PHY 201 Quiz #10 **Name** _____

Score _____

Instructions:
1. Do all of your work on this sheet.
2. **Show all of your steps** in problems for full credit.
3. **Be clear and neat** in your work. Any illegible work, or scribbling in the margins, will not be graded.
4. Place your **answers in a box**. Do not forget **units**!
5. If you need more space, you may use the back of the page and write **On back** in the problem space.

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1. **Multiple Guess (3 pts)** Find the answer which best fits the question and write it in the space provided.

a. In transverse wave motion
a) the direction of particle displacement is parallel to the direction of wave motion b) the vibrating particles move in circles c) the energy carried by each particle is not transmitted to adjacent particles d) the direction of particle displacement is perpendicular to the direction of wave motion

d

b. The superposition of waves which produces a composite wave of greater amplitude than any of the individual waves is
a) constructive interference b) destructive interference
c) reflection d) harmonic motion

a

c. If the sound level is increased by 10 dB, the intensity increases by a factor of
a) 2. b) 5. c) 10. d) 20. e) 100.

C

2. **Definition/Principle (3 pts)**
a. Give exact expressions for the following:
i. Fahrenheit Temperature T_F in terms of Celsius Temperature T_c.

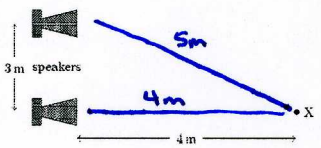
$T_F = \frac{9}{5}T_c + 32$

ii. The Mechanical Equivalent of Heat. 1.0 cal = 4.186 J

b. The intensity of sound is $45 W/m^2$ 2.0 meters from a source. What is the intensity 6.0 meters from the source?

$45 \cdot (\frac{2}{6})^2 = 5 W/m^2$

Bonus: Two small identical speakers are connected (in phase) to the same source. An observer stands at X. Find the largest wavelength needed so that the sound at X is least intense.



$\frac{\Delta L}{\lambda} = \frac{1}{2}$ $\Delta L = 5-4 = 1m$

$\lambda = 2\Delta L = 2m$

Who's picture all over Dr. Herman's Office? _____

3. **Problems (14 pts)** .
a. A string held firmly at its two ends is found to resonate at 175 Hz and 210 Hz. What is the fundamental frequency and the harmonic frequencies less than 175 Hz?

$f_1 = 210-175 = 35Hz$

$\{35, 70, 105, 140\}$

b. A 30.0 cm long piece of wire lengthens 1.62 mm when heated from 20°C to 300°C. What is the coefficient of linear thermal expansion for the material of the wire?

$\alpha = \frac{\Delta L}{L_0 \Delta T} = \frac{1.62\times10^{-3}}{.3(280)} = 1.93\times10^{-5}(°C)^{-1}$

c. (6 pts) $y(x,t) = 5.00\sin(6.28x - 9.42t)$ describes a wave, where x is in meters, y is in centimeters, and t is in seconds. Find the
i. amplitude 5.00 cm

ii. wavelength $\lambda = \frac{2\pi}{k}$ 1.00 m

iii. wave speed $v = \frac{\omega}{k}$ 1.50 m/s

iv. transverse speed of the string at $x = 0.50$ m and $t = 1.00$ s.

$\frac{dy}{dt} = 47.1\cos(6.28(.5) - 9.42) = 46.8 cm/s$

v. If the wave is along a string of mass 5.0 g and length 1.20 m, then what is the tension in the string?

$v = \sqrt{\frac{T}{\mu}} \Rightarrow T = \mu v^2 = \frac{.005}{1.2}(1.5)^2 = 9.4\times10^{-3} N$

d. Find the third harmonic for a 0.85 m long organ pipe with one end closed, assuming the air temperature is 25 °C.

$f_3 = \frac{3v}{4L} = \frac{3(346)}{4(.85)} = 305 Hz$

$v = 331 + 0.6T_c = 346 m/s$

e. A cup contains 150 g of coffee at 90 °C. What mass m of ice at 0 °C must be added to change the coffee temperature to 70 °C? Neglect the heat flow to the coffee cup and assume that the coffee has the properties of water.

$mc\Delta T = mL + mc\Delta T$

$20(150) = 80m + 70m = 150m$

$m = 20g$

Constants: Water: $L_f = 80$ cal/g $L_v = 540$ cal/g