Exam 2

P202 Spring 2009,
Instructor: Prof. Abanov

03/04/09

Name_____ Section_____

(print)

517 Labs at 12:40-03:30 pm, TA: Wenlong Yang

518 Labs at 01:50-04:40 pm, TA: Jianping Xiao

519 Labs at 03:00-05:50 pm, TA: Kyle Damborsky

Your grade:

Problem 1.

A 2.5-A current is maintained in a simple circuit with a total resistance of 400 Ω.

What is the potential difference across the resistance?_____

What net charge passes through any point in the circuit during a one minute interval?_____

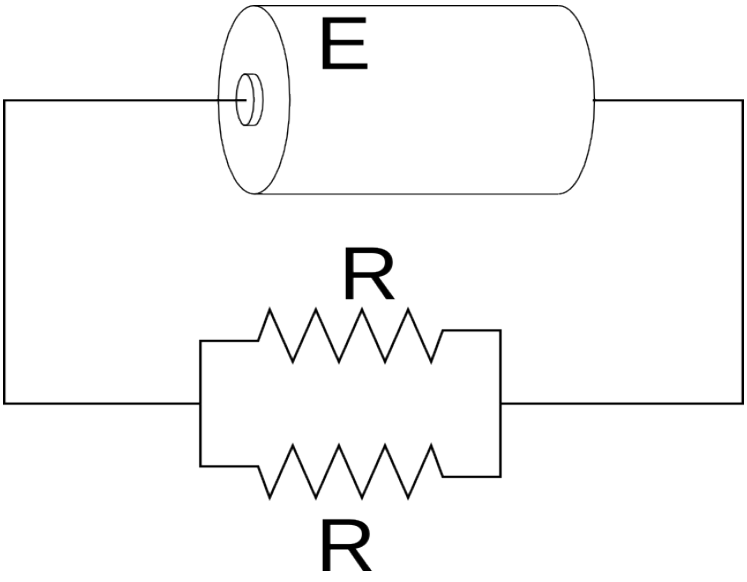
How much energy dissipated in the resistor during this time interval? _____

What net charge would pass through any point in the circuit during a one minute interval if we doubled the resistance but kept the current constant?_____

What net charge would pass through any point in the circuit during a one minute interval if we doubled the resistance but kept the voltage constant instead?_____

Problem 2.

A battery with $E = 20\text{V}$ and internal resistance $r = 1\text{k}\,\Omega$ is connected to a simple circuit shown in the schematics with $R = 18\text{k}\,\Omega$.



What is the current through the battery?_____

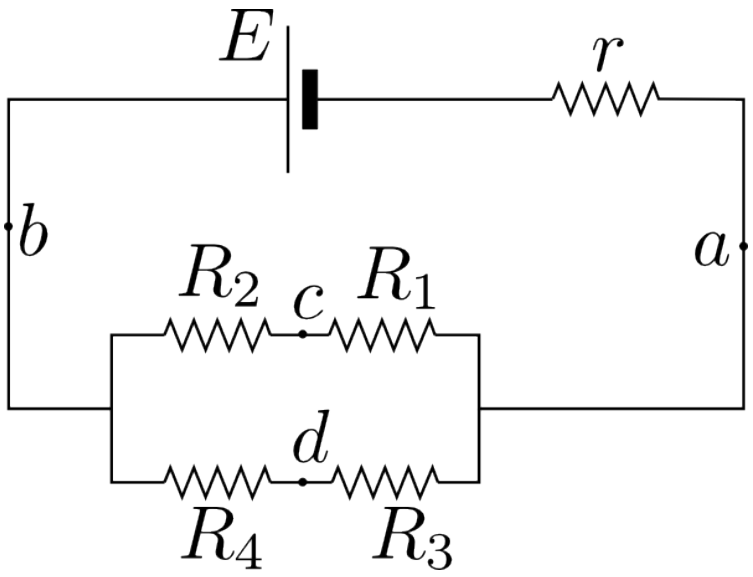
What is the potential difference between the battery's terminals?_____

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

How much power dissipates inside the battery?_____

Problem 3.

In the circuit shown in the picture
$E = 10\text{V}$, $r = 1\text{k}\,\Omega$, $R_1 = 1\text{k}\,\Omega$,
$R_2 = 3\text{k}\,\Omega$, $R_3 = 7\text{k}\,\Omega$, $R_4 = 5\text{k}\,\Omega$



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

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

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

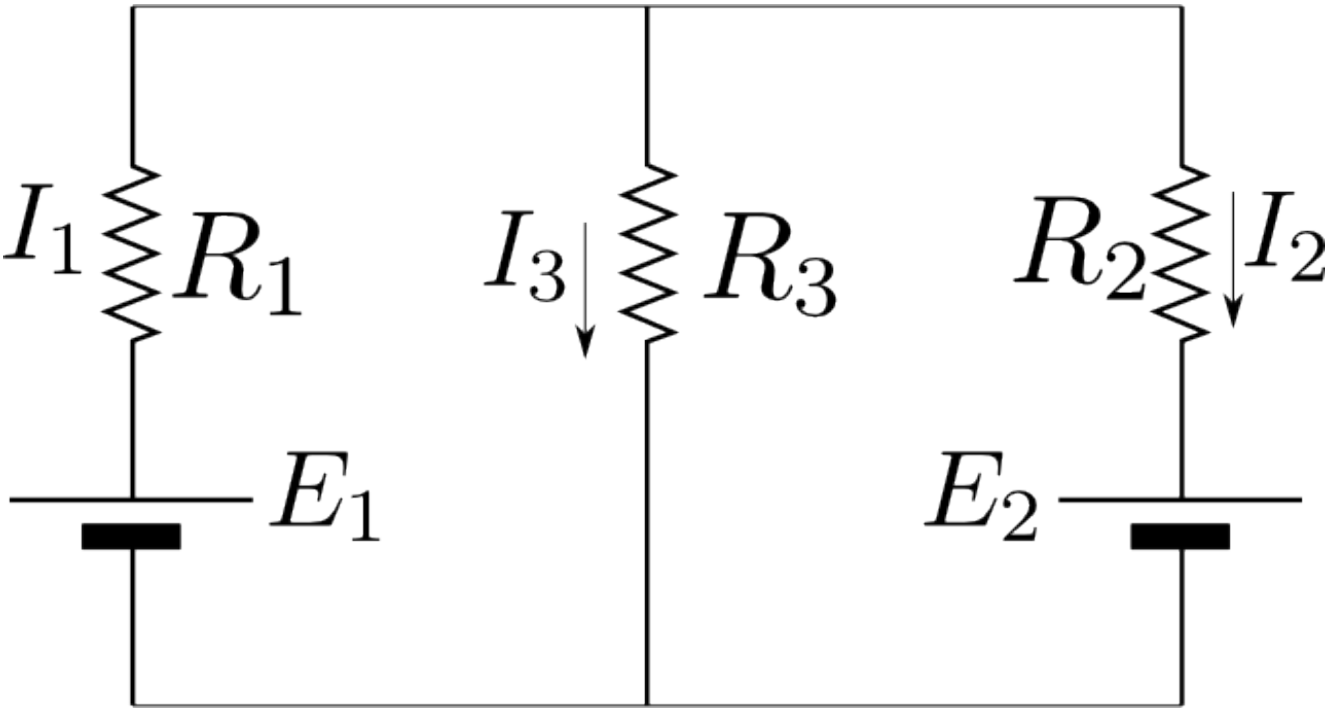
What is the potential difference between points "a" and "b"?_____

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

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

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

Problem 4.



In the circuit shown in the figure $E_1 = 28\text{V}$, $R_2 = 6\text{k}\,\Omega$, $R_3 = 3\text{k}\,\Omega$, $I_2 = 4\text{mA}$, and $I_3 = 8\text{mA}$ (directions of I_2 and I_3 are shown)

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

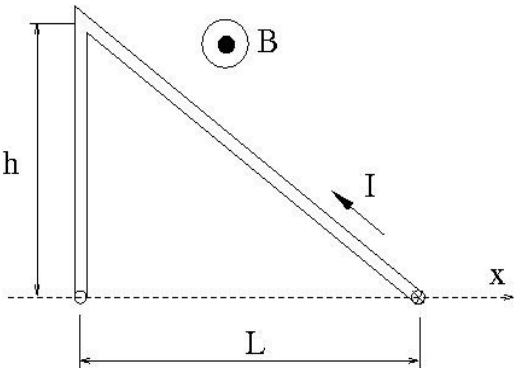
What is the value of the resistor R_1 ?_____

What is E_2 ?_____

What total power is being dissipated by all the resistors together?_____

Problem 5.

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.

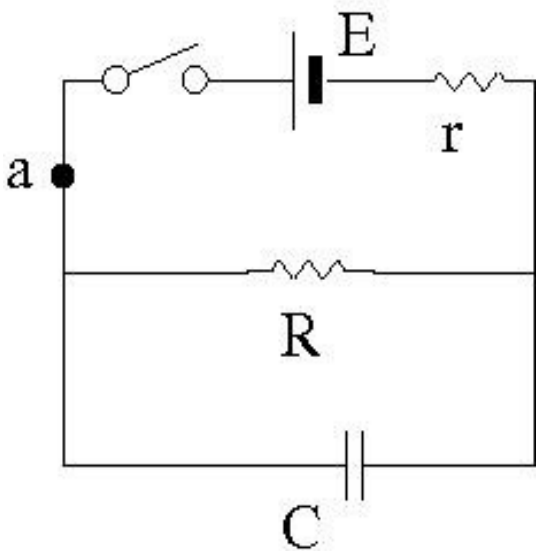


What is x component of the force acting on the wire?___

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

Problem 6.

In the circuit shown in the figure $E=10\text{V}$, $r=6\text{k}\Omega$, $R=4\text{k}\Omega$, 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 planar loop of area $A = 0.02\text{m}^2$ carries a current $I = 1\text{A}$. The magnetic field $B = 0.5\text{T}$ is at angle $30°$ 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 8.

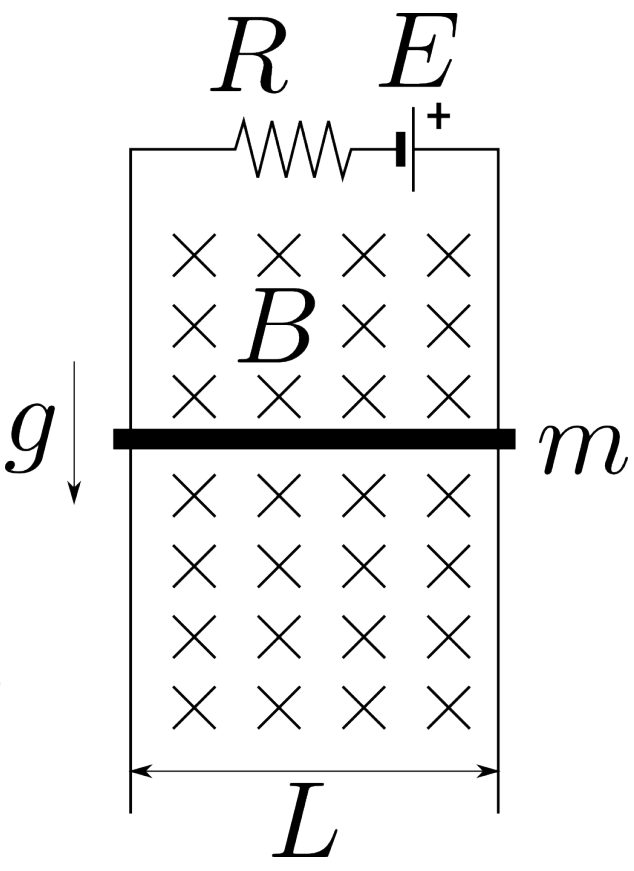
Two high current transmission lines carry currents of $50A$ and $75A$ in the opposite directions. And are suspended parallel to each other $35cm$ apart. The vertical posts supporting these wires divide the lines into strait $15m$ segments.

What magnetic force does each segment exert on the other?_____

Is this force attractive or repulsive?_____

What would happen to the force if we double each current?_____

Problem 9.



A metal bar of mass $m=10\text{kg}$ can move frictionlessly along two vertical straight rails which are $L=1\text{m}$ apart from one another. The resistor $R=2\,\Omega$ and battery $E=2\text{V}$ are connected to the rails. Magnetic field is $B=0.5\text{T}$. At the first moment the bar is released at zero velocity.

What is the direction of the electric current in the bar at the first moment? (to the left, or to the right)

What is the magnitude of the electric current in the bar at the first moment?_____

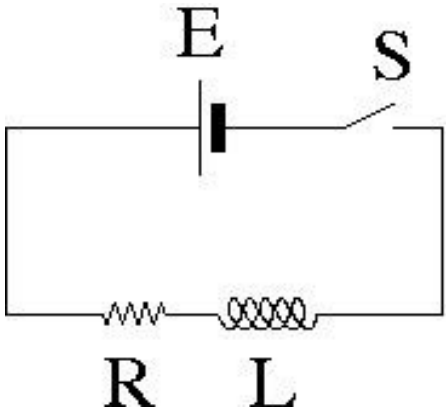
What is the direction of electric current after a long period of time? (show on the figure)

What is the direction of the magnetic force on the bar after a long period of time?(show on the figure)

What is the velocity of the bar after a long period of time?_____

Problem 10.

A circuit show on the figure has $E=15\text{V}$, $R=5\text{k}\Omega$, $L=5\text{mH}$.



What is the current right after the switch is closed?_____

How fast the current is changing right after the switch is closed?____

What is the current long time after the switch is closed?____

What is the time constant of this circuit?____