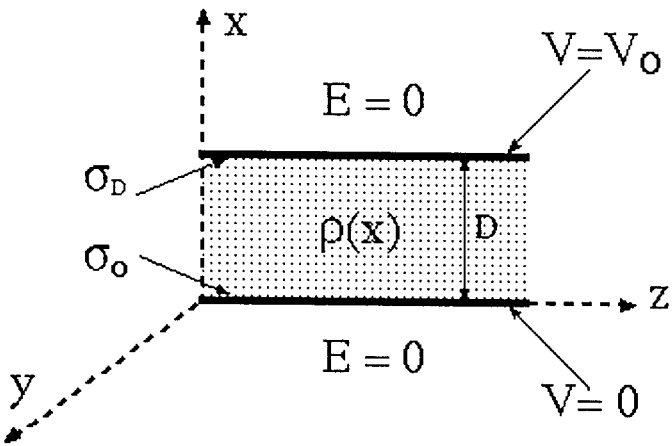
EM 7all00B

Two infinite, parallel conducting plates occupy the yz plane at $x = 0$ and $x = D$ and are at potentials $V = 0$ and $V = V_o$, respectively. A volume charge density $\rho(x) = \rho_o x/D$ is present between the plates, where ρ_o is a constant. Surface charge densities, σ_o and σ_D, are present on the upper surface of the lower plate and the lower surface of the upper plate, respectively. No other charges are present. Outside of the plates, $x < 0$ and $x > D$, the electric field is zero. The figure below shows a cross section of the charges and plates. Of course, only a portion of the infinite planes is shown in the figure.



A) Find the potential, $V(x)$, for $0 < x < D$.

B) Find the magnitude of the electric field, $E(x)$, for $0 < x < D$.

C) Find the surface charge densities, σ_o and σ_D, at $x = 0$ and $x = D$ on the lower and upper plates, respectively.

D) Starting with neither volume nor surface charges between the plates, find the work per unit area of the plates that was done to assemble the volume and surface charges from infinity and bring the plates to the above indicated potentials.