

Exam 3

**P208 Fall 2007,
Instructor: Prof. Abanov**

11/05/07

Name _____

Section _____

(print)

Your grade:

Problem 1.

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

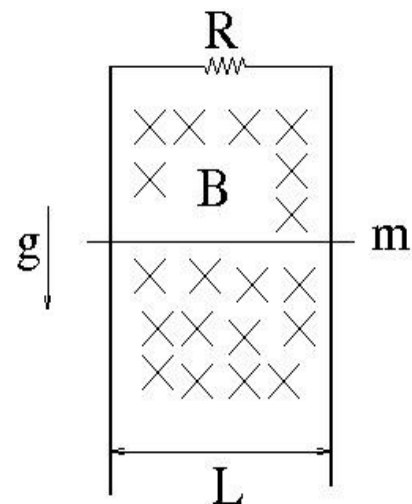
What magnetic force does each segment exert on the other?_____

Is this force attractive or repulsive?_____

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

Problem 2.

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



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

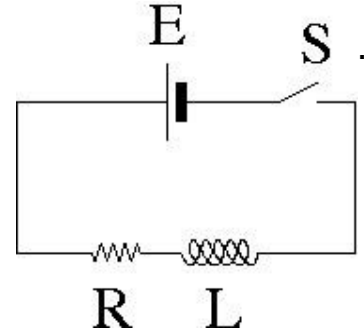
What is the direction of the magnetic force acting on the bar?(show on the figure)

What is the velocity of the bar?_____

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

Problem 3.

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



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

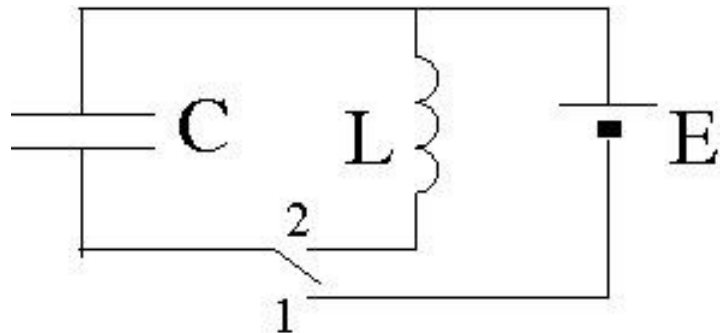
How fast the current is changing right after the switch is closed?_____

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

What is the time constant of this circuit?_____

Problem 4.

After the switch had been in the position 1 for a very long time, it was switched to the position 2. If $C=20mF$, $L=5mH$, $E=10V$ find:



What is the time derivative of the current right after the switch was switched?_____

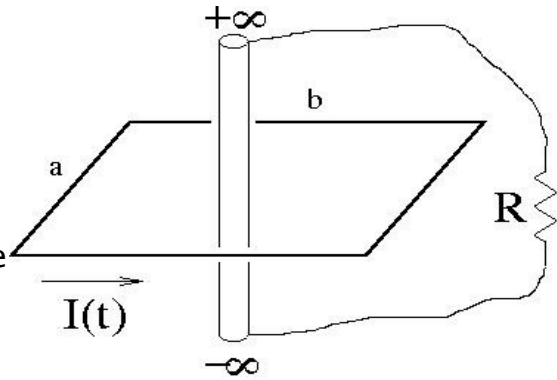
What is the frequency of oscillations?_____

What is the amplitude of the current oscillations?_____

What is the total energy in the contour?_____

Problem 5.

An infinitely long vertical thin solenoid with the cross-section area A goes through the center of the rectangular horizontal loop of wire with sides a and b . The density of turns in the solenoid is n . There is a time dependent current $I(t)$ in the wire loop.



What Electro Motive Force is between the ends of the solenoid? _____

How would this EMF change if we double the side a ? _____

How would this EMF change if we tilt the solenoid to the angle ϕ with respect to the vertical? _____

What charge went through the resistor R , if the current in the wire loop had changed from I_i to I_f during the experiment? _____