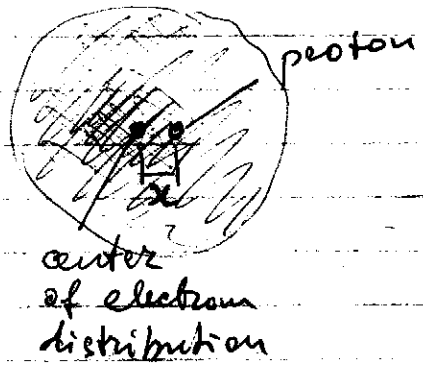
Assignments – Electrostatics II (due Jan 24 @ 1pm)

(1) Show that the force acting on a proton as a result of its displacement x from the central position is proportional to x. Treat proton as a point charge $+e$, while the electron's charge is distributed spherically and it decays exponentially

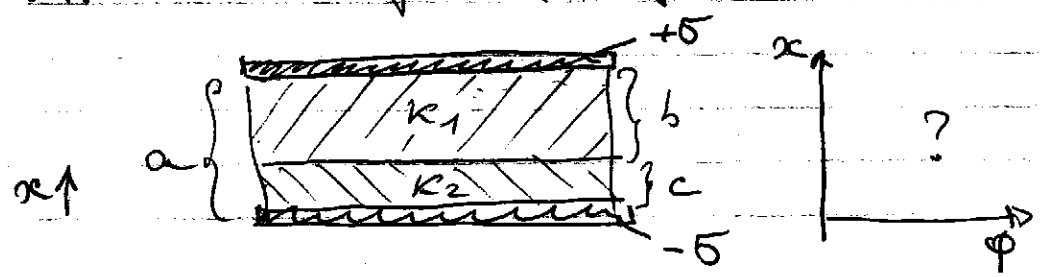
$$\rho_e(r) = \frac{-e}{\pi a^3} e^{-2r/a}$$

a is the Bohr radius

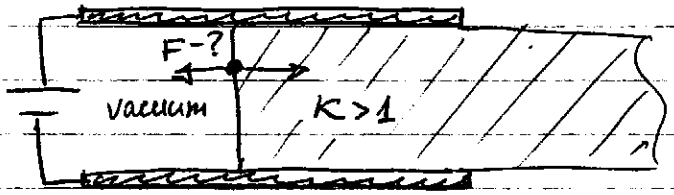
Assume $x \ll a$



(2) Find a potential distribution inside two dielectric materials sandwiched between electrodes with the surface charge $\pm\sigma$

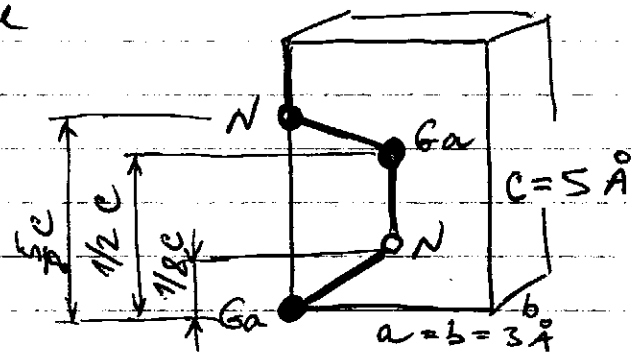


(3)



A dielectric material is inserted into the capacitor. Will the capacitor expel or attract the dielectric material inside? How the force will depend on the dielectric constant $\underline{k}$?

(4) Determine the electric field resulted from a uniform strain (1%) along c-axis applied to GaN - crystal shown on the figure. What will be the associated potential difference measured on the opposite sides of 1 mm thick layer of GaN?



Gallium and nitrogen atoms carry the effective charge of $\pm 2.5e$, respectively.