Practice Midterm 1

written response

1. Briefly explain why the Doppler formula can not be correct in general. Why do we learn incorrect equations?

partial credit questions

2. A string is kept under tension by attaching a weight of mass M to one end and hanging it over a massless pulley. If the mass M is doubled what happens to the fundamental frequency of oscillation of the string? What happens to it if 1/2 of the mass is immersed in syrop. Assume that the density of the syrop is 30

3. Two charges with $q = +4\mu C$ are placed at $\pm 2cm$ from the y-axis. A third charge with $q = -6nC$ is placed 6 cm up the positive y-axis. Determine the magnitude and direction of the total force on the third charge.

multiple choice questions

4. You hear a sound with a wavelength of 30 cm. Assuming that the speed of sound is 343 m/s, what is the frequency of the sound wave?

a. 10300 Hz
b. 114300 Hz
c. 103 Hz
d. 1143 Hz

5. If the air temperature is doubled in the above example what happens to the wavelength and the frequency? Assume air is an ideal gas.

a. wavelength doubles, frequency stays the same
b. wavelength goes up by $\sqrt{2}$, frequency stays the same
c. wavelength goes up by $\sqrt{2}$, frequency goes up by $\sqrt{2}$
d. wavelength stays the same, frequency goes up by 2
e. wavelength stays the same, frequency goes up by $\sqrt{2}$

6. Use Gauss's Law to determine the electric field at a radius r from the axis of a hollow conductor of charge λ C/m. The tube has radius a and you should take $r > a$.

a.

$$\frac{\lambda}{4\pi\epsilon_0 r^2}$$

b.

$$\frac{\lambda}{2\pi\epsilon_0 r}$$

c.

$$\frac{\lambda}{\epsilon_0}$$

d.

$$\frac{\lambda a^2}{4\pi r^3}$$

7. Two microphones pick up a sound wave and transmit the sound to a speaker in the lab. One of the microphones is thrown towards to the sound source at 10 m/s. If the speed of sound is 343 m/s and the source frequency is 1200 Hz, what beat frequency is heard in the lab?

a. 25 Hz
b. 1235 Hz
c. 50 Hz
d. 35 Hz

8. A 5000 Hz tone is produced by a speaker which is moving towards a wall at 43 m/s. The wall has a hole of diameter 10 cm in it. What is the diffraction angle of the wave as it passes through the hole? Use $v = 343$ m/s for the speed of sound.

a. 11 deg

b. 23 deg
c. 47 deg
d. 57 deg

equations

$v = \lambda f$ $v = \sqrt{TL/m}$ $v = \sqrt{B_{ad}/\rho}$ $v = \sqrt{Y/\rho}$

$y = A\sin(2\pi ft \pm 2\pi x/\lambda)$ $I = P/A$ $\beta = (10db)\log(I/I_0)$

$f_o = f_s\frac{v \pm v_o}{\mp v_s}$ $\sin\theta = \lambda/D$ $\sin\theta = 1.22\lambda/D$ $f_n = \frac{nv}{2L}$

$F = \frac{|q_1||q_2|}{4\pi\epsilon_0 r^2}$ $\epsilon_0 = 8.85 \cdot 10^{-12}$ $|q_e| = 1.6 \cdot 10^{-19}\text{C}$

$E = F/q_0$ $E = \sigma/\epsilon_0$ $\Phi_E = \int E\cos\phi dA = Q/\epsilon_0$