First major (T-002)

(1)Q0 The power transmitted by a sinusoidal wave on a string does not
002Q0 depend on:
17 Q0
   Q0
   A1 the length of the string.
   A2 the frequency of the wave.
   A3 the wavelength of the wave.
   A4 the tension in the string.
   A5 the amplitude of the wave.
   Q0
(2)Q0 A sinusoidal wave is described as:
002Q0
17 Q0   y = (0.1 m) * sin[10*pi*(x/5 + t - 3/2)],
991Q0
   Q0 where x is in meters and t is in seconds. What are
   Q0 the values of its frequency(f), and its velocity(v)?

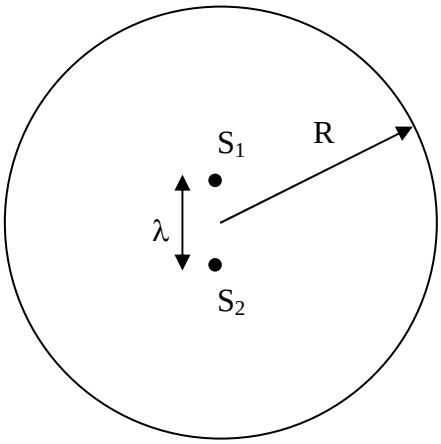
   Q0
   A1 f=5 Hz, v = 5 m/s moving in -x-direction.
   A2 f=5 Hz, v = 5 m/s moving in +x-direction.
   A3 f=5 Hz, v = 1 m/s moving in -x-direction.
   A4 f=5 Hz, v = 1 m/s moving in +x-direction.
   A5 f=2 Hz, v = 5 m/s moving in -x-direction.
   Q0
(3)Q0 A 100-Hz oscillator is used to generate a sinusoidal wave, on a
002Q0 string, of wavelength 10 cm. When the tension in the string is
17 Q0 doubled, the oscillator produces a wave with a frequency and
   Q0 wavelength of:
   Q0
   A1 100 Hz and 14 cm.
   A2 200 Hz and 20 cm.
   A3 200 Hz and 14 cm.
   A4 100 Hz and 20 cm.
   A5 50 Hz and 14 cm.
   Q0
(4)Q0 The lowest resonant frequency, in a certain string clamped
002Q0 at both ends, is 50 Hz. When the string is clamped at its
 17Q0 midpoint, the lowest resonant frequency is:
   Q0
   A1 100 Hz.
   A2 150 Hz.
   A3 200 Hz.
   A4 250 Hz.
   A5 50 Hz.
   Q0
(5)Q0 The equation for a standing wave is given by:
17 Q0   y = 4.00*10**(-3) sin(2.09 x) cos(60.0 t) (SI units).
992Q0 What is the distance between two consecutive antinodes?
002Q0
   A1 1.50 m.
   A2 0.56 m.
   A3 2.20 m.
   A4 5.00 m.
   A5 3.00 m.
   Q0

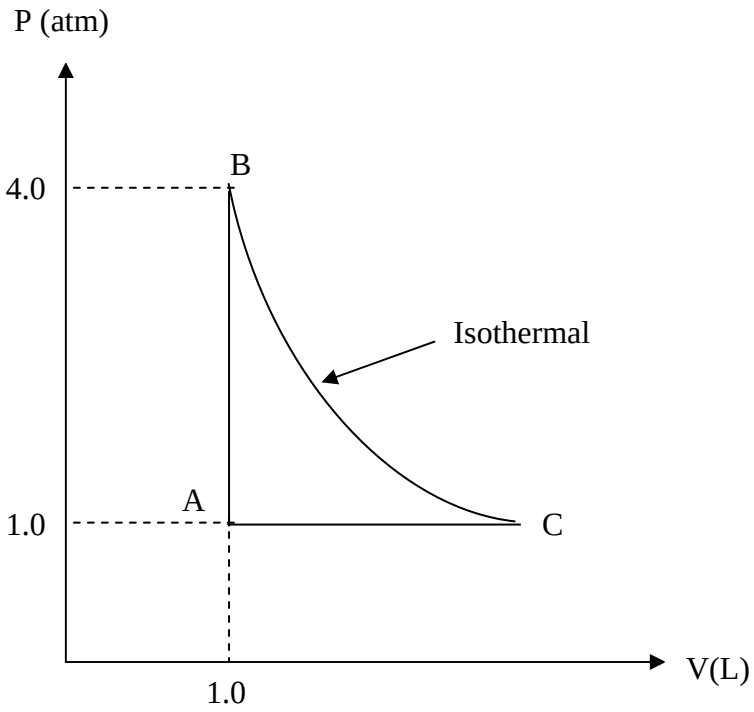
06 Q0 Two transmitters, S1 and S2 in figure (1), emit sound waves of
18 Q0 wavelength lambda. The transmitters are separated by a distance
002Q0 lambda. Consider a big circle of radius R with center halfway
Q0 between these transmitters. How many interference minima (i.e.
Q0 completely silent positions) are there on this big circle?
Q0
A1 4.
A2 6.
A3 2.
A4 5.
A5 1.
Q0
07 Q0 A man strikes a long steel rod at one end. Another man, at the
18 Q0 other end with his ear close to the rod, hears the sound of the
002Q0 of the blow twice (one through air and once through the rod),
Q0 with a 0.1 seconds interval between. How long is the rod?
Q0 [For the steel, the bulk modulus = 2.1*10**11 Pa, and the
Q0 density = 7.0*10**3 kg/m**3. Speed of sound in air = 340 m/s.]
Q0
A1 36 m.
A2 34 m.
A3 42 m.
A4 40 m.
A5 44 m.
Q0
(8)Q0 If two successive frequencies of a pipe, closed at one end and
18Q0 filled by air, are 500 Hz and 700 Hz, the length of the pipe is:
002Q0 [speed of sound in air = 340 m/s].
Q0
A1 0.85 m.
A2 1.70 m.
A3 0.43 m.
A4 3.40 m.
A5 0.18 m.
Q0
(9)Q0 If the distance from a source of sound increases by 1 meter, the
18 Q0 sound level is decreased by 2 dB. Assume the loudspeaker that is
Q0 emitting this sound emits sound in all directions. The original
002Q0 distance from the sound source is:
Q0
A1 3.86 m.
A2 1.93 m.
A3 7.72 m.
A4 9.93 m.
A5 12.0 m.
Q0
10 Q0 An ambulance siren emits a sound of frequency 1.60 kHz. A
18 Q0 person running with a speed of 2.50 m/s hears a frequency of
992Q0 1.70 kHz as the ambulance approaches him from the back. How
002Q0 fast is the ambulance moving? (speed of sound is 340 m/s).
Q0
A1 22.4 m/s.
A2 17.7 m/s.
A3 12.2 m/s.
A4 25.6 m/s.
A5 2.50 m/s.
Q0

11 Q0 In a constant-volume gas thermometer, the pressure is 0.019
19 Q0 atm at 100 degrees Celsius. Find the temperature when the
991Q0 pressure is 0.027 atm.
002Q0
   A1 257 degrees Celsius.
   A2 531 degrees Celsius.
   A3 340 degrees Celsius.
   A4 321 degrees Celsius.
   A5 132 degrees Celsius.
   Q0
 12Q0 A 100 g of water at 100 degrees Celsius is added to a 20-g
19 Q0 aluminum cup containing 50 g of water at 20 degrees Celsius.
002Q0 What is the equilibrium temperature of the system?
   Q0 The specific heat of aluminum is 900 J/(kg*K) and the specific
   Q0 heat of water is 4186 J/(kg*K).
   Q0
   A1 72 degrees Celsius.
   A2 63 degrees Celsius.
   A3 14 degrees Celsius.
   A4 55 degrees Celsius.
   A5 95 degrees Celsius.
   Q0
13 Q0 A solid aluminum rod, of length 1.60 m and cross-sectional area
19 Q0 of 3.14*10**(-4) m**2, has one end in boiling water and the
002Q0 other end in ice. How much ice melts in one minute?
   Q0 [The thermal conductivity of aluminum is 205 Watts/(m*K)
   Q0 and the heat of fusion of water is 3.35*10**5 J/kg.]
   Q0 (neglect any heat loss, by the system, to the surrounding)
   Q0
   A1 7.2*10**(-4) kg.
   A2 7.9*10**(-2) kg.
   A3 6.3*10**(-4) kg.
   A4 5.8*10**(-4) kg.
   A5 3.2*10**(-3) kg.
   Q0
 14Q0 An iron ball has a diameter of 6.0 cm and is 0.01 mm too large
19 Q0 to pass through a hole in a brass ring when both are at a
002Q0 temperature of 30 degrees Celsius. To what temperature should
   Q0 the brass ring be heated so that the ball just passes through
   Q0 the hole? [The coefficient of volume expansion of
   Q0 iron = 3.6*10**(-5) K**-1 and of brass = 5.7*10**(-5) K**-1]
   Q0
   A1 39 degrees Celsius.
   A2 59 degrees Celsius.
   A3 47 degrees Celsius.
   A4 52 degrees Celsius.
   A5 32 degrees Celsius.
   Q0
 15Q0 5 moles of hydrogen gas occupy a balloon that is inflated to a
20 Q0 volume of 0.3 m**3 and at 1.0 atmospheric pressure. What is the
002Q0 root-mean square velocity of the molecules inside the balloon?
   Q0 [The mass of hydrogen atom is 1.66*10**(-27) kg].
   Q0
   A1 4.3*10**3 m/s.
   A2 3.4*10**2 m/s.
   A3 3.0*10**9 m/s.
   A4 2.2*10**3 m/s.

A5 1.3*10**3 m/s.
Q0
16 Q0 For an ideal gas, which of the following statements is FALSE:
20 Q0
002Q0
Q0
A1 In any cyclic process, the work done by the gas is zero.
A2 In an adiabatic process, no heat enters or leaves the system.
A3 In an isothermal process, the work done is equal to heat energy.
A4 In an isothermal process, there is no change in the internal
A4 energy.
A5 In a constant volume process, the work done by the gas is zero.
Q0
17 Q0 Helium gas is heated at constant pressure from 32 degrees
20 Q0 Fahrenheit to 212 degrees Fahrenheit. If the gas does 20.0
002Q0 Joules of work during the process, what is the number of moles?
Q0
A1 0.024 moles.
A2 0.013 moles.
A3 0.200 moles.
A4 0.111 moles.
A5 0.050 moles.
Q0
18 Q0 Two moles of helium (monatomic) gas are heated from 100
20 Q0 degrees Celsius to 250 degrees Celsius. How much heat is
991Q0 transferred to the gas if the process is isobaric?

002Q0
A1 6.23 kJ.
A2 2.63 kJ.
A3 3.11 kJ.
A4 1.51 kJ.
A5 8.52 kJ.
Q0
19 Q0 An ideal diatomic gas, initially at a pressure Pi = 1.0 atm and
20 Q0 volume Vi, is allowed to expand isothermally until its volume
002Q0 doubles. The gas is then compressed adiabatically until it
Q0 reaches its original volume. The final pressure of the gas will
Q0 be:
Q0
A1 1.3 atm.
A2 0.5 atm.
A3 2.0 atm.
A4 0.4 atm.
A5 1.7 atm.
Q0
20 Q0 One mole of an ideal gas undergoes the thermodynamic process
20 Q0 shown in figure (2). If the process BC is an isothermal, how
002Q0 much work is done by the gas in this isothermal process?
Q0
A1 0.56*10**3 J.
A2 1.30*10**3 J.
A3 1.69*10**3 J.
A4 5.29*10**4 J.
A5 0.92*10**3 J.


S1
R
λ
S2


P (atm)
4.0
B
Isothermal
A
1.0
C
1.0
V(L)