

Exam 3

**P202 Spring 2009,
Instructor: Prof. Abanov**

04/02/09

Name_____

Section_____

(print)

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

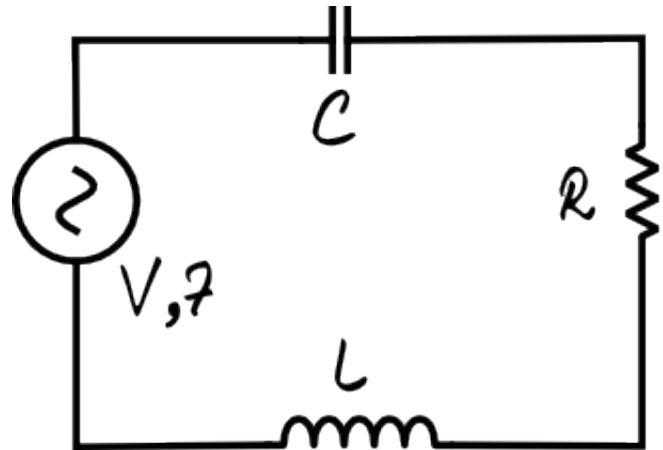
518 Labs at 01:50-04:40 pm, TA: Jianping Xiao

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

Your grade:

Problem 1.

The series RCL circuit is given on the figure. The source supplies alternating voltage with amplitude $V=3V$, and frequency $f=150\text{Hz}$. The capacitance of the capacitor is $C=2.5\text{mF}$ and inductance of the inductor is $L=10\text{mH}$ and the resistance $R=10\Omega$.



What is the amplitude of the current in the circuit? _____

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

What average power is supplied by the source? _____

**What average power is dissipating on the capacitor and inductor?
_____, _____**

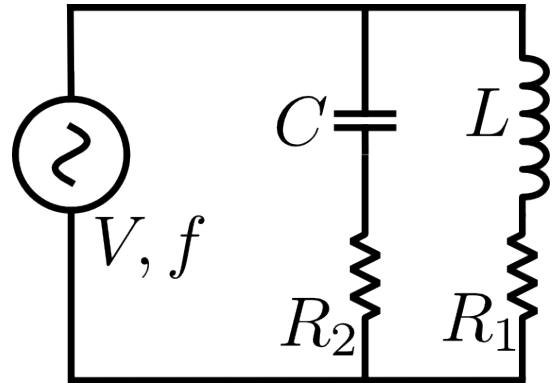
What average power is dissipating on the resistor? _____

What is the resonance frequency of the circuit? _____

Problem 2.

In the circuit shown in the drawing, the generator supplies the same amount of rms voltage $V_{rms}=15V$ at either very small or very large frequencies.

The resistance of the resistors are $R_1=5k\Omega$,
 $R_2=3k\Omega$.



What current is supplied by the source at very small frequency? _____

What power is supplied by the source at very small frequency? _____

What current is supplied by the source at very large frequency? _____

What power is supplied by the source at very large frequency? _____

Problem 3.

A radio station broadcasts at a frequency 630kHz . At some point the magnetic field amplitude of the electromagnetic wave is $6 \times 10^{-11}\text{T}$.

What is the wavelength of the electromagnetic wave?_____

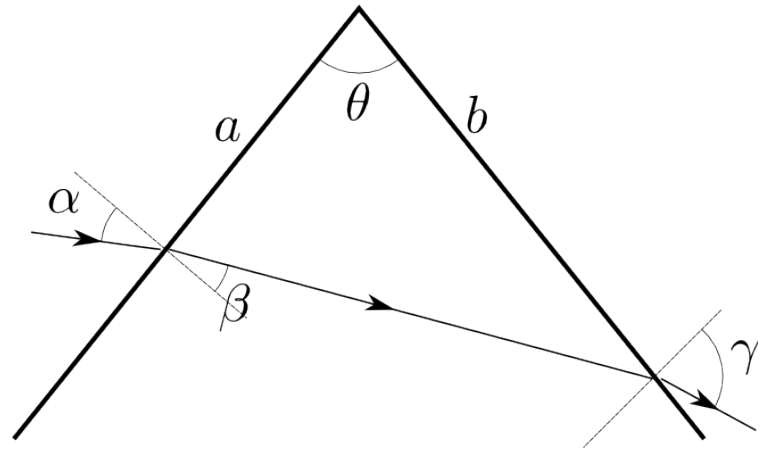
What is the angular frequency of the electromagnetic wave?_____

What is the electric field magnitude of the electromagnetic wave?_____

What is the energy density of the electromagnetic wave at this point?_____

Problem 4.

A ray of light enters a glass angle ($\theta=60^\circ$) with $n_g=1.33$ from the side **a** at the angle $\alpha=41.68^\circ$

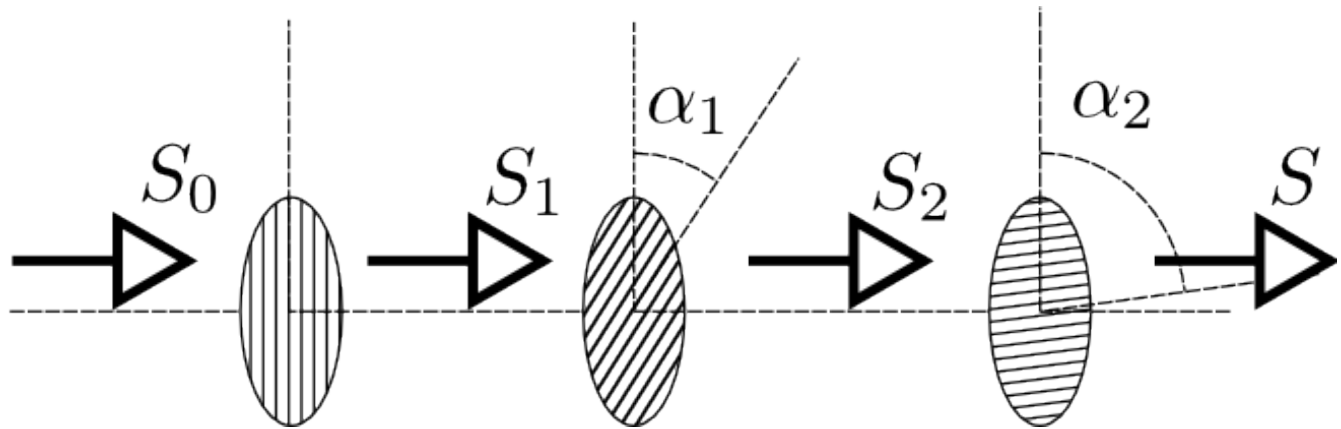


What is angle β ? _____

What is the angle γ ? _____

What must α be in order for the ray not to go through the side b?

Problem 5.



An unpolarized beam of light is incident upon a group of three polarizing sheets which are arranged so that the transmission axis of the sheets are rotated by $\alpha_1=30^\circ$ and $\alpha_2=90^\circ$ with respect to the vertical

What fraction of the incident intensity S_0 passes through the first polarizer? _____

What fraction of the incident intensity S_0 passes through the second polarizer? _____

What fraction of the incident intensity S_0 is transmitted? _____

Problem 6.

An object is placed 30.0 cm from a concave spherical mirror with radius of curvature 80.0 cm.

Is the image virtual or real? _____

Is the image inverted? _____

What is the focal length of the mirror? _____

What is the distance from the image to the mirror? _____

What is the magnification? _____

Problem 7.

A diver is under water ($n=1.33$) in a sunny day. He looks up and sees a diving board which appears to be 3m above the water.

What is the real height of the diving board above the water?

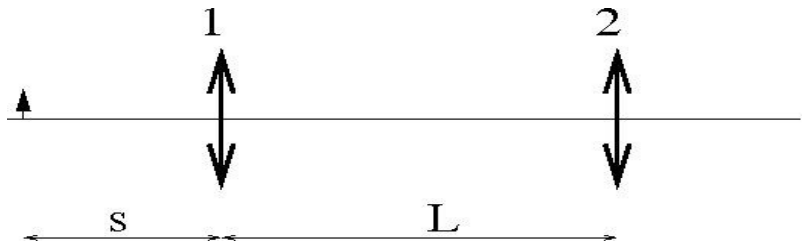
What is the angle of internal reflection?_____

If the diver is 2m under water what is the radius of the bright circle he sees when he looks up?_____

Problem 8.

The object is $s=15\text{cm}$ from the first lens. The distance between lenses is $L=20\text{cm}$. The focal length of the first lens is

$f_1=10\text{cm}$ and of the second lens it is $f_2=5\text{cm}$.



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 lens? _____

What is the magnification of the second lens? _____

What is the final magnification? _____

Is the final image virtual? _____

Is the final image inverted? _____

Problem 9.

A telescope with the angular magnification 100 has an eye piece lens with focal length 5cm.

What is the focal length of the objective?_____

What is the the distance between objective lens and the eyepiece?_____

Problem 10.

A far sighted person has a near point at 2m. (A healthy person has a near point at 25cm)

Does he need convergent or divergent lenses for his glasses?_____

What should be the focal length of his glasses?_____

What is the power of those lenses?_____