NAME

PHYS-1200 PHYSICS II QUIZ 2 NOVEMBER 2, 2005

SOLUTIONS

PART A.

1. D
2. D
3. B
4. B
5. C
6. D
7. D
8. D

PART B.

1. a) **NO DIRECTION, IT IS ZERO** That is the equilibrium position.

   b) **TO THE RIGHT** Back toward the equilibrium position.

   c) **NO DIRECTION, IT IS ZERO** That is the equilibrium position.

   d) **TO THE LEFT** Back toward the equilibrium position.

2. a) The wavelength can be read directly from the graph on the left. $\underline{\lambda = 3.0\ \text{m}}$

   b) $v = \lambda/T$. λ is known from part a), and from the graph on the right, $T = 0.60$ s. Then,
   $v = (3.0\ \text{m})/(0.60\ \text{s})$ $\underline{v = 5.0\ \text{m/s}}$

   c) NEGATIVE x DIRECTION. The graph on the right shows that the displacement at $x = 0$ becomes negative as time increases from $t = 0$. The graph on the left shows that the negative values of displacement are on the positive side of $x = 0$. Therefore, the displacements on the positive side of $x = 0$ must move toward $x = 0$. The wave moves in the negative x direction.

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PART C.

1. a) $\Phi_B = BA$, so $B = \frac{\Phi_B}{A}$, and $\frac{dB}{dt} = \frac{1}{A}\frac{d\Phi_B}{dt} = \frac{1}{\pi R^2}\frac{d\Phi_B}{dt} = \frac{1}{\pi (0.30\,\text{m})^2} 0.15\,\text{V}$

$$\underline{\frac{dB}{dt} = 0.53\,\text{T/s}} \quad \text{(or V/m}^2\text{)}$$

b) TO THE TOP OF THE PAGE According to Lenz's law, the direction of the induced field will oppose the change that produced it.

c) $\oint \vec{E}\cdot d\vec{s} = -\frac{d\Phi_B}{dt}$, and from symmetry, $E2\pi r = -\frac{d\Phi_B}{dt}$, so $E = -\frac{1}{2\pi r}\frac{d\Phi_B}{dt}$. Since the problem asks for the magnitude, $|E| = \frac{1}{2\pi r}\left|\frac{d\Phi_B}{dt}\right| = \frac{1}{2\pi (0.80\,\text{m})} 0.15\,\text{V}$

$$\underline{|E| = 3.0\times 10^{-2}\ \text{V/m}} = 30\,\text{mV/m}$$

2. a) $f_{beat} = \Delta f = 440\ \text{Hz} - 400\ \text{Hz}$ $\qquad \underline{f_{beat} = 40\ \text{Hz}}$

b) At the fundamental frequency, $L_{string} = \frac{\lambda}{2} = \frac{v}{2f} = \frac{600\,\text{m/s}}{2(400\,\text{Hz})}$ $\qquad \underline{L_{string} = 0.75\ \text{m}}$

c) At the fundamental frequency, $L_{pipe} = \frac{\lambda}{2} = \frac{v}{2f} = \frac{343\,\text{m/s}}{2(440\,\text{Hz})}$ $\qquad \underline{L_{pipe} = 0.39\ \text{m}}$

d) **TOWARD THE MICROPHONE** The source must approach the detector to result in a higher frequency.

e) For a moving source $f' = f\frac{v}{v - v_{string}}$. Then, $v - v_{string} = \frac{f}{f'}v$, and

$v_{string} = \left(1 - \frac{f}{f'}\right)v = \left(1 - \frac{400\,\text{Hz}}{440\,\text{Hz}}\right)(343\,\text{m/s})$ $\qquad \underline{v_{string} = 31\ \text{m/s}}$