Final Exam

P202 Spring 2007,

Instructor: Prof. Abanov

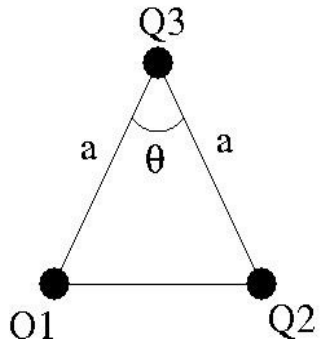
05/09/07

Name_____ Section_____

(print)

Your grade:

Problem 1.



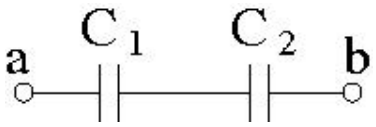
Three charges Q1, Q2, and Q3 are positioned in the corners of a triangle whose side measures a=0.5m and angle $\theta = 60°$
Q1=Q2=+3.0mC and Q3= +1.0mC. The mass of charge Q3 is M=10g. At initial time the charge Q3 is released.

What is initial acceleration of the charge Q3?_____

What is the velocity of the charge Q3 at infinity?_____

What would the velocity at infinity be if charge Q3 started from midpoint between charges Q1 and Q2?_____

Problem 2.



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=10Volts.

What is the total capacitance of the system?_____

What is the charge Q_1 on capacitor C_1 ?_____

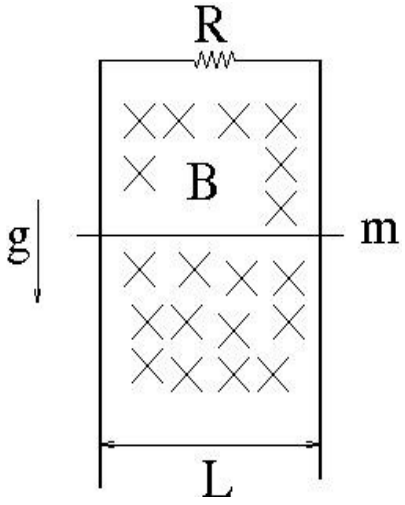
What is the charge Q_2 on capacitor C_2 ?_____

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 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 a constant velocity.



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

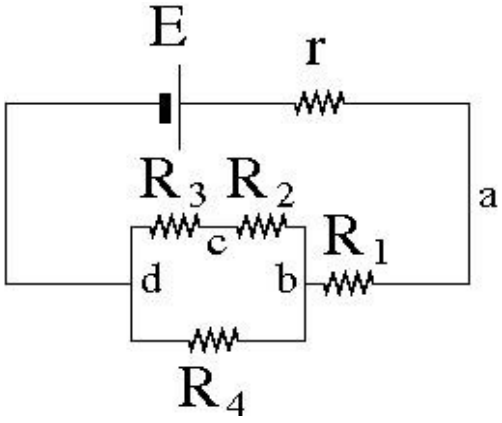
What is the direction of the magnetic force acting on the bar?(show on the figure)

What is the velocity of the bar?_____

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

Problem 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?_____

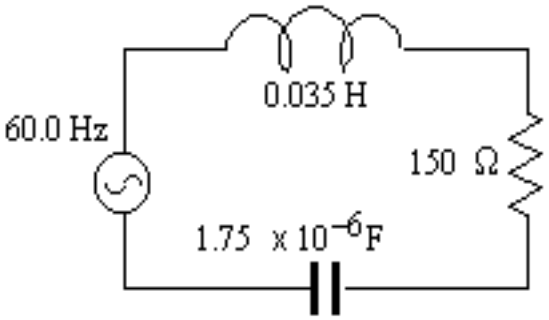
What is the potential difference between points b and d?_____

What is the the current at point c?_____

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

Problem 5.

The series RCL circuit is given on the figure.
The source supplies $2V$.



What is the current in the circuit?_____

What is the phase angle between the current and the voltage?_____

What is the voltage drop on the Inductor?_____

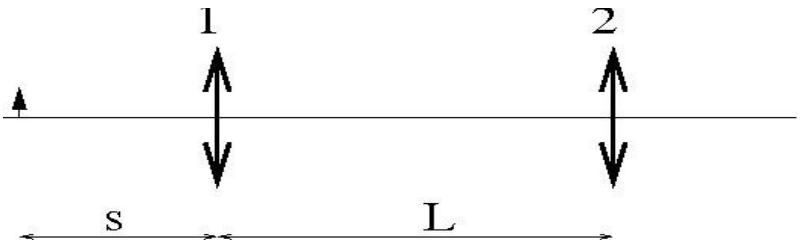
What is the the voltage drop on the capacitor?_____

What is the voltage drop on the resistor?_____

What is the resonance frequency of the circuit?_____

Problem 6.

The object is s=30cm from the first lens. The distance between lenses is L=50cm. The focal length of the first lens is $f_1 = 10\text{cm}$ and of the second lens it is $f_2 = 20\text{cm}$.



What is the distance between the first lens and the first image?_____

What is the distance between the second lens and the final image?_____

What is the magnification of the first length?_____

What is the magnification of the second lens?_____

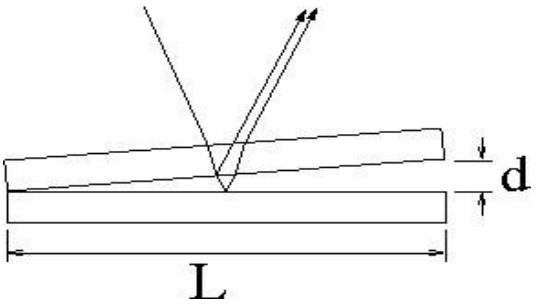
What is the final magnification?_____

Is the final image virtual?_____

Is the final image inverted?_____

Problem 7.

Two microscopic slides L=10cm long are in contact at one end and are separated by a piece of paper d=0.020mm thick at the other. The monochromatic light with $\lambda = 500\text{nm}$ is used.



Is the fringe at the line of contact bright or dark?_____

What is the separation between the dark interference fringes?_____

If we want to double the separation between the dark interference fringes what wavelength of light should we use?_____

Problem 8.

When ultraviolet light with $\lambda = 400.0\text{nm}$ falls on a certain metal surface, the maximum kinetic energy of the emitted photoelectrons is measured to be 1.10eV.

What is the maximum kinetic energy of the photoelectrons when light of wavelength 300.0nm falls on the same surface?_____

What is the maximum kinetic energy of the photoelectrons when light of wavelength 830.0nm falls on the same surface?_____

Problem 9.

Calculate the binding energy (in MeV) of

$._{26}^{56}Fe$ **(atomic mass 55.934937u)_____. What is the binding energy per nucleon?____**

$._{82}^{207}Pb$ **(atomic mass 206.975897)_____. What is the binding energy per nucleon?____**

Problem 10.

A 12.0g sample of $._{}^{149}Sm$ is observed to decay at a rate of 2.65 Bq.

How many nuclei are in this sample?_____

What is $\Delta N/\Delta t$ for this sample?_____

What is the half-life of this isotope, in years?_____