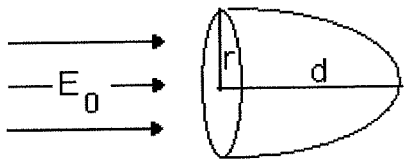
Physics 111 Homework Set #6

1) A point charge q is located at the center of a uniform ring charge with linear charge density λ and radius a. Determine the total electric flux through a sphere centered at the point charge with a radius R<a.
2) An E-field has a magnitude of 20,000N/C and directed perpendicular to the earth's surface. A car (approximated as a rectangle 6m x 3m) is traveling along a road inclined 10° relative to the ground. Determine the magnitude of the electric flux through the bottom of the car.
3) If the constant magnitude E-filed shown below has a magnitude E_0, calculate the total electric flux through the paraboloidal surface.



4) A charge of 12μC is place at the geometric center of a cube. What is the total electric flux through one faces of the cube?
5) On a clear, sunny day there is a vertical E-field of approximately 130 N/C pointing downward over flat ground or water. What is the surface charge density?
6) A solid sphere of radius a=40cm has a total positive charge q=26μC uniformly distributed throughout its volume. Calculate the Electric field at r=0, 10cm, 40cm, and 60cm.
7) A sphere of radius a has a volume charge density that varies with the radius as $\rho=\rho_0(r/a)^2$. Calculate the electric field for r<a and for r>a.
8) Two identical conducting sphere each with radius R are connected by a long thin wire of length L, with L>>R. Determine the tension in the wire if a charge Q is placed on one of the conductors.
9) A hollow conducting sphere of radius a, is surrounded by a larger concentric spherical conducting shell of inner radius b and outer radius c. The inner sphere has a net negative charge -Q and the outer has a net positive charge +3Q. Using Gauss' law, find the electric field everywhere.
10) A long thin wire is surround by a metal cylinder of inner radius a and outer radius b. The wire has a charge per unit length of λ and the cylinder has a net charge per unit length of 2λ. (a) Determine the charge per unit length on the inner and outer surfaces of the cylinder and (b) determine the E-field for r>b.
11) For the configuration shown, a=5cm, b=20cm and c=25cm. Suppose that at r=10cm the electric field points radially inward with a magnitude of 3600N/C and at r=50cm the electric field points radially outward with a magnitude of 200N/C. Find the charge on each of the surface r=a, r=b, and r=c.