Exam 2

P202 Spring 2007,

Instructor: Prof. Abanov

03/01/07

Name______________ Section___________

(print)

Your grade:

Problem 1.

A 5-A current is maintained in a simple circuit with a total resistance of 200 Ω.

What is the potential difference across the resistance?______

What net charge passes through any point in the circuit during a 1minute interval?______

What net charge would pass through any point in the circuit during a 1minute interval if we doubled the resistance but kept the current constant?______

What net charge would pass through any point in the circuit during a 1minute interval if we doubled the resistance but kept the voltage constant?______

Problem 2.

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

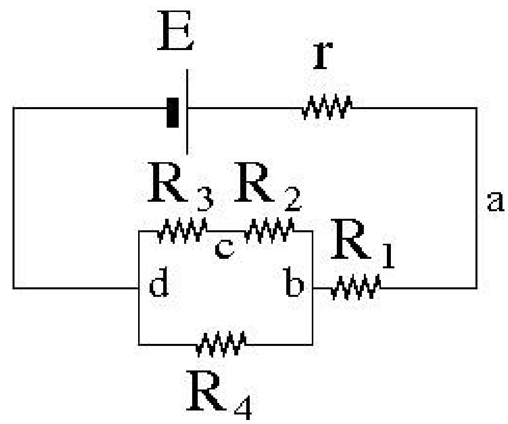
What is the current through the battery?______

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 $E = 10\mathrm{V}$, $r = 1\mathrm{k}\Omega$, $R_1 = 2\mathrm{k}\Omega$, and $R_2 = R_3 = R_4 = 3\mathrm{k}\Omega$.

What is the current at point a of the circuit?________

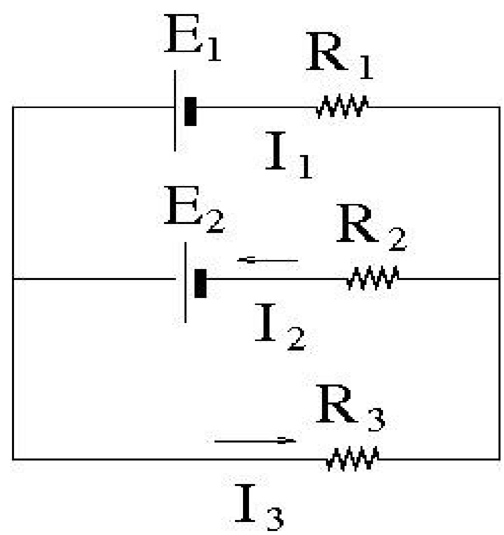
What is the potential difference between points a and b?_______

What is the potential difference between points b and d?_______

What is the the current at point c?_________

What is the potential difference between points c and b?___________

Problem 4.



In the circuit shown in the figure $E_1 = 28\mathrm{V}$, $R_2 = 6\Omega$, $R_3 = 3\Omega$, $I_2 = 4\mathrm{A}$, and $I_3 = 6\mathrm{A}$ (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 5.

An electron $e = 1.6\text{X}\,10^{-19}C$, $m_e = 9.1\text{X}10^{-31}kg$ 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

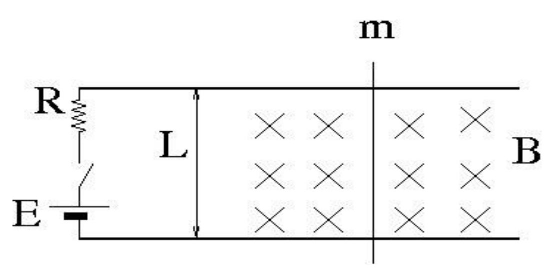
What is the magnitude of the velocity of the electron in magnetic field?_____

What is the magnitude of the magnetic field?_____

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

Problem 6.

A metal bar is at rest on two rails, as shown on the figure. $E = 10\text{V}$, $R = 1\,\Omega$, $L = 50\text{cm}$, $B = 5\text{T}$, and $m = 0.5\text{kg}$



What is the current through the bar right after the switch is closed?______

What are direction and magnitude of the magnetic force acting on the bar at the first moment?_____

What is the acceleration of the bar?______

Problem 7.

A planar loop of area $A = 0.05\mathrm{m}^2$ carries a current $I = 1\mathrm{A}$. The magnetic field $B = 0.5\mathrm{T}$ 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 8.

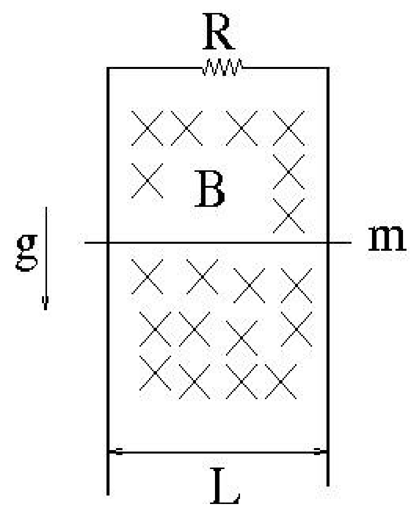
Two high current transmission lines carry currents of $25\mathrm{A}$ and $75\mathrm{A}$ in the same direction. And are suspended parallel to each other $35\mathrm{cm}$ apart. The vertical posts supporting these wires divide the lines into strait $15\mathrm{m}$ segments.

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 $m=10\mathrm{kg}$ can move along two vertical straight rails which are $L=1\mathrm{m}$ apart from one another. The total friction force between the bar and the rails is $F_f=50\mathrm{N}$. The resistor $R=2\,\Omega$ connects the rails. Magnetic field is $B=0.5\mathrm{T}$ After a long time the bar falls with a constant velocity.

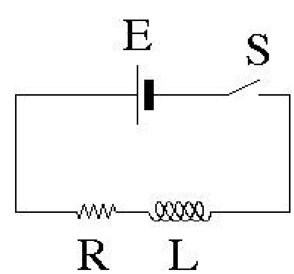
What is the direction of electric current induced by the motion?(show on the figure)

What is the direction of the magnetic force acting on the bar?(show on the figure)

What is the velocity of the bar?________

What will be the velocity if we double the magnetic field?_________

Problem 10.



A circuit show on the figure has $E=10\mathrm{V}$, $R=1\mathrm{k}\,\Omega$, $L=5\mathrm{mH}$.

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?______