

PHYS-1200 PHYSICS II QUIZ 2 NOVEMBER 2, 2005

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	DCC 324	SCOTT DWYER	MR 8:00 A.M.
	2	DCC 324	SCOTT DWYER	MR 10:00 A.M.
	3	DCC 308	HEIDI NEWBERG	MR 10:00 A.M.
	4	DCC 308	THOMAS SHANNON	MR 12:00 NOON.
	5	DCC 330	TIMOTHY HAYES	MR 12:00 NOON.
	6	DCC 308	GARY ADAMS	MR 2:00 P.M.
	7	DCC 308	THOMAS SHANNON	MR 2:00 P.M.
	8	DCC 308	GARY ADAMS	MR 4:00 P.M.
	9	DCC 318	SUSANNE HAUGER	TF 10:00 A.M.
	10	DCC 337	ANGEL GARCIA	TF 12:00 NOON
	11	DCC 318	SUSANNE HAUGER	TF 12:00 NOON
	12	DCC 330	TIMOTHY HAYES	TF 2:00 P.M.

	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.

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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 unit of inductance is the:

- A. Hall
- B. Heisenberg
- C. Helmholtz
- D. Henry
- E. Hertz

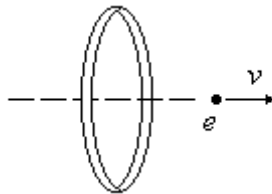
___ 2. When an object undergoes simple harmonic motion, its displacement as a function of time is described by the equation, $x = x_m \cos(\omega t + \phi)$. The frequency of oscillation is related to the quantity ω by the equation:

- A. $f = \pi\omega$
- B. $f = 2\pi\omega$
- C. $f = \frac{\omega}{\pi}$
- D. $f = \frac{\omega}{2\pi}$
- E. $f = \frac{2\omega}{\pi}$

___ 3. In an oscillating *LC* circuit, the charge on the capacitor is a maximum when:

- A. the current in the inductor is a maximum.
- B. the emf in the inductor is a maximum.
- C. the emf in the inductor is zero.
- D. the rate of change of current is zero.
- E. none of the above.

___ 4. An electron has just passed through the center of a circle while moving along the axis of the circle, as shown in the sketch. At the instant shown, in the plane of the circle, directed along the axis of the circle:



- A. there is only a real current
- B. there is only a displacement current
- C. there are both real and displacement currents
- D. there is neither a real nor a displacement current
- E. none of the above

___ 5. Below are Maxwell's equations for free space, where there are no charges or currents.

I. $\oint \vec{E} \cdot d\vec{A} = 0$

III. $\oint \vec{E} \cdot d\vec{s} = -\frac{d\Phi_B}{dt}$

II. $\oint \vec{B} \cdot d\vec{A} = 0$

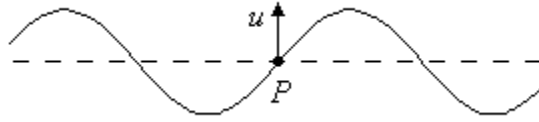
IV. $\oint \vec{B} \cdot d\vec{s} = \mu_0 \epsilon_0 \frac{d\Phi_E}{dt}$

Which equations must be modified if they are to be applied where charges and currents might be present?

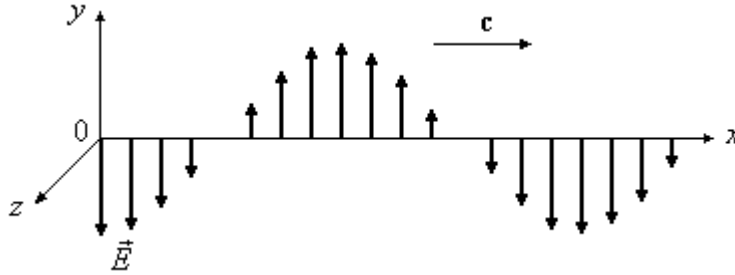
- A. I and II
- B. I and III
- C. I and IV
- D. III and IV
- E. Some other combination.

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- ___ 6. The transverse wave shown below is traveling along a string. The direction of u , the instantaneous velocity of the *string*, at point P is upward, as indicated by the arrow in the sketch. The direction in which the *wave* is traveling on the string is:



- A. \uparrow B. \downarrow C. \rightarrow D. \leftarrow E. some other direction
- ___ 7. The speed of a sound wave is determined by:
- A. its amplitude D. the transmitting medium
B. its wavelength E. none of the above
C. its pitch
- ___ 8. The electric field for a plane electromagnetic wave traveling in the $+x$ direction is shown. The $+z$ direction points out of the page. The direction of the \vec{B} field at $x = 0$, where \vec{E} points in the $-y$ direction, is:

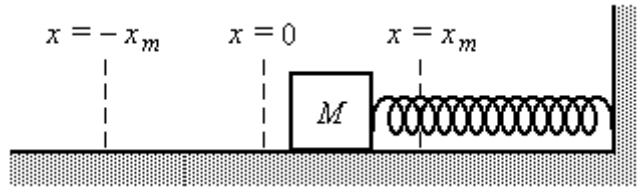


- A. $+y$ B. $-y$ C. $+z$ D. $-z$ E. some other direction

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PART B. (20%)

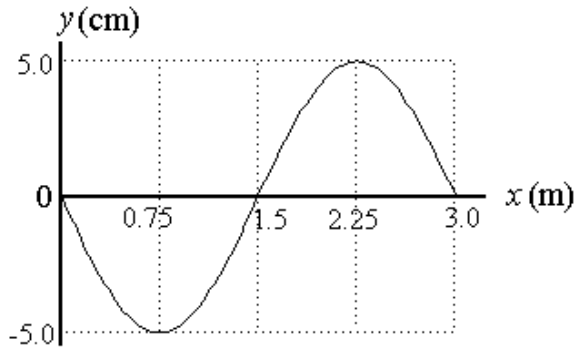
1. (12%) The sketch below shows a block of mass M , on a frictionless horizontal surface, and connected to a spring. The spring is at its equilibrium position when the center of mass of the block is at the spot marked $x = 0$. The block is moving in simple harmonic motion between the limits $x = x_m$ and $x = -x_m$, also marked on the sketch.



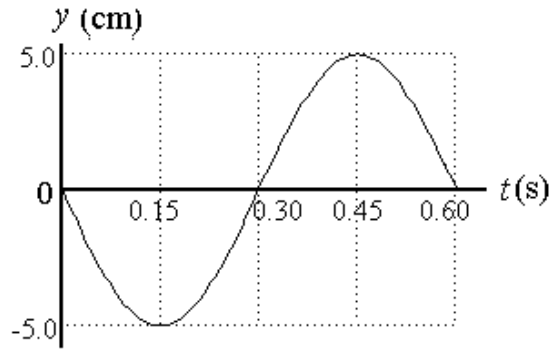
- a) (3%) When the center of mass of the block is at $x = 0$, and the block is moving to the *left*, the direction of the acceleration of the block is: (Circle the correct choice)
- | | |
|---------------------|---------------------------------|
| TO THE LEFT | SOME OTHER DIRECTION |
| TO THE RIGHT | NO DIRECTION, IT IS ZERO |
- b) (3%) When the center of mass of the block is at $x = -x_m$, and the velocity of the block is *zero*, the direction of the acceleration of the block is: (Circle the correct choice)
- | | |
|---------------------|---------------------------------|
| TO THE LEFT | SOME OTHER DIRECTION |
| TO THE RIGHT | NO DIRECTION, IT IS ZERO |
- c) (3%) When the center of mass of the block is at $x = 0$, and the block is moving to the *right*, the direction of the acceleration of the block is: (Circle the correct choice)
- | | |
|---------------------|---------------------------------|
| TO THE LEFT | SOME OTHER DIRECTION |
| TO THE RIGHT | NO DIRECTION, IT IS ZERO |
- d) (3%) When the center of mass of the block is at $x = +x_m$, and the velocity of the block is *zero*, the direction of the acceleration of the block is: (Circle the correct choice)
- | | |
|---------------------|---------------------------------|
| TO THE LEFT | SOME OTHER DIRECTION |
| TO THE RIGHT | NO DIRECTION, IT IS ZERO |

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2. (8%) A traveling wave on a string is shown in the two sketches below.



at $t = 0$



at $x = 0$

The picture on the left shows the displacement of the string as a function of position, x , at time $t = 0$. The picture on the right shows the displacement of the string as a function of time, t , at the position $x = 0$.

a) (2%) What is the wavelength of the wave?

$$\lambda = \underline{\hspace{2cm}} \text{ units}$$

b) (3%) At what speed does the wave travel along the string?

$$v = \underline{\hspace{2cm}} \text{ units}$$

c) (3%) In what direction does the wave move along the string? (Circle the correct answer.)

POSITIVE x DIRECTION;

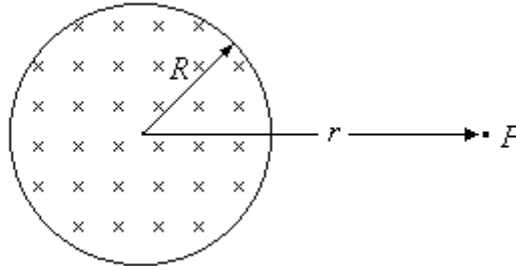
NEGATIVE x DIRECTION;

IMPOSSIBLE TO DETERMINE WITH THE INFORMATION GIVEN.

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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 circular region containing a uniform magnetic field that is directed into the page. The magnetic flux through the region is increasing at the rate $\frac{d\Phi_B}{dt} = 0.15 \text{ V}$.



- a) (5%) Find the rate at which the magnetic field, B , is increasing. The radius of the circular region containing the flux is $R = 0.30 \text{ m}$.

$$\frac{dB}{dt} = \underline{\hspace{10em}} \text{ units}$$

- b) (4%) The changing magnetic field induces an electric field at point P in the sketch. The direction of the induced electric field at P is: (Circle the correct choice.)
- | | |
|------------------------|---------------------------|
| INTO THE PAGE | OUT OF THE PAGE |
| TO THE LEFT | TO THE RIGHT |
| TO THE TOP OF THE PAGE | TO THE BOTTOM OF THE PAGE |
| SOME OTHER DIRECTION | |

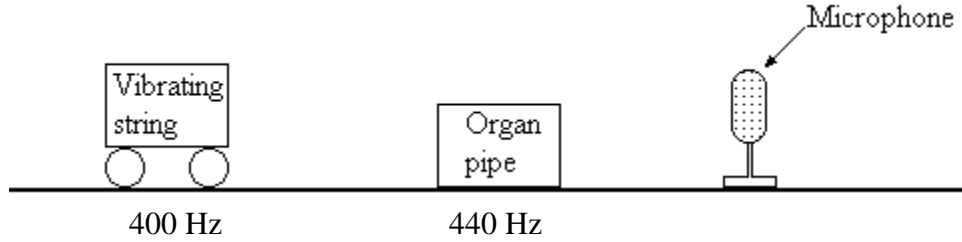
- c) (6%) Find the magnitude of the induced electric field at point P . The distance from the center of the circular region containing the magnetic flux to point P is $r = 0.80 \text{ m}$.

Remember, $\frac{d\Phi_B}{dt} = 0.15 \text{ V}$

$$|E| = \underline{\hspace{10em}} \text{ units}$$

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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 400 Hz. The box to its right contains an organ pipe, emitting a sound wave of frequency 440 Hz.



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

$$f_{beat} = \underline{\hspace{2cm}} \text{ units}$$

- b) (5%) The vibrating string is fixed at both ends, and is vibrating in its fundamental mode at 400 Hz. The wave velocity in the string is 600 m/s. How long is the string?

$$L_{string} = \underline{\hspace{2cm}} \text{ units}$$

- c) (5%) The organ pipe is open at both ends, and is oscillating in its fundamental mode at 440 Hz. The wave velocity of sound in air is 343 m/s. How long is the pipe?

$$L_{pipe} = \underline{\hspace{2cm}} \text{ units}$$

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The box containing the vibrating string is on wheels, and can be moved. If it is moved at the correct velocity, the sound from the moving vibrating string that is detected by the microphone could have the same frequency as the sound from the stationary organ pipe, and no beats would be detected.

- d) (4%) In which direction should the vibrating string be moved if the microphone is to detect a frequency of 440 Hz when the string is vibrating at 400 Hz.

(Circle the correct choice.)

TOWARD THE MICROPHONE

AWAY FROM THE MICROPHONE

IT CAN'T BE DONE

- e) (6%) At what speed should the vibrating string be moved if the microphone is to detect a frequency of 440 Hz when the string is vibrating at 400 Hz. 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.

$v_{string} =$ _____
units