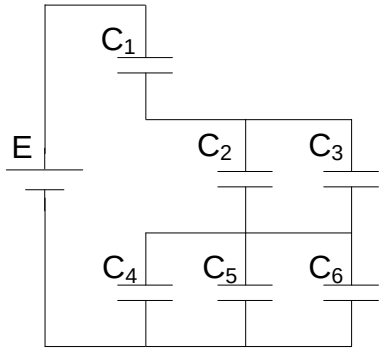
Physics 132, Midterm Exam #2, May 19, 2005 Page Score _____

Name: _____

Recitation Instructor: Knobbe Morss Parks Potashnik Slaunwhite Stevens

Problem 1, 25 points total. E = 100 V and all capacitors are 20 μF.



(a) [13 points] How much energy is stored in the capacitor network?

(b) [12 points] Find the voltage across each capacitor.

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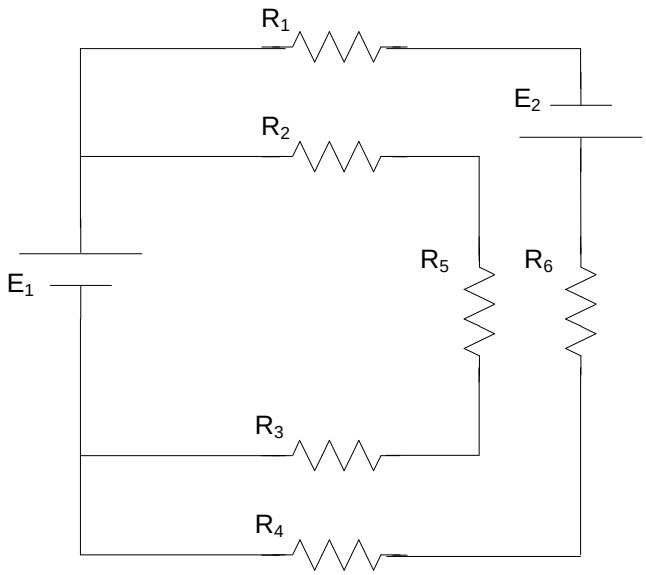
Problem 2, 27 points total.

E_2 = 10 V. The current through R_5 is 0.020 A.
R_1 = 100 Ω, R_2 = 200 Ω, R_3 = 300 Ω,
R_4 = 400 Ω, R_5 = 500 Ω, R_6 = 600 Ω.

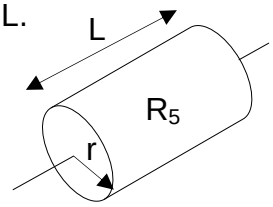


(a) **[7 points]** What is E_1?

(b) **[7 points]** What is the voltage across R_6?

(c) **[7 points]** How much power is supplied by E_1?

(d) **[6 points]** Suppose R_5 was in the shape of a cylinder with radius r and length L.



(i) If the radius was doubled the resistance would (circle one):

decrease **remain the same** **increase**

(ii) If the length was doubled the current through R_6 would (circle one):

decrease **remain the same** **increase**

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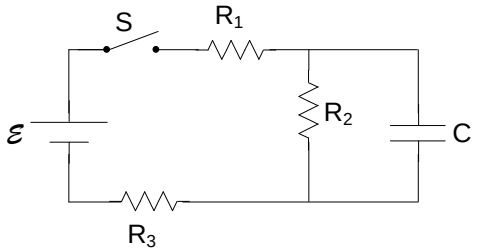
Problem 3, 24 points total. E = 10V, R_1 = 10 Ω, R_2 = 20 Ω, R_3 = 30 Ω, C = 2 μF. The switch is initially open and the capacitor is initially uncharged. The switch is then closed.



(a) [12 points] Immediately after the switch is closed, find:

- V_1 the voltage across resistor R_1.
- i_c = the current through C.
- P = the battery power.

(b) [8 points] A long time after the switch is closed, find:

- V_2 = voltage across resistor R_2.
- U = the energy stored by C.

(c) [4 points] If the switch was opened again, what would be the time constant for the capacitor discharge?

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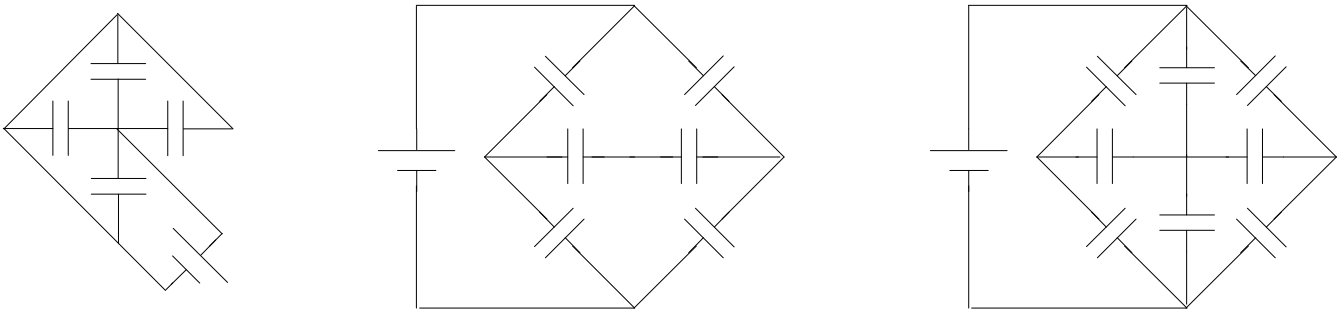
Problem 4, 24 points total. Following are several unrelated questions.

(A) [9 points] For each circuit below: Circle every capacitor that is in parallel with at least one other capacitor; Draw an "X" through every capacitor that is in series with at least one other capacitor.



(B) [15 points] A solid conducting sphere, radius 1.0 cm, is at a potential of 300 V. (Assume a potential reference of V = 0 at infinity.)

(i) What is the potential at the center of the sphere?

(ii) What is the potential at a distance of 2.0 cm from the center of the sphere?

(iii) What is the net charge on the sphere? (Reminder: $k = \frac{1}{4\pi\varepsilon_o} = 8.99\times10^9 \frac{Nm^2}{C^2}$)