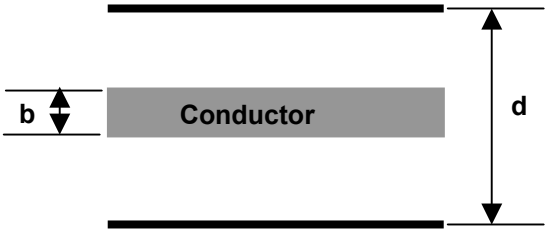
Problems of the Week 4

Always show your work to receive credit (NO WORK=NO CREDIT)

1. A battery is connected to a parallel-plate capacitor of area A and plate separation d=5.0cm. Once the plates are fully charged, the battery is removed. While maintaining a charge q on the plates, a slab of copper of thickness b= 1.0cm is inserted halfway between the parallel plate capacitor. How much work is done on the conductor as it is inserted into the capacitor?



A. $W = -\frac{2.5q^2}{\varepsilon_o A}$

B. $W = \frac{q^2}{2\varepsilon_o A}$

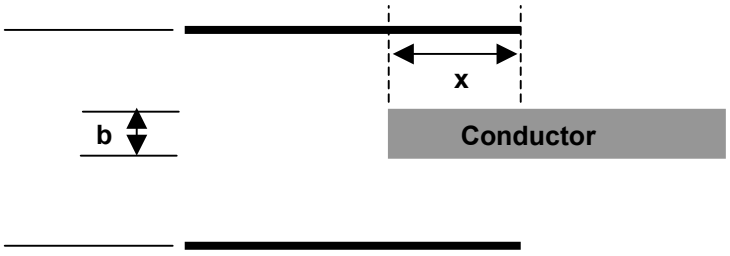
C. $W = -\frac{q^2}{\varepsilon_o A}$

D. $W = \frac{.025q^2}{\varepsilon_o A}$

E. $W = -\frac{0.005q^2}{\varepsilon_o A}$

Note -the numerical constants in the above choices have dimensions of length.

2. Given that the plate dimensions are 0.50mx0.50m, what is the force on the conductor after a length x=0.25m has been inserted into the capacitor? Assume the charge on the plates remains constant (2pts).



A. $\frac{0.040q^2}{\varepsilon_o}$

B. $\frac{0.12q^2}{\varepsilon_o}$

C. $\frac{0.25q^2}{\varepsilon_o}$

D. $\frac{0.75q^2}{\varepsilon_o}$

E. $\frac{1.5q^2}{\varepsilon_o}$

Note-the numerical constants in the above choices have dimensions of 1/(length)^2.