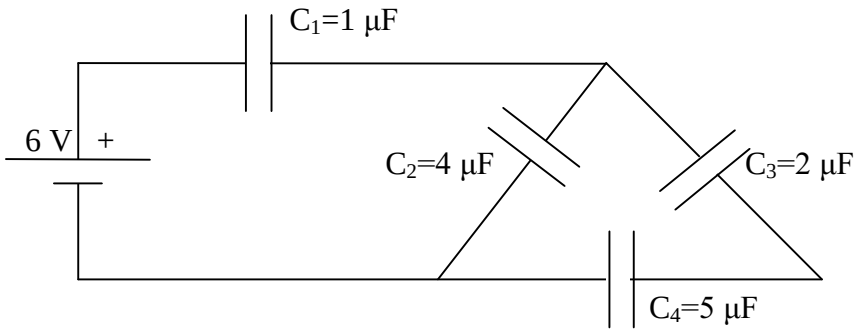
$\mu=10^{-6}$ $\varepsilon_0=8.85\times10^{-12}$ $NC^{-2}m^2$

Quiz for February 16th 2005 - Physics 151-001 - Prof. Thomson

1) *Showing your work,* for the network below:



$C_{eq}=$ μF

U= Joules

(2 pts) a. Find the equivalent capacitance.
(1 pt) b. How much energy is stored in this system?

c. How would you rearrange this network to store the maximum amount of energy? Draw your new network and calculate its equivalent capacitance.
(1 pt) d. How much energy could be stored in this new network?

$C_{max}=$ μF

$U_{max}=$ Joules

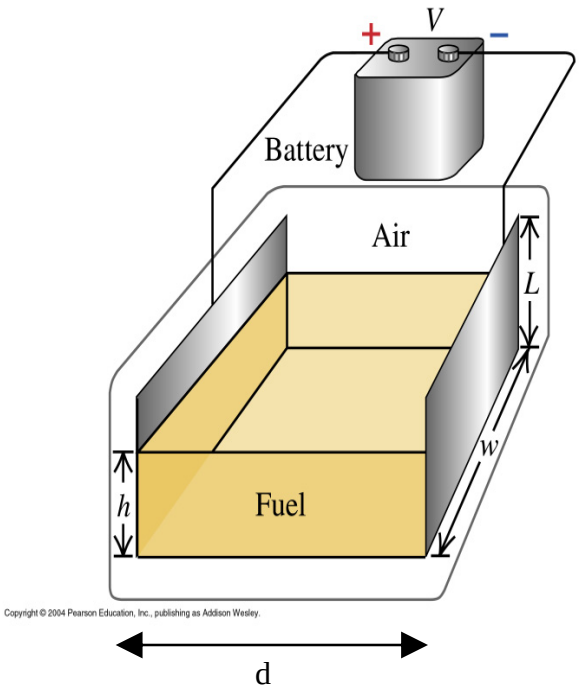
Question 2 is overleaf!

(5 pts)

2) A fuel gauge uses a capacitor to determine the height of the fuel in a tank. The effective dielectric constant K_{eff} changes from a value of 1 when the tank is empty to a value of K, the dielectric constant of the fuel, when the tank is full. The appropriate electronic circuitry can determine the effective dielectric constant of the combined air and fuel between the capacitor plates. Each of the two rectangular plates has a width w and a length L. The height of the fuel between the plates is h. You can ignore any fringing effects.

a. *Showing your work,* derive an expression for K_{eff} as a function of h.

K_{eff}=



b. What is the effective dielectric constant for a tank ¼ full, ½ full and ¾ full, if the fuel is gasoline (K=1.95)?

¼ full K_{eff}=
½ full K_{eff}=
¾ full K_{eff}=