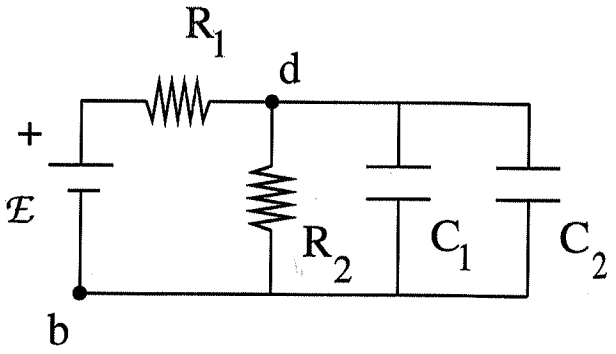
NAME: KEY

Quiz 4, Physics 9C, Winter 2016

General Instructions: This quiz is closed book. Only a calculator is allowed. Please show all your work, and give units for all answers and on all graphs. Credit will only be given for complete solutions. The constant k in Coulomb's law is $k = 9 \cdot 10^9$ Nm^2/C^2.

[1] In the Figure, $\mathcal{E} = 50.0$ V, $R_2 = 5.0\Omega$, $C_1 = 4.0\mu F$ and $C_2 = 12.0\mu F$. After the capacitors have attained their final charges, the charge on C_1 is $Q_1 = 8.0\mu C$. (a) What is the final charge on C_2? (b) What is the resistance R_1? (c) What is the potential difference between points b and d?



a) potential across R_2, C_1 and C_2 must all be equal.

$C = \frac{Q}{V}$

across C_2 $V_2 = Q_2/C_2 = Q_2/12\mu F = 5$ so $Q_2 = 24\mu C$

across C_1 $V_1 = Q/C_1 = 8\mu C/4\mu F = 2$ volts

b) V across R_2 must be 2 volts so I through R_2 is $2/5$ A

$= 5\Omega$

since no current flows onto C_1 and C_2 when they are fully charged, current through R_1 = current through R_2

Then $E - I_1 R_1 - 2 = 0$ so $R_1 = \frac{5}{2}48 = 120\Omega$

E: 50, I: $2/5$

c) potential between b, d is 2 Volts, the potential across C_1, C_2 and R_2.

[2] Can a charged particle move through a magnetic field without experiencing any force? If so, how? If not, why not? For full credit, connect your response to the formula for the magnetic force on a moving charge.

A charged particle can move in a magnetic field without experiencing a force if its velocity is parallel to the field.

$\vec{F} = q\vec{v} \times \vec{B}$ $\quad |\vec{F}| = q|\vec{v}||\vec{B}|\sin\theta$

θ: angle between $\vec{v}$ and $\vec{B}$

if $\vec{v} \parallel \vec{B}$ $\theta = 0 \rightarrow \vec{F} = 0$