Warmup 8 – Linear dielectrics

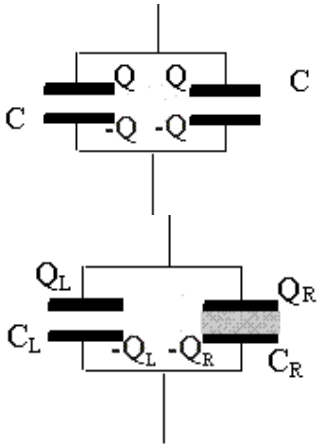
In the following problems, vectors are written in boldface.

Consider a situation in which you have a linear dielectric (say plastic) which is placed into an external field $\mathbf{E}_0$.
Griffiths says that in a linear dielectric $\mathbf{D} = \epsilon\mathbf{E}$. This is the main formula/result of Chapter 4.4.1. But it's a little confusing - there are now several possible E-fields inside the dielectric, among them for example, $\mathbf{E}_0$, $\mathbf{E}_{induced}$, $\mathbf{E}_{induced} + \mathbf{E}_0$, $\mathbf{E}_0 - \mathbf{E}_{induced}$, and $\mathbf{E}_{induced} - \mathbf{E}_0$. Which of these, if any, is the $\mathbf{E}$ in the above equation? Please choose one.

a) $\mathbf{E}_0$ b) $\mathbf{E}_{induced}$ e) $\mathbf{E}_{induced} + \mathbf{E}_0$
d) $\mathbf{E}_0 - \mathbf{E}_{induced}$ e) $\mathbf{E}_{induced} - \mathbf{E}_0$ f) None of these g) It depends

Please explain your answer briefly but clearly:

Consider two identical capacitors in parallel, as shown. Each one has charge Q.



Now keep this system isolated (it is NOT connected to a battery), and insert a dielectric material into the RIGHT-hand capacitor. How do the free charges Q_L (left) and Q_R (right) compare? Please choose one:

a) $Q_L > Q_R$ b) $Q_L = Q_R$ c) $Q_L < Q_R$ d) Not enough information

How does Q_L compare with Q (the *original* charge on the left capacitor)? Please choose one.

a) Q_L > Q b) Q_L = Q c) Q_L < Q d) Not enough information

Please explain your answers to the previous 2 questions briefly but clearly:

In the capacitor setup above, after the dielectric is inserted, how does the total E field in the region between the plates compare? Please choose one:

a) Greater on the left b) Greater on the right c) Equal in both capacitors d) Not enough information

Please explain your answer briefly but clearly: