

Do problems 4.8, 4.9 and 4.15 of chapter 4 plus the following two problems

Problem A Consider a grounded perfectly conducting ^{solid} metal object from which an ellipsoidal cavity is hollowed out. The dielectric constant inside the cavity is ϵ_0 , and the cavity is filled with a uniform charge density $\rho = \rho_0$. If the cavity is located in the region, $(x/a)^2 + (y/b)^2 + (z/b)^2 < 1$, verify that the electrostatic potential can be expressed in the form,

$$V(x, y, z) = K_1 + K_2 [(x/a)^2 + (y/b)^2 + (z/b)^2],$$

and determine the constants K_1 and K_2 . What is the surface charge density at the point $(0, 0, b)$ on the surface of the conductor?

Problem B A circular line charge of density $\rho_L = Q/2\pi a$ and radius a is situated in the plane $z = a$ in vacuum. The region $z < 0$ is occupied by a grounded perfect conductor.

- (a) What is the potential at the center of the circle?
- (b) What is the force on a point charge of $-2Q$ situated at the center of the circle?

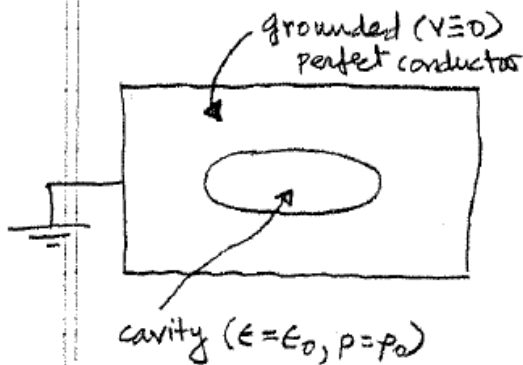


Diagram for problem A

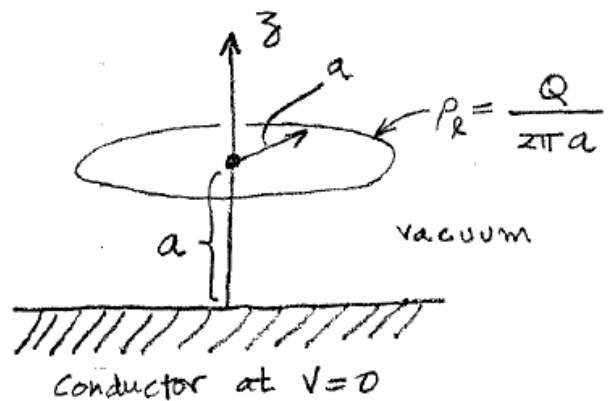


Diagram for problem B