

Workshop module 5 - Physics 142, Fall 2010

1. Batteries are always labeled with their emf; for instance, an AA flashlight battery is labeled "1.5 volts." Would it also be appropriate to put a label on batteries stating how much current they provide? Why or why not?
2. A parallel-plate capacitor has plates of area 600 cm^2 and a separation of 4 mm. The capacitor is charged to 100 V and is then disconnected from the battery. (a) Find the electric field E_0 and the electrostatic energy U . A dielectric of constant $\kappa=4$ is then inserted, completely filling the space between the plates. Find (b) the new electric field E , (c) the potential difference V and (d) the new electrostatic energy.
3. A constant potential difference of 24 V is maintained between the terminals of a $0.25 \mu\text{F}$ parallel-plate air capacitor. A) A sheet of Plexiglas ($K=3.4$) is inserted between the plates of the capacitor, completely filling the space between the plates. When this is done, how much additional charge flows onto the positive plate of the capacitor? B) What is the total induced charge on either face of the plexiglas sheet? C) What effect does the plexiglas sheet have on the electric field between the plates? How does this jive with the increase in the charge on the plates which should serve to increase the field between the plates?
4. A dielectric slab is inserted halfway into a charged capacitor, is the force on the slab a) zero, b) directed to pull the slab into the capacitor, or c) directed to push the slab out of the capacitor? Why? What is the amount of work done by inserting the slab into the capacitor?
5. Find the capacitance of the parallel-plate capacitor (area A and separation d) shown in the figure.

