Physics 606 Homework #5 Spring '20
Dr. Drake

1. Jackson 4.8
2. Jackson 4.9
3. Jackson 4.13
4. Consider a square capacitor ($L \times L$) with plate separation d with $d \ll L$ and total charge Q. A block of dielectric of dielectric constant ϵ, mass m and dimensions equal to the interior of the capacitor is placed just outside of the capacitor. At $t = 0$ the dielectric is moved just inside the capacitor plates with zero initial velocity and then released. Neglect the fringing of the capacitor field and any friction between the capacitor plates and the dielectric.
   (a) Describe what happens to the block of dielectric (the capacitor is held fixed).
   (b) Derive an equation of motion for the dielectric.
   (c) Derive an expression for the velocity when the dielectric is completely inside the capacitor.
   (d) Derive an expression for the period τ of the motion of the dielectric. Evaluate τ for $\epsilon = \epsilon_0(1 + \delta)$ with δ small and for $\delta \gg 1$. Describe the physics in those limits.