EXAM II Physics 208 2016

Last Name.....First Name.....Section Number.....

USEFUL INFORMATION

For two point particles

$$\vec{F} = \frac{1}{4\pi\epsilon_0}\frac{q_1 q_2}{r^2}\hat{r}$$

$$\frac{d\vec{r}}{dt} = \frac{dx}{dt}\vec{i}_x + \frac{dy}{dt}\vec{i}_y = \frac{dr}{dt}\vec{i}_r + r\frac{d\theta}{dt}\vec{i}_\theta$$

$$V(\vec{r}_2) - V(\vec{r}_1) = -\int_{\vec{r}_1}^{\vec{r}_2} \vec{E}\cdot d\vec{r}$$

$$C = \frac{Q}{V} \qquad R = \rho\frac{l}{A}$$

$$\oint \vec{E}\cdot d\vec{S} = \frac{Q_{inside}}{\epsilon_0}$$

$$V = iR \qquad \vec{E} = \rho\vec{j}$$

For parallel plates $C = \frac{A\epsilon_0}{d}$

WARNING: In any circuit problem, failure to indicate the direction of currents and/or the failure to indicate where charges are located on capacitors will result in no credit being given.

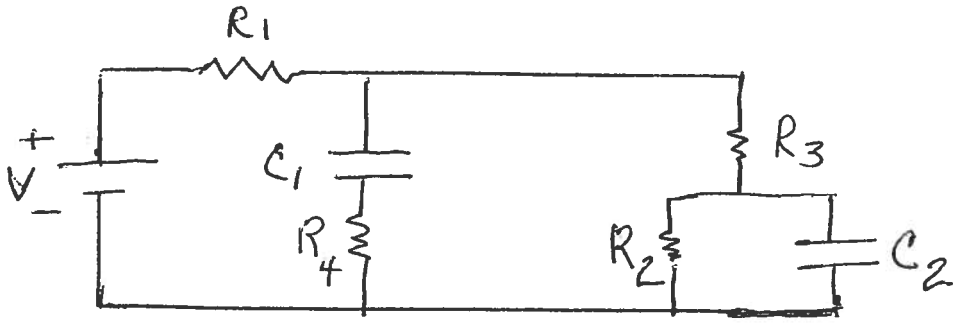
1.

2.

3.

4.

1. (25 points)In the circuit below, all the $R's$, $C's$ and V are known. The circuit was put together a long time ago. Find the currents in each resistor and the charges on the capacitors. You must clearly indicate what you are doing or you will receive no credit!

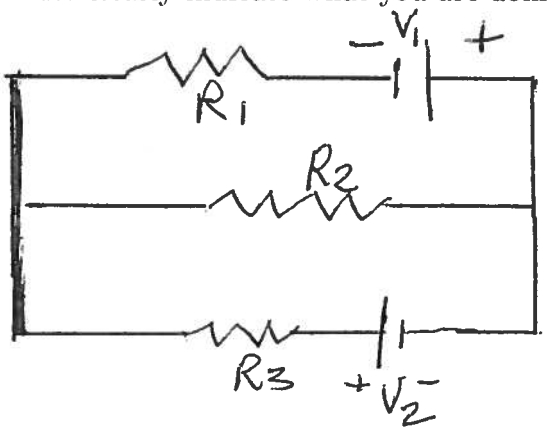


Laws or Definitions

Application

2 points Result: Evaluate each current and the charges if $R_1 = 4\Omega$, $R_2 = 2\Omega$,$R_3 = 6\Omega$, $R_4 = 5\Omega$, $V = 12volts$, $C_1 = 1\mu f$ and $C_2 = 2\mu f$.

2. (25 points)In the circuit below, all the $R's$ and $V's$ are known. The circuit was put together a long time ago. Obtain enough equations so that you could find the currents in each resistor. You must clearly indicate what you are doing or you will receive no credit!

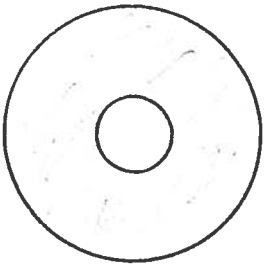


Laws or Definitions

Application

2 points Result: If $V_1 = 2V_2$, how must R_1 and R_3 be related in order to have no current flow through resistor R_2?

3. (25 points) A spherical shell with inner radius A and outer radius 3A which has a uniform charge density, i.e. charge per unit volume, ρ_0. Find difference in the electric potential between the center of the shell and a point a distance 2A from the center. Also find this electric potential difference if instead of a uniform charge density there were a nonuniform charge density within the shell that depends on the distance from the center given by $\rho(r) = \rho_0(\frac{r^2}{D^2})$, where D is a known constant.

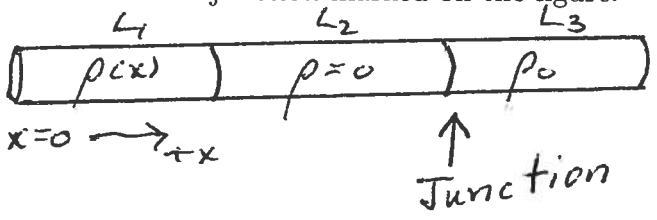


Laws or Definitions

Application

Result

4. (25 points) Three wires, with lengths L_1, L_2, and L_3 each have cross sectional area a. One of the wires has resistivity which varies with x, defined in the figure, according to $\rho(x) = \rho_0 \frac{x}{L_1}$ where ρ_0 is a known constant. The second wire has resistivity zero andd the third has constant resistivity ρ_0. Find the current that would flow throw this set of wires if it is connected to a battery with voltage V by wires with zero resistivity. Also find the charge that would be on the junction marked on the figure.



Laws or Definitions

Application

Result