PHYS UN1602 Recitation Week 4 Worksheet

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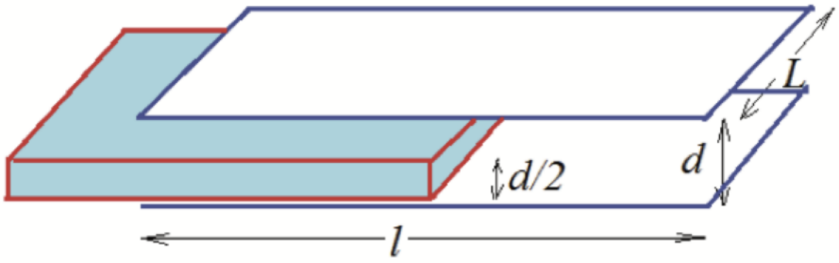
Problem 1

Find the capacitance of a capacitor that consists of two coaxial cylinders of radii a and b and length L. Assume $L \gg b - a$ so that end corrections may be neglected. Check your results by showing that, if the gap between the cylinders $b - a$ is very small compared to the radius, your formula reduces to one that could have been obtained by using the formula for a parallel-plate capacitor.

Problem 2

Consider two parallel plates separated by a distance d with length L and width l. A conducting slab of thickness $d/2$ and width l protrudes into the gap between the two plates, as shown below.



a) Find the force pulling the slab into the gap between the plates in the case where the plates carry charges $+Q$ and $-Q$.

b) Solve for the force again, now in the case where the two plates are connected to a battery of voltage V. Be careful to consider both the neergy stored in the plate-plate-slab system and in the battery.

c) Show that the force is the same for the two cases considered above when the potential difference V between the plates is the same. Explain why.