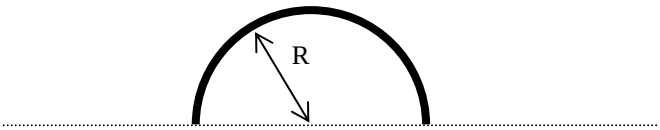
## Workshop module 2 - Physics 142, Fall 2007

1. A flat, square surface with sides of length L is described by the equations x=L, 0<=y<=L, 0<=z<=L. (a) draw the square on a drawing of x, y, z axes (b) find the electric flux through the square due to a positive point charge q placed at the origin.

2. Some modern aircraft are made primarily of composite materials (nonconductors). The U.S. Federal Aviation Administration requires that such aircraft have conducting wires imbedded into their surfaces. Why?

3. A total positive charge Q is uniformly distributed around a semicircle of radius R. Find the electric field (magnitude and direction) at the center of the semicircle (center of curvature).




4. A conducting spherical shell with inner radius A and outer radius B has a positive charge of magnitude +2Q distributed evenly in its interior. The total charge on the shell is –3Q, and it is insulated from its surroundings That is to say, we have a spherical region with radius A that has a charge of +2Q spread evenly throughout which is surrounded by a conducting shell (inner radius A and outer radius B) holding a net charge of -3Q. (a) Where does the charge reside on the conducting shell? (b) Calculate the electric fields everywhere for this system. (c) Graph the electric field as a function of the radius. (d) How would this problem change if the charge distributed in the interior had a volume charge density given by $\rho(r)=(C/r^2)$, where C is a constant?

5. A Geiger counter is a device used to detect ionizing radiation such as beta or alpha particles. It consists of a thin, positively charged central wire surrounded by a concentric circular conducting cylinder with an equal negative charge. The cylinder contains a low-pressure inert gas. When ionizing radiation enters the cylinder, it ionizes gas atoms along its path. The resulting free electrons are drawn toward the positive wire at the center of the device. However, the electric field is so intense that the initially liberated electrons gain enough energy to ionize more gas atoms which release electrons that ionize more atoms and so forth. The resulting avalanche of electrons is collected by the central wire and yield a measurable electrical pulse on the wire. Suppose that the radius of the central wire is 25 micrometers, the radius of the cylinder is 1.4 cm and the length of the tube is 16 cm. If the electric field at the cylinder's inner wall is $2.9 \times 10^4$ N/C, what is the total positive charge on the central wire?