PHYS 102 Midterm examination #1 (Sample)

October 15, 2004   Name_____

Time: 50 minutes   Student No._____

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1(4/20 marks). An equilateral triangle with side a=6.0cm has a charge Q=2.0μC at each vertex.
(a) Find the electric potential at the centre of the triangle.
(b) Find the magnitude of the electric field at the centre of the triangle.

2(4/20 marks). Two parallel-plate capacitors of C_1=3.0μF and C_2=4.0μF are separately charged to Q_1=10.0μC and Q_2=18.0μC, respectively. They are then attached so that the (+) plate of the first capacitor is connected to the (+) plate of the second one.
(a) Find the final voltage across the parallel combination of the two capacitors after the charges are redistributed.
(b) Now the space between the plates of the first capacitor is filled with a material whose dielectric constant is 25. Find the voltage across the second capacitor now.

3(4/20 marks).
(a) Draw the electric field lines of a uniform electric field.
(b) A solid sphere made of ideal conductor is placed in this field. Sketch the electric field lines to show the change of the filed lines caused by the insertion of the sphere.

4(4/20 marks). The diagram on the right depicts an RC circuit where C=8.40nF, R1=11.0, R2=18.5, and V_0=20.0V.

(a) What is the current through R1 immediately after the switch S is closed?
(b) What is the current through the capacitor immediately after the switch S is closed?
(c) What is the current throughR1 after the switch S has been closed for a very long time? (Assume that the battery does not go dead.)

Capacitor initially uncharged
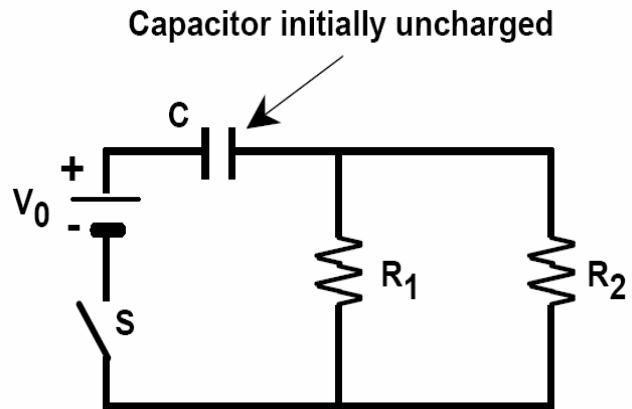
5(4/20 marks).   Use Gauss's law to determine the electric filed due to a large thin sheet of charge. The charge per unit area of the sheet is σ=2.0μC/m².