6. A nonuniform electric field is given by the expression
\[ \mathbf{E} = ay \mathbf{i} + bz \mathbf{j} + cx \mathbf{k} \]
where \(a, b,\) and \(c\) are constants. Determine the electric flux through a rectangular surface in the \(xy\) plane, extending from \(x = 0\) to \(x = w\) and from \(y = 0\) to \(y = h\).

17. An infinitely long line charge having a uniform charge per unit length \(\lambda\) lies a distance \(d\) from point \(O\) as shown in Figure P24.17. Determine the total electric flux through the surface of a sphere of radius \(R\) centered at \(O\) resulting from this line charge. Consider both cases, where (a) \(R < d\) and (b) \(R > d\).

19. A particle with charge \(Q = 5.00 \ \mu C\) is located at the center of a cube of edge \(L = 0.100\) m. In addition, six other identical charged particles having \(q = -1.00 \ \mu C\) are positioned symmetrically around \(Q\) as shown in Figure P24.19. Determine the electric flux through one face of the cube.
21. A particle with charge \( Q \) is located a small distance \( \delta \) immediately above the center of the flat face of a hemisphere of radius \( R \) as shown in Figure P24.21. What is the electric flux (a) through the curved surface and (b) through the flat face as \( \delta \to 0 \)?

22. Figure P24.22 (page 742) represents the top view of a cubic gaussian surface in a uniform electric field \( \vec{E} \) oriented parallel to the top and bottom faces of the cube. The field makes an angle \( \theta \) with side \( \vec{1} \), and the area of each face is \( A \). In symbolic form, find the electric flux through (a) face \( \vec{1} \), (b) face \( \vec{2} \), (c) face \( \vec{3} \), (d) face \( \vec{4} \), and (e) the top and bottom faces of the cube. (f) What is the net electric flux through the cube? (g) How much charge is enclosed within the gaussian surface?
32. Assume the magnitude of the electric field on each face of the cube of edge $L = 1.00 \text{ m}$ in Figure P24.32 is uniform and the directions of the fields on each face are as indicated. Find (a) the net electric flux through the cube and (b) the net charge inside the cube. (c) Could the net charge be a single point charge?

33. Consider a long, cylindrical charge distribution of radius $R$ with a uniform charge density $\rho$. Find the electric field at distance $r$ from the axis, where $r < R$. 