

MIDTERM-II

Duration: 90 minutes

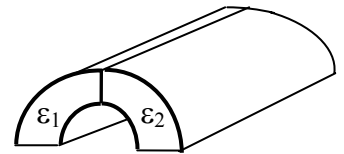
26 April 2007

1] (25 pts)

A resistor is in the shape of a spherical shell, with an inside surface of radius of a covered with a conducting material and an outside surface of b covered with a conducting material. Assuming a uniform resistivity ρ calculate the resistance between the conducting surfaces.

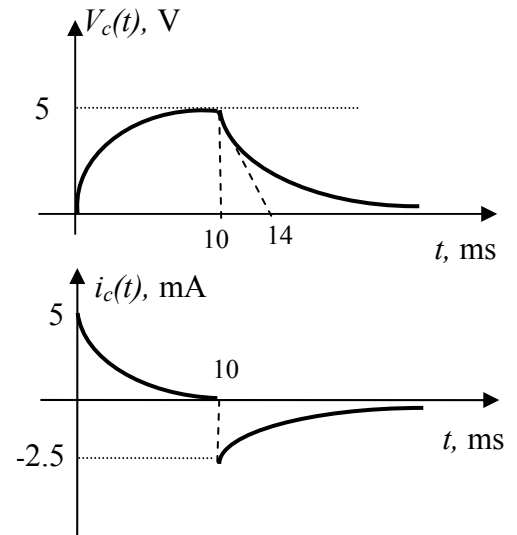
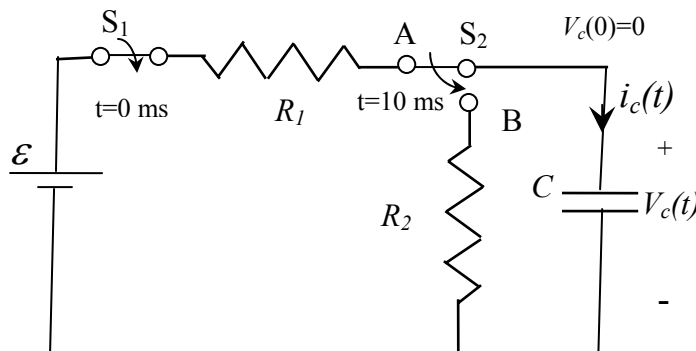
2] (25 pts)

Determine the capacitance per unit length of the semi-cylindrical structure with inner radius a and outer radius b , with dielectric regions of ϵ_1 and ϵ_2 as shown in the figure. (Neglect the fringe fields.)



3] (25 pts)

At time $t=0$, the switch S_1 is closed and later at $t=10$ ms the switch S_2 is thrown from position A to B. Using the capacitor voltage and currents shown on the right, determine the numerical values of ϵ , R_1 , R_2 , and C . (Get the right numerical values, no partial credits!)



4] (25 pts)

Figure on the right shows an arrangement used to measure the masses of ions. An ion of mass m and charge $+q$ is produced essentially at rest in source S , a chamber in which gas discharge is taking place. The ion is accelerated by potential difference ΔV and allowed to enter a magnetic field \mathbf{B} . In the field it moves in a semicircle striking a photographic plate at distance x from the entry slit. Determine the ion mass m in terms of x , q , B , ΔV .

(Derive all relations you use.)

