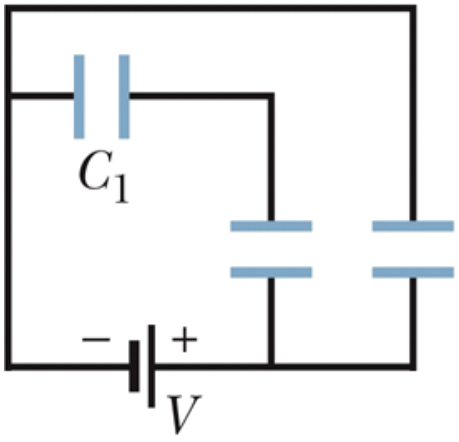
Phyx 135-2 Midterm #2 (10 am) **Name** _____

1) In the network at right, C_1 = 6 μF and the other two capacitors have C = 3 μF. We have V = 9 volts.



1a) (5 points) What is the electrostatic energy contained in C_1?

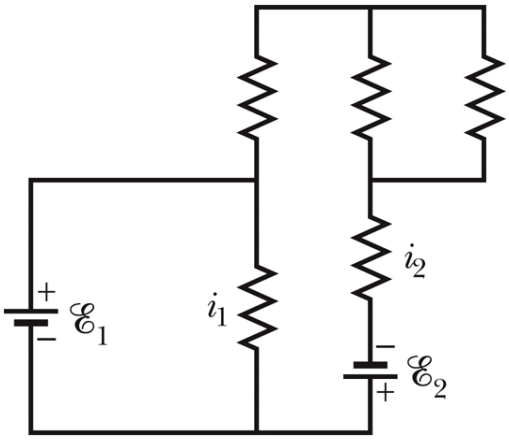
1b) (5 points) Suppose I fill C_1 with a dielectric that has κ = 3.00, and fill the other two capacitors with a κ = 2.00 dielectric. (You may assume that they are all parallel plate capacitors.) What would be the electrostatic energy contained in C_1 then?

2) (5 points) Suppose we have a copper wire of radius 0.3 mm which is 1000 m long. And, suppose we have an aluminum wire of unknown radius that is also 1000 m long. What radius would the aluminum wire need to be if it is to have the same resistance as the copper wire?

resistivity of copper = $1.69 \times 10^{-8}\ \Omega$ m resistivity of aluminum = $2.75 \times 10^{-8}\ \Omega$ m

3) (5 points) A parallel-plate capacitor is filled with a $\kappa = 5.5$ dielectric. The area of each plate is 0.034 m^2 and the plates are separated by 2.0 mm. The capacitor will fail (short out) if the electric field between the plates exceeds 200 kN/C. What is the maximum energy that the capacitor can store?

4) (10 points) In the network at right, $\mathcal{E}_1$ = 6 v, $\mathcal{E}_2$ = 9 v, and all of the resistors are 5 Ω. What are the values of currents i_1 and i_2, and are they going up or down through their respective resistors?



5) Suppose you have a cyclotron which has a radius of 53 cm and is capable of maintaining a uniform magnetic field of 1.20 Tesla. The voltage difference between the two halves of the cyclotron is 80 kV. A radioactive source at the exact center of the cyclotron is injecting α-particles into it at approximately zero velocity. (The mass of the α-particle is 6.68×10^{-27} kg. It has a charge of 2e.)

5a) (5 points) Estimate the maximum energy (in eV) that the α-particles emerging from this cyclotron can achieve.

5b) (5 points) About how long does it take for the α-particle to achieve this energy inside the cyclotron?