Problem set 02

Problem 1

A long cylindrical capacitor is made of two concentric cylindrical metal plates with radii $b > a > 0$. The space between the cylindrical metal plates is filled with dielectric materials having dielectric constants ϵ_1 in the region $a < r < d$, but ϵ_0 for $b > r > d$, where r is the radial cylindrical coordinate and d is a fixed radius where the two dielectric materials meet. The two metal plates have the potential difference V_0.

(a) Find the capacity of the system per length.

(b) Find the density of free charges in the system and the equivalent bound polarized charges.

(c) Find the electrostatic force acting on the plates per length.

Problem 2

Uniformly charged nonconducting solid sphere with radius R carries total charge Q. Find the net force the northern hemisphere exerts on the southern one. (The wording was changed 24.01. 2025 to underline that I have in mind a solid sphere).

The problems are due Monday January 27 2025 at 20:00