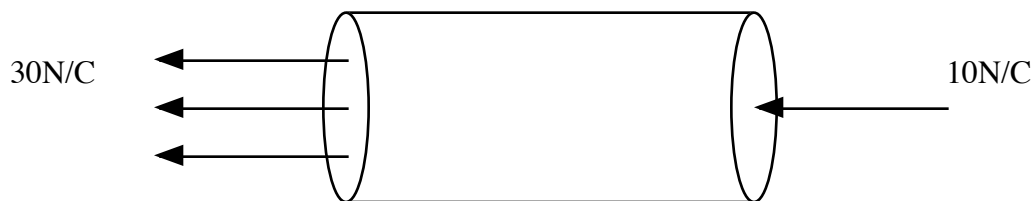


Sample Exam 1
Physics 132

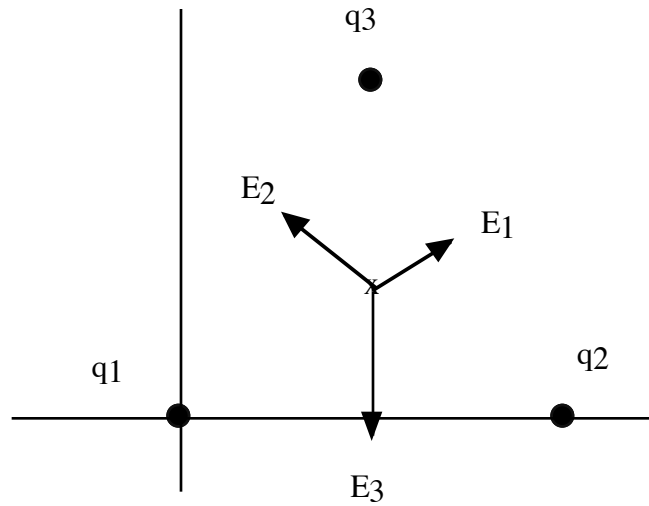
1. Compute the size of the charge necessary for two spheres separated by 1m to be attracted with a force of 1 N. How many electrons is this charge?
2. What is the electric field on the surface of a Uranium nucleus. Take the nucleus to be a uniformly charged sphere with a charge of $+92e$ and radius 10 fm.
3. How many electrons pass per second if a current of 10 A flows in a wire?
4. A proton and an electron are separated by a distance of 1Angstrom. What is the dipole moment of this system? What torque would this dipole experience if it was placed in a uniform electric field of 1000 N/C at an angle of 30 degrees with respect to the field?
5. The electric field at a certain point is 100 N/C. What force would a 10 C charge feel at that point?
6. What is the electric field inside a conductor and why?
7. A cube encloses an electric dipole with $p = 10 \times 10^{-9}$ Cm. What is the net flux through the surface of the cube? You may assume that the dipole is at the center.
8. A point charge $+q$ is placed inside a conducting spherical shell with inner radius a and outer radius b . What is the total charge on the inner surface and why? What is the charge on the outer surface and why? Sketch the field as a function of r .
9. A closed cylindrical surface is placed in an electric field that points along its axis. The cylinder is 1 m long and has a radius of 0.3 m. The field has a strength of 10 N/C on one of the endcaps and has a strength of 30 N/C on the other. What is the net electric flux and what net charge is contained in the surface?



10. An electron is placed at the center of a cube. What is the electric flux through one side of the cube?

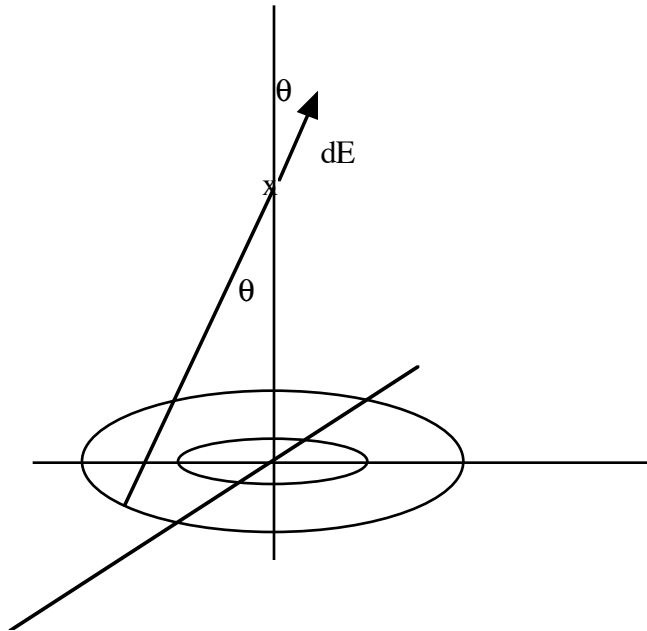
Problems.

1. Charges $+q$, $+2q$ and $+3q$ are placed at the edges of an equilateral triangle with side a . The $+q$ is placed on the origin, the $+2q$ is at $x=a$, $y=0$, and the $+3q$ is placed at the remaining corner



- Compute the electric field vector for a point at the center of the triangle.
- What force would a charge $-q$ experience at that point?
- Make a sketch of the field.

2. A ring of radius a with charge per unit length λ_a lies in the x - y plane. A second ring with radius b lies in the same plane with charge per unit length λ_b .



- Find an expression for the electric field due to the ring with radius a for a point at a distance z away from the x - y plane.
- What is the expression for the total field due to both rings at a point z above the x - y plane?
- What relationship between the charge densities would give zero field at the point z above the plane? Is there a point on the z axis that has zero field no matter what the charge densities are?

3. A nonconducting sphere has a uniform charge density of $1 \text{ C} / \text{m}^3$ and a radius of 0.1 m

- What is the total charge on the sphere?
- What is the electric field at a distance of 1 m away from the sphere's center.

Now consider a Gaussian surface inside the sphere. Assume the Gaussian surface is a sphere of radius r where r is less than 0.1 m .

- What is the charge contained in the Gaussian surface?
- What is the net electric flux as written in terms of the field E ?
- What is the electric field at a distance r away from the center, where r is less than 0.1 m .