Questions following Vol 2: Ch 8 *Reading*

1. *Cost-Benefit Analysis* - Part I

Question Given: a) For the kinds of devices described in Chapter 8, ***sketch*** a plot of Q, the amount of charge that has been sloshed from one plate and onto the other, as a function of ΔV, the voltage difference that is applied across the plates.

b) For these kinds of devices, does the *capacitance* $C \equiv Q/\Delta V$ depend on ΔV, the voltage difference that is applied across the plates?

c) For these kinds of devices, does the capacitance depend on Q, the amount of charge that has been sloshed from one plate and onto the other?

d) ***True or false?*** The value of the capacitance is zero if the plates are not charged.

2. *Geometry #1* - Parallel Plates

Question Given: Would you place the plates of a parallel-plate capacitor *closer* together or *farther* apart to increase their capacitance? ***Explain!***

3. *Series or Parallel?*

Question Given: a) If you wish to store a large amount of *charge* in a capacitor bank, would you connect capacitors in series or in parallel? Explain.

b) The energy stored in a capacitor is $U = \frac{1}{2}Q\Delta V = \frac{1}{2}C(\Delta V)^2 = \frac{1}{2}\frac{Q^2}{C}$.
If you wish to store a large amount of *energy* in a capacitor bank, would you connect capacitors in series or parallel? Explain your thinking.

4. *What are the constraints in your set-up?*

Question Given: Discuss how the energy stored in an empty but charged capacitor *changes* when a dielectric is inserted if (a) the capacitor is isolated so that its *charge* does not change; (b) the capacitor remains connected to a battery so that the *potential difference* between its plates does not change.

5. *How is a conductor different from an insulator?*

Question Given: Discuss what would happen if a conducting slab (rather than a dielectric) were inserted into the gap between the capacitor plates, without touching either plate.

6. *Why do people use terms that sound so similar, for such different things?*

Question Given: Distinguish between dielectric strength and the dielectric constant.

7. *Gradients matter!*

Question Given: Elaborate on why molecules in a dielectric material experience net forces on them in a non-uniform electrical field but not in a uniform field.

8. *Do your electrical devices ever get hot? What might that change?*

Question Given: Explain why the dielectric constant of a substance containing permanent molecular electric dipoles decreases with increasing temperature.