PHYS-1200 PHYSICS II QUIZ 2 MARCH 29, 2006

NAME _____

Put a mark in the box next to the section of the course to which you are assigned. If you are not now in the examination room to which your section is assigned, ***GO TO IT NOW*!**

	SECTION NUMBER	**EXAMINATION ROOM**	**INSTRUCTOR**	**DAY AND TIME THAT SECTION MEETS**
	1	SA 3510	SCOTT DWYER	MR 8:00 A.M.
	2	SA 3510	SCOTT DWYER	MR 10:00 A.M.
	3	SA 3303	PAUL STOLER	MR 12:00 NOON.
	5	DCC 324	THOMAS SHANNON	TF 10:00 A.M.
	6	DCC 324	THOMAS SHANNON	TF 12:00 NOON
	7	DCC 330	SHAWN-YU LIN	TF 2:00 P.M.
	8	SA 3303	PAUL STOLER	MR 2:00 P.M.
	9	DCC 330	ANGEL GARCIA	MR 12:00 NOON

There are 8 different pages in this quiz, including the cover page. Check now to see that you have all of them.

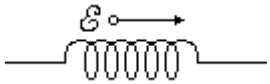
	CREDIT	GRADE
PART A	40%	
PART B	20%	
PART C-1	15%	
PART C-2	25%	
TOTAL	100%	

All work and answers must be given in the spaces provided on these pages.

NAME _____

PART A. (40%) Each question is worth 5%. In the space provided, to the left of the question number, write the letter corresponding to the best answer to the question.

___ 1. The diagram shows an inductor that is part of a circuit. The direction of the emf induced in the the inductor is indicated. Which of the following is possible?



A. The current is constant and directed to the right.
B. The current is constant and directed to the left.
C. The current is increasing in magnitude and directed to the right.
D. The current is increasing in magnitude and directed to the left.
E. None of the above.

___ 2. Two particles are executing simple harmonic motion. If they are to remain in phase with each other, they must have the same:

A. masses.
B. periods.
C. amplitudes.
D. force constants.
E. kinetic energies.

___ 3. In an oscillating *LC* circuit, the current in the inductor is zero when:
A. the charge on the capacitor is zero.
B. the emf in the inductor is zero.
C. the rate of change of current is zero.
D. the emf in the inductor is a maximum.
E. none of the above.

___ 4. A 1.0 ampere current is used to charge a parallel plate capacitor. A large square piece of paper is placed between the plates of the capacitor, and parallel to them, so it sticks out on all sides. (The electric field of the capacitor is perpendicular to the plane of the paper.) The magnitude of the integral $\oint \vec{B} \cdot d\vec{s}$ around the perimeter of the paper is:

A. 2.0 T·m
B. $4\pi \times 10^{-7}$ T·m
C. 8.85×10^{-12} T·m
D. 10^{-7} T·m
E. cannot be determined from the information given.

___ 5. Which of the following equations, along with a symmetry argument, can be used to calculate the electric field produced by a uniform time-varying magnetic field?

A. $\oint \vec{E} \cdot d\vec{A} = \dfrac{q}{\varepsilon_0}$
B. $\oint \vec{B} \cdot d\vec{A} = 0$
C. $\oint \vec{E} \cdot d\vec{s} = -\dfrac{d\Phi_B}{dt}$
D. $\oint \vec{B} \cdot d\vec{s} = \mu_0\left(i + \varepsilon_0 \dfrac{d\Phi_E}{dt}\right)$
E. none of the above

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___ 6. Three separate strings are made of the same material. String 1 has length L and is under tension τ, string 2 has length $2L$ and tension 2τ, and string 3 has length $3L$ and tension 3τ. A pulse is started at one end of each string. If the pulses start at the same time, the order in which they reach the other end is:
A. 1, 2, 3 B. 3, 2, 1 C. 2, 3, 1 D. 3, 1, 2 E. they all take the same time

___ 7. The term "beats" in sound refers to:
A. interference of two waves of the same frequency.
B. interference of two waves of slightly different frequency.
C. reversal of phase of a reflected wave relative to the incident wave.
D. two different media having slightly different sound velocities.
E. the effect of relative motion of source and observer.

___ 8. Which of the following groups of electromagnetic waves of different types is correctly arranged in order of increasing frequency?
A. radio waves, visible light, infra-red, x-rays, ultraviolet
B. radio waves, infra-red, visible light, ultraviolet, x-rays
C. infra-red, radio waves, visible light, ultraviolet, x-rays
D. infra-red, visible light, radio waves, ultraviolet, x-rays
E. radio waves, infra-red, visible light, x-rays, ultraviolet

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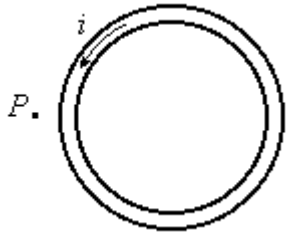
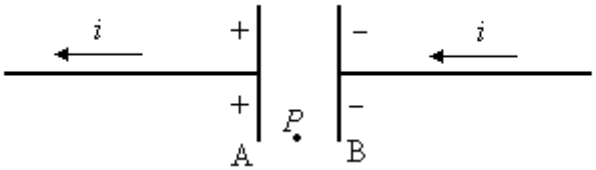
PART B. (20%)

1. (4%) A circular loop of wire carries a current, *i*, in the counterclockwise direction, as shown in the sketch. The current is ***decreasing*** with time. As a result, an ***electric*** field is induced at point *P*. The direction of the induced electric field at point *P* is:
(Circle the correct choice)

TO THE LEFT	**TO THE TOP OF THE PAGE**
TO THE RIGHT	**TO THE BOTTOM OF THE PAGE**
INTO THE PAGE	**SOME OTHER DIRECTION**
OUT OF THE PAGE	**NO DIRECTION, IT IS ZERO**



2. (6%) The figure below shows a parallel plate capacitor with circular plates A and B. Long straight wires, in which a current *i* is flowing, are connected to the centers of the circular plates. The current is discharging the capacitor. The positive charge on plate A and the negative charge on plate B are both decreasing in magnitude.



a) (3%) The direction of the displacement current flowing between the plates of the capacitor is: (Circle the correct choice)

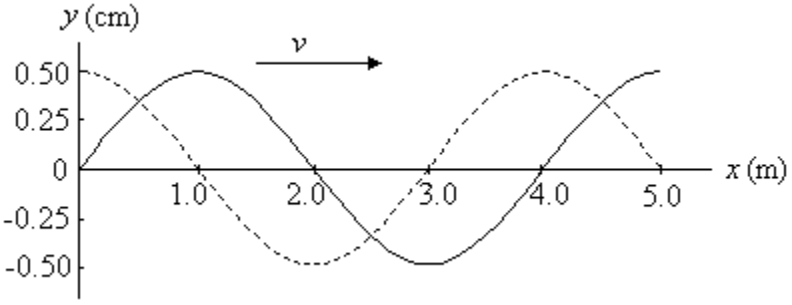
TO THE LEFT	**INTO THE PAGE**	**NO DIRECTION, IT IS ZERO**
TO THE RIGHT	**OUT OF THE PAGE**	**SOME OTHER DIRECTION**

b) (3%) Point *P* in the diagram is below the center of the circular plates. The direction of the magnetic field at point P is: (Circle the correct choice)

TO THE LEFT	**INTO THE PAGE**	**NO DIRECTION, IT IS ZERO**
TO THE RIGHT	**OUT OF THE PAGE**	**SOME OTHER DIRECTION**

NAME _____

3. (10 pts) A transverse sinusoidal wave travels on a very long string in the *positive x* direction. A graph of the displacement of the string as a function of position, x, is given below for two times, $t_1 = 0$ (the dashed curve) and $t_2 = 0.04$ seconds (the solid curve).



a) (4 pts) Find the speed of the wave.

$v =$ _____ _____
units

b) (3 pts) Find the wavelength of the wave.

$\lambda =$ _____ _____
units

b) (3 pts) Find the frequency of the wave.

$f =$ _____ _____
units

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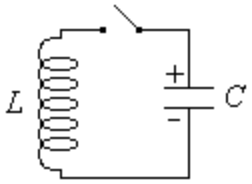
PART C. (40%) You must show all your work or state your reasoning in order to receive credit.

1. (15%) The sketch shows a charged capacitor C, carrying a charge Q, in series with an inductor L, and an open switch. The values of L, C, and Q are given next to the sketch.

$L = 2.0$ mH (2.0×10^{-3} H)
$C = 0.40\ \mu$F (4.0×10^{-7} F)
$Q = 1.5\ \mu$C (1.5×10^{-6} C)



a) (5%) When the switch is closed, the circuit will oscillate. Find the frequency of oscillation

f = _____
units

b) (5%) Find the magnitude of the electromotive force in the inductor immediately after the switch is closed.

$\mathcal{E}$ = _____
units

c) (5%) Find the energy stored in the inductor when the charge on the capacitor has reduced to one half of Q, its initial value.

U_B = _____
units

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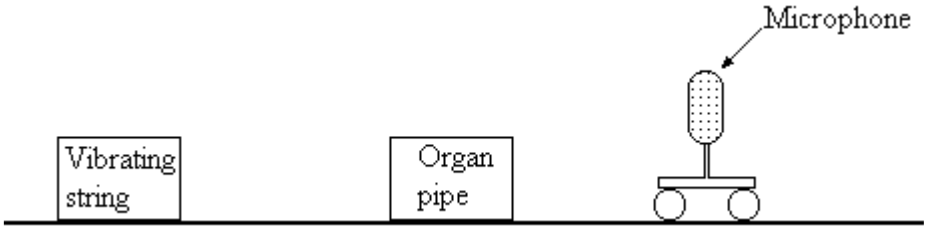
2. (25%) The sketch below shows two sources of sound and a microphone. The box on the left contains a vibrating string, emitting a sound wave of frequency 300 Hz. The box to its right contains an organ pipe, emitting a sound wave of frequency 330 Hz.



a) (5%) When the two waves arrive at the microphone, it detects beats. What is the beat frequency?

f_{beat} =_____
units

b) (5%) The vibrating string is fixed at both ends, and is vibrating in its fundamental mode at 300 Hz. The wave velocity in the string is 600 m/s. How long is the string?

L_{string} = _____
units

c) (5%) The organ pipe is open at both ends, and is oscillating in its fundamental mode at 330 Hz. The wave velocity of sound in air is 343 m/s. How long is the pipe?

L_{pipe} = _____
units

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The microphone is on wheels, and can be moved. If it is moved at the correct velocity, the frequency of the sound from the organ pipe that is detected by the microphone could be reduced to 300 Hz, the frequency of the vibrating string.

d) (3%) In which direction should the microphone be moved, if it is to detect a frequency of 300 Hz from the organ pipe when the organ pipe is emitting a 330 Hz sound wave. (Circle the correct choice.)
TOWARD THE ORGAN PIPE **AWAY FROM THE ORGAN PIPE**
IT CAN'T BE DONE

e) (5%) At what speed should the microphone be moved if it is to detect a frequency of 300 Hz from the organ pipe when the organ pipe is emitting a 330 Hz sound wave. The speed of sound in air is 343 m/s. If you circled **IT CAN'T BE DONE** in the previous question, explain why you made that choice.

v_{mic} = _____
units

f) (2%) If the microphone is moved with the speed and direction calculated in parts d) and e), will it still detect beats? (Circle the correct choice.)
IT WILL DETECT BEATS **IT WILL NOT DETECT BEATS**