EXAM 3 PHYS 103 FALL 2011

Waves: $v = \lambda \cdot f$ linear mass: $\mu = \frac{m}{L}$ $v = \sqrt{\frac{F}{\mu}} = \sqrt{\frac{Tension}{\mu}}$

sound: $v = 343$ m/s $v = 331$ m/s $\sqrt{\frac{T}{273\ K}}$

$I_0 = 10^{-12}$ W/m^2 $I = \frac{E}{t \cdot A}$ $I = \frac{P}{4\pi R^2}$ $\beta = 10\text{dB} \log \frac{I}{I_0}$ $\beta_2 - \beta_1 = 10\text{dB} \log \frac{I_2}{I_1}$ $f = f_0 \frac{v_{sound} \pm v_d}{v_{sound} \mp v_s}$

standing waves: on string and in open pipe at both ends: $n = 1, 2, 3.,$ $f = \frac{v}{2L} n$ $\lambda = \frac{2L}{n}$

in pipe closed at one end: $n = 1, 3, 5, \ldots$ $f = \frac{v}{4L} n$ $\lambda = \frac{4L}{n}$

interference: constructive: $d_2 - d_1 = n\lambda$ $f = \frac{v}{d_2 - d_1} n$ destructive: $d_2 - d_1 = (n+½)\lambda$ $f = \frac{v}{d_2 - d_1} (n+½)$

Electric charge: $q = Ne$ $F = k \frac{q_1 q_2}{r^2}$ $E = k \frac{q}{r^2}$ $F = qE$ $qE = ma$

$k = 8.99 \times 10^9$ Nm^2/C^2 $e = 1.6 \times 10^{-19}$ C $m_e = 9.11 \times 10^{-31}$ kg Circuits: $R = \rho \frac{L}{A}$;

$R = R_0[1 + \alpha(T - T_0)]$; $V = I*R$ $I = \frac{\Delta q}{\Delta t} = \frac{Ne}{t}$; $Q = mc\Delta T$ $P = \frac{E}{\Delta t}$ $P = I^2R$

$P = \frac{V^2}{R}$ $P = I*V$; in series : $R_{eq} = R_1 + R_2 + \ldots + R_n$ in parallel: $1/R_{eq} = 1/R_1 + 1/R_2 + \ldots + 1/R_n$

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NAME_____

Honors Code Pledge: As an NJIT student I _____, pledge to comply with the provisions of the NJIT Academic Honor Code. I assert that I have not violated the NJIT Academic Honor Code.

1. A sound wave in air has a frequency of 500 Hz and a wavelength of 0.68 m. What is the air temperature?
a. –18°C
b. 0°C
c. 15°C
d. 27°C
e. – 8°C

2. What is the intensity of a sound with a measured intensity level of 84 dB? ($I_0 = 10^{-12}$ W/m^2)

a. 8.4×10^{-3} W/m^2
b. 2.5×10^{-4} W/m^2
c. 1.2×10^{-5} W/m^2
d. 7.4×10^{-4} W/m^2
e. 0.4×10^{-3} W/m^2

23. What sound level change corresponds to a factor of two change in intensity?

a. 0.5 dB
b. 2 dB
c. 3 dB
d. 5 dB
e. 8 dB

4. A sound source of frequency 1 000 Hz moves at 50.0 m/s toward a listener who is at rest. What is the apparent frequency heard by the listener? (speed of sound = 340 m/s)

a. 553 Hz
b. 872 Hz
c. 2 150 Hz
d. 1 170 Hz
e. 1 450 Hz

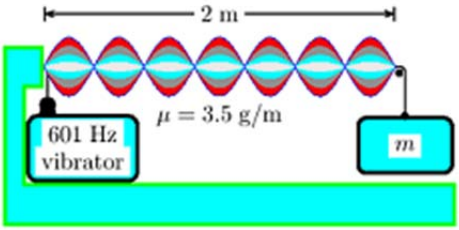
5. An open pipe shown resonates at 1080 Hz. What is the length of the pipe? Speed of the sound is 343 m/s

a. 48 cm
b. 61 cm
c. 15 cm
d. 88 cm
e. 24 cm

6. . A violin string 15.0 cm long and fixed at both ends oscillates in its n=1 mode. The speed of the waves on the string is 240 m/s and the speed of the sound in air is 343 m/s. The wavelength of the emitted sound wave is closest to

a. 0.002 m
b. 0.082 m
c. 0.170 m
d. 0.246 m
e. 0.430 m

7. A 2-m long string of linear mass 3.5 g/m vibrates with a frequency of 601 Hz according to pattern shown in the figure below. Find the mass of the hanging block.



a.5 kg
b. 12 kg
c. 18 kg
d. 25 kg
e. 36 kg

8. A metallic object holds a charge of -3.8×10^{-6} C. What total number of electrons does this represent? ($e = 1.6 \times 10^{-19}$ C is the magnitude of the electronic charge.)

a. 4.2×10^{14}
b. 6.1×10^{13}
c. 2.4×10^{13}
d. 1.6×10^{14}

9. An electron with a charge value of 1.6×10^{-19} C is moving in the presence of an electric field of 400 N/C. What force does the electron experience?

a. 2.3×10^{-22} N
b. 1.9×10^{-21} N
c. 6.4×10^{-17} N
d. 4.9×10^{-17} N
e. 1.2×10^{-15} N

10. In x-ray machines, electrons are subjected to electric fields as great as 6.0×10^{5} N/C. Find an electron's acceleration in this field. ($m_e = 9.11 \times 10^{-31}$ kg, $e = 1.6 \times 10^{-19}$ C)

a. 1.1×10^{17} m/s^2
b. 5.4×10^{13} m/s^2
c. 4.6×10^{10} m/s^2
d. 3.6×10^{8} m/s^2
e. 2.5×10^{15} m/s^2

11. The current in an electron beam in a cathode-ray tube is measured to be 70 μA. How many electrons hit the screen in 5.0 s? ($e = 1.6 \times 10^{-19}$ C)

a. 2.2×10^{11} electrons
b. 8.8×10^{13} electrons
c. 2.2×10^{15} electrons
d. 8.8×10^{18} electrons
e. 2.2×10^{14} electrons

12. Number 10 copper wire (radius = 1.3 mm) is commonly used for electrical installations in homes. What is the voltage drop in 40 m of #10 copper wire if it carries a current of 10 A? (The resistivity of copper is 1.7×10^{-8} Ω·m.)

a. 1.3 V
b. 0.77 V
c. 0.50 V
d. 0.13 V
e. 2.2 V

13. If a 500-W heater carries a current of 4.00 A, what is the resistance of the heating element?

a. 85.7 Ω
b. 42.8 Ω
c. 31.3 Ω
d. 11.2 Ω
e. 65.0 Ω

14. An electric clothes dryer draws 15 A at 220 V. If the clothes put into the dryer have a mass of 7.0 kg when wet and 4.0 kg dry, how long does it take to dry the clothes? (Assume all heat energy goes into vaporizing water, $L_v = 2.26 \times 10^6$ J/kg).

a. 55 min
b. 34 min
c. 20 min
d. 16 min
e. 5 min

15. A water pump draws about 3.8 A when connected to 240 V. What is the cost (with electrical energy at 9 cents per kWh) of running the pump for 10 h?

a. 8.0 cents
b. 15 cents
c. 82 cents
d. 95 cents
e. 28 cents

16. A solar panel measures 80 cm × 50 cm. In direct sunlight, the panel delivers 3.2 A at 15 V. If the intensity of sunlight is 1 000 W/m^2, what is the efficiency of the solar panel in converting solar energy into electrical energy?

a. 24%
b. 18%
c. 12%
d. 6.0%
e. 2.0%

17. Resistors of values 8.0 Ω, 12.0 Ω, and 24.0 Ω are connected in series across a 110 V battery . What is the power dissipated in the 12.0 Ω resistor ?

a. 75 W
b. 55 W
c. 35 W
d. 15 W
e. 0. 5 W