

Exam 2

**P208 Fall 2008,
Instructor: Prof. Abanov**

10/13/08

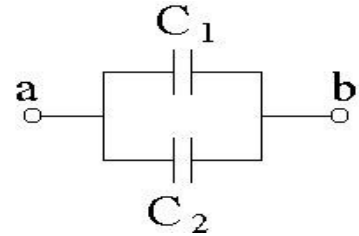
Name _____
(print)

Section _____

Your grade:

Problem 1.

A system of capacitors is shown on the figure, $C_1=2\mu F$,
 $C_2=3\mu F$. Potential difference between points a and b is
 $V=10\text{Volts}$.



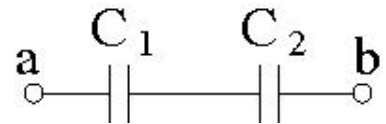
What is the charge Q_1 on capacitor C_1 ? _____

What is the charge Q_2 on capacitor C_2 ? _____

What is the total capacitance of the system? _____

Problem 2.

A system of capacitors is shown on the figure, $C_1=6\mu F$,
 $C_2=3\mu F$. Potential difference between points a and b is $V=10\text{Volts}$.



What is the total capacitance of the system? _____

What is the charge Q_1 on capacitor C_1 ? _____

What is the charge Q_2 on capacitor C_2 ? _____

What is the voltage difference V_1 across the capacitor C_1 ? _____

What is the voltage difference V_2 across the capacitor C_2 ? _____

Problem 3.

A battery with $E=10\text{V}$ and internal resistance $r=1\text{k}\Omega$ is connected to a simple circuit with a total resistance of $R=9\text{k}\Omega$.

What is the current through the battery? _____

What is the potential difference between the battery's terminals? _____

How much power does the battery supply to the simple circuit? _____

How much power dissipates inside the battery? _____

Problem 4.

In the circuit shown in the picture $E=10\text{V}$, $r=1\text{k}\Omega$, $R_1=2\text{k}\Omega$, and $R_2=R_3=R_4=3\text{k}\Omega$.

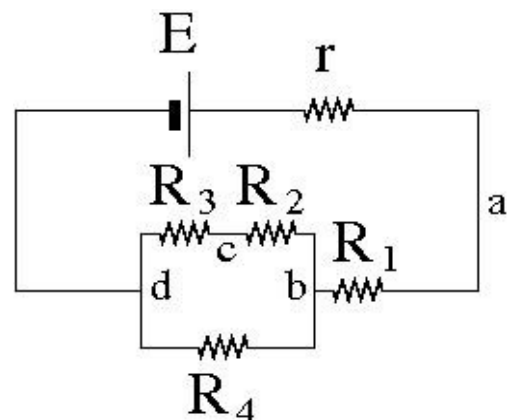
What is the current at point "a" of the circuit? _____

What is the potential difference between points "a" and "b"? _____

What is the potential difference between points "b" and "d"? _____

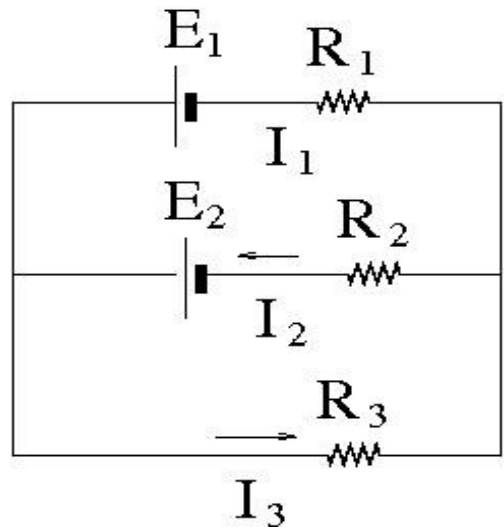
What is the current at point "c"? _____

What is the potential difference between points "c" and "b"? _____



Problem 5.

In the circuit shown in the figure $E_1=28V$,
 $R_2=6\Omega$, $R_3=3\Omega$, $I_2=4A$, and $I_3=6A$
 (directions of I_2 and I_3 are shown)



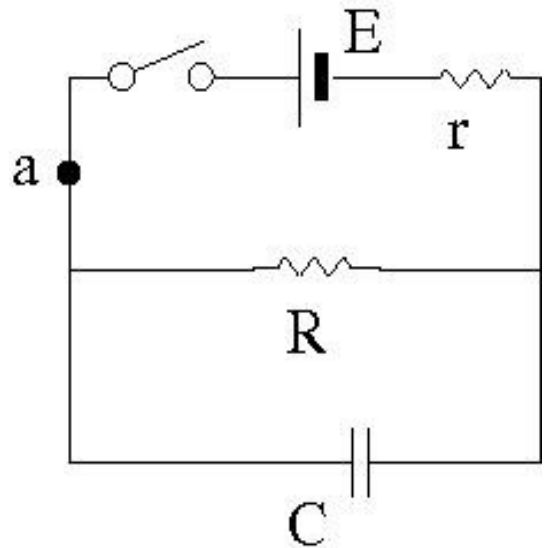
What is the magnitude and direction (show in the figure) of the current I_1 ? _____

What is the value of the resistor R_1 ? _____

What is E_2 ? _____

Problem 6.

In the circuit shown in the figure $E=10V$,
 $r=6k\Omega$, $R=4k\Omega$, and $C=4\mu F$. Initially the capacitor is uncharged. At the moment t_0 the switch is closed.



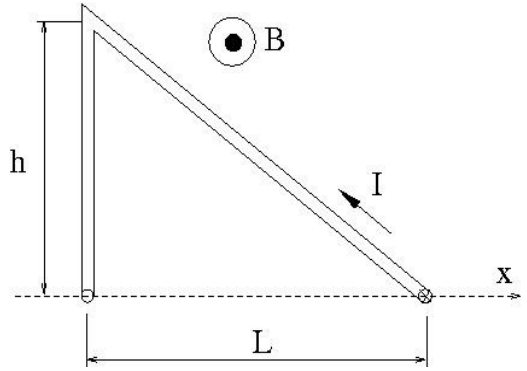
What is the current in point "a" immediately after t_0 ? _____

What is the current in point "a" after a very long time?

What is the charge on the capacitor C long time after t_0 ? _____

Problem 7.

A wire with a current $I=2\text{mA}$ has the form shown in the figure with dimensions $L=10\text{cm}$ and h unknown. It was placed in the magnetic field $B=0.5\text{T}$ pointing out of the paper.



What is x component of the force acting on the wire? _____

What is y component of the force acting on the wire? _____

Problem 8.

A planar loop of area $A=0.05\text{m}^2$ carries a current $I=1\text{A}$. The magnetic field $B=0.5\text{T}$ is at angle 45° with the norm to the loop.

What is magnetic moment of the loop? _____

What torque should be applied to the loop in order to keep it at rest?

What torque would be needed if the loop had 100 turns?

Problem 9.

An electron $e=1.6 \times 10^{-19} C$, $m_e=9.1 \times 10^{-31} kg$ is accelerated through a potential difference of $2kV$. It then passes into magnetic field perpendicular to its path, where it moves in a circular arc of diameter $0.36m$

What is the magnitude of the velocity of the electron in magnetic field?

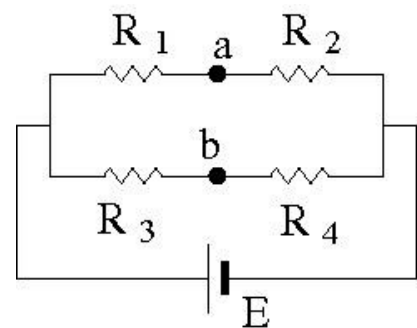
What is the magnitude of the magnetic field?_____

What is the frequency of the electron's motion in the magnetic field?_____

Problem 10.

In the circuit shown on the figure $R_1=2\Omega$, $R_2=6\Omega$, and $R_3=5\Omega$.

What the resistance of the resistor R_4 must be for the potential difference between the points "a" and "b" to be 0 ?_____

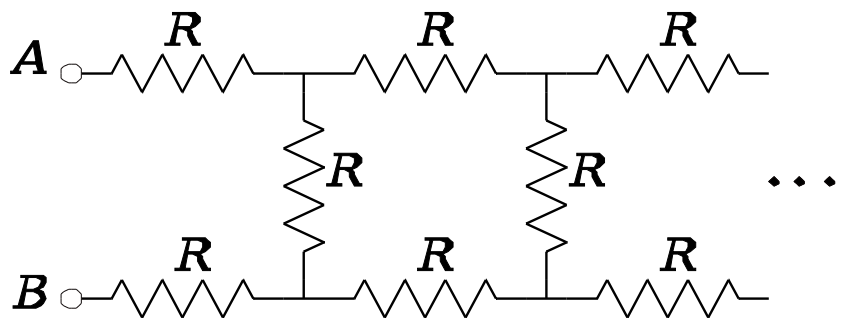


Extra Problems.

You have all the time till the end of the semester to solve these problems. Please take this sheet with you. The first student who solves one of the problems will get 10 extra points for this exam.

Extra Problem 1.

The resistance of each resistor of the **infinite** series shown in the picture is $R=1\text{ Ohm}$. Find the total resistance between points "A" and "B".



Extra Problem 2.

An **infinite** square lattice is made of resistors of resistance $R=1\text{ Ohm}$.

Find the resistance between nearest neighborhood vertices "A" and "B".

