FIRST MAJOR T-041

1 Q0 Figure 1 shows the snap shot of part of a transverse wave
17 Q0 traveling along a string. Which statement about the motion
41 Q0 of elements of the string is correct?
   Q0 For the element at
   Q0
   A1 S, the magnitude of its acceleration is a maximum.
   A2 S, the magnitude of its acceleration is zero.
   A3 P, its the speed is a maximum.
   A4 Q, its the speed is zero.
   A5 Q, its displacement is a maximum.
   Q0
2 Q0 A wave in a string, is given by the equation:
 17Q0
41 Q0   y(x,t) = 0.24*sin(3.0*x-24*t),
   Q0
   Q0 where x and y are in meters and t is in seconds. Calculate
   Q0 the magnitude of the transverse speed at x = 2.0 m and
   Q0 t = 1.0 s.
   Q0
   A1 3.8   m/s.
   A2 1.8   m/s.
   A3 5.5   m/s.
   A4 8.0   m/s.
   A5 2.1   m/s.
   Q0
3 Q0 A point source emits sound waves which are reflected from a
17 Q0 metal plate with air in between, as shown in figure 3.
   Q0 Standing waves are produced in between the source and the
041Q0 plate. If the points R, S and T are three successive nodes,
   Q0 what is the frequency of the wave?
   Q0 [Speed of sound in air is 342 m/s].
   Q0
   A1   114 Hz.
   A2   158 Hz.
   A3   225 Hz.
   A4   312 Hz.
   A5   Not enough information.
   Q0
4 Q0 In figure 2, two equivalent pulses, Pulse 1 and Pulse 2,
17 Q0 are sent from points A and B at the same time, respectively.
   Q0 Which pulse reaches point C first?
041Q0
   Q0
   A1   Pulse 1.
   A2   Pulse 2.
   A3   Both at the same time.
   A4   312 Hz.
   A5   Not enough information.
   Q0
1 Q0 Two pipes have the same length L. Pipe B open at one end and
18 Q0 closed at the other, while pipe A open both ends. Which
41 Q0 harmonic of pipe B matches the second harmonic of pipe A?
   Q0
   A1   Never match.
   A2   The fourth.
   A3   The second.

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   A4   The fundamental.
   A5   One needs to know the exact length.
   Q0
2  Q0 An ambulance emits sound with a frequency of 2600 Hz. After
18 Q0 passing a motorist driving (in the same direction of the
   Q0 ambulance) with a speed of 5 m/s, the motorist receives the
   Q0 sound with frequency of 2424 Hz. Calculate the speed of the
   Q0 ambulance.
   Q0 [speed of sound in air is 340 m/s]
   Q0
   A1 30.0  m/s.
   A2 50.0  m/s.
   A3  5.0  m/s.
   A4 15.0  m/s.
   A5  1.0  m/s.
   Q0
3  Q0 The intensity of sound wave A is 800 times that of sound wave B
18 Q0 at a fixed point from both sources. If the sound level of sound
41 Q0 A is 110 dB. What is the sound level of wave B:
   Q0
   A1 81    dB.
   A2 50    dB.
   A3 7.3   dB.
   A4 690   dB.
   A5 555   dB.
   Q0
4  Q0 In figure 4, two small identical speakers are connected (in
18 Q0 phase) to the same source. The speakers are 4.10 m apart
41 Q0 and at ear level. An observer stands at X, 8.00 m in
   Q0 front of one speaker. In the frequency range 200 Hz-500 Hz,
   Q0 the sound he hears will be most intense if the frequency is:
   Q0 [speed of sound in air is 343 m/s]
   Q0
   A1   346 Hz.
   A2   422 Hz.
   A3   500 Hz.
   A4   210 Hz.
   A5   600 Hz.
   Q0
01 Q0 It is recommended to use a new temperature scale called Z.
19 Q0 On Z scale, the boiling point of water is 65.0 degrees Z and
041Q0 the freezing point is -15.0 degrees Z. To what temperature
   Q0 on the Fahrenheit scale would a temperature of -100 degrees Z
   Q0 correspond? [Note: both scales are linear]
   Q0
   A1  -159 Degrees Fahrenheit.
   A2  -100 Degrees Fahrenheit.
   A3  -110 Degrees Fahrenheit.
   A4  -15  Degrees Fahrenheit.
   A5  +15  Degrees Fahrenheit.
   Q0
02 Q0 Fifty grams of ice at zero degrees Celsius is placed in a
19 Q0 thermos bottle containing 100 grams of water at 6.0 degrees
041Q0 Celsius. How many grams of ice will melt?
   Q0
   A1  7.5  grams.
   A2  2.0  grams.
   A3  50   grams.
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   A4  17   grams.
   A5  3.5 grams.
   Q0
3  Q0 A cylinder with a frictionless piston contains 0.2 kg of
 19Q0 water at 100 degrees Celsius. What is the change in
041Q0 internal energy of water when it is converted to steam
   Q0 at 100 degrees Celsius at constant pressure of 1 atm.
   Q0 [Density of steam = 0.6 kg/m**3, water = 10**3 kg/m**3]
   Q0
   A1   418 kJ.
   A2   452 kJ.
   A3   333 kJ.
   A4   226 kJ.
   A5   113 kJ.
   Q0
4  Q0
19 Q0 The internal energy of a fixed mass of an ideal gas depends on
 41Q0
   Q0
   A1 temperature, but not volume or pressure.
   A2 pressure, but not volume or temperature.
   A3 volume, but not temperature or pressure.
   A4 temperature and pressure, but not volume.
   A5 temperature and volume, but not pressure.
   Q0
 1 Q0 A mass of an ideal gas of volume V at pressure P undergoes
20 Q0 the cyclic process shown in figure 5. At which points is the
041Q0 gas coolest and hottest?
   Q0
   A1  Coolest at Z and hottest at X.
   A2  Coolest at X and hottest at Y.
   A3  Coolest at Y and hottest at X.
   A4  Coolest at Y and hottest at Z.
   A5  Coolest at Z and hottest at Y.
   Q0
 2 Q0 A system of an ideal gas undergoes the cyclic process shown
20 Q0 in figure 5. Calculate the work done by the system along the
041Q0 path XY.
   Q0
   A1  90  J.
   A2 -90  J.
   A3  60  J.
   A4 -60  J.
   A5  zero
   Q0
3  Q0 In this question use:  W = work, Q = heat,  S = Entropy.
   Q0 Which of the following are state functions, i.e. path
 20Q0 independent?
041Q0
   Q0 1. W
   Q0 2. Q-W
   Q0 3. S
   Q0 4. Q
   Q0 5. Q-2*W
   Q0
   A1  2, 3.
   A2  Only 2.
   A3  1, 2 and 4.
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   A4  2 and 5.
   A5  3 and 4.
   Q0
4  Q0 The temperature of two moles of helium gas is raised from
20 Q0 zero degrees Celsius to 100 degrees Celsius at constant
041Q0 pressure. Calculate the work done by the gas?
   Q0
   A1    1.66  kJ.
   A2    1.20  kJ.
   A3    6.00  kJ.
   A4    10.0  kJ.
   A5    1.00  kJ.
   Q0
5  Q0 A cylinder of volume 2.5 L contains 0.25 moles of helium
20 Q0 [M = 4.0 grams/mole] at 2.0 atmospheric pressure. What is
41 the internal energy of the gas?
   Q0
   A1    0.76  kJ.
   A2    1.20  kJ.
   A3    0.61  kJ.
   A4    0.01  kJ.
   A5    1.60  kJ.
   Q0
1  Q0 A heat engine has a thermal efficiency of 20%. It runs 2
21 Q0 revolutions per second and delivers 80 W. For each cycle
41 Q0 find the heat discharged to the cold reservoir.
   Q0
   A1    160   W.
   A2    200   W.
   A3    40    W.
   A4    61    W.
   A5    121   W.
   Q0
2  Q0 Two moles of an ideal gas undergo an adiabatic free expansion
21 Q0 from an initial volume of 0.6 L to 1.3 L. Calculate the change
041Q0 in entropy of gas.
   Q0
   A1    12.9  J/K.
   A2    zero.
   A3    16.6  J/K.
   A4   -12.9  J/K.
   A5    -5.3  J/K.
   Q0
3  Q0 System A (one kilogram of ice at zero degrees Celsius) is
21 Q0 added to system B (one kilogram of water at 100 degrees
41 Q0 Celsius) in an insulator container. Calculate the total
041Q0 change in entropy of system A.
   Q0
   A1    1.37  kJ/K.
   A2    1.20  kJ/K.
   A3    6.00  kJ/K.
   A4   -1.41  kJ/K.
   A5    Infinite.
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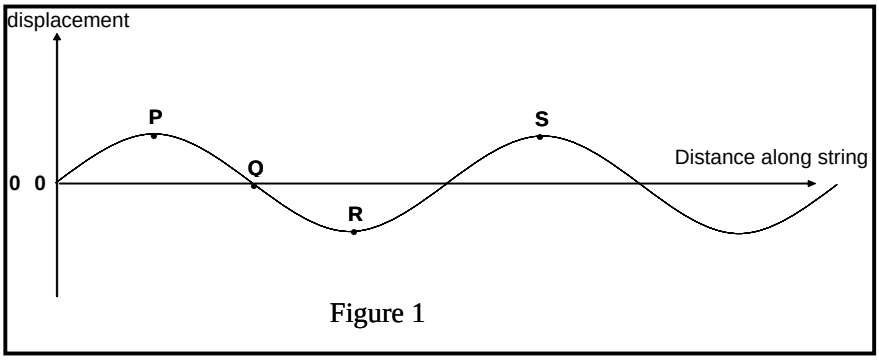

Figure 1

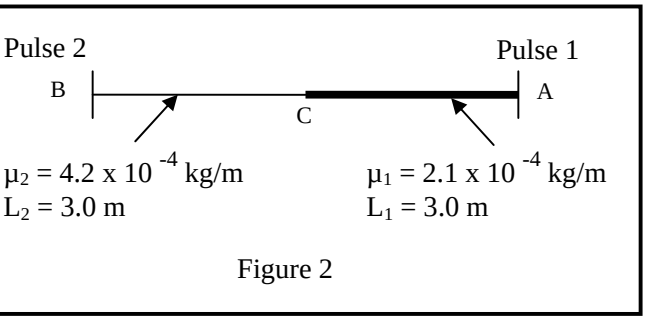

Figure 2

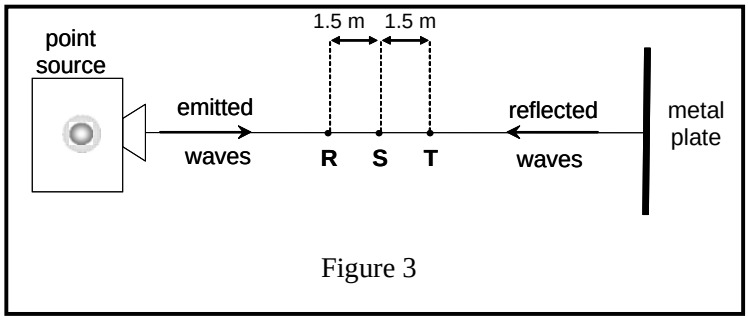

Figure 3

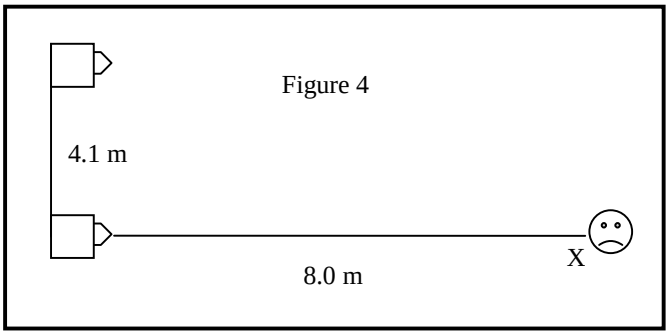

Figure 4

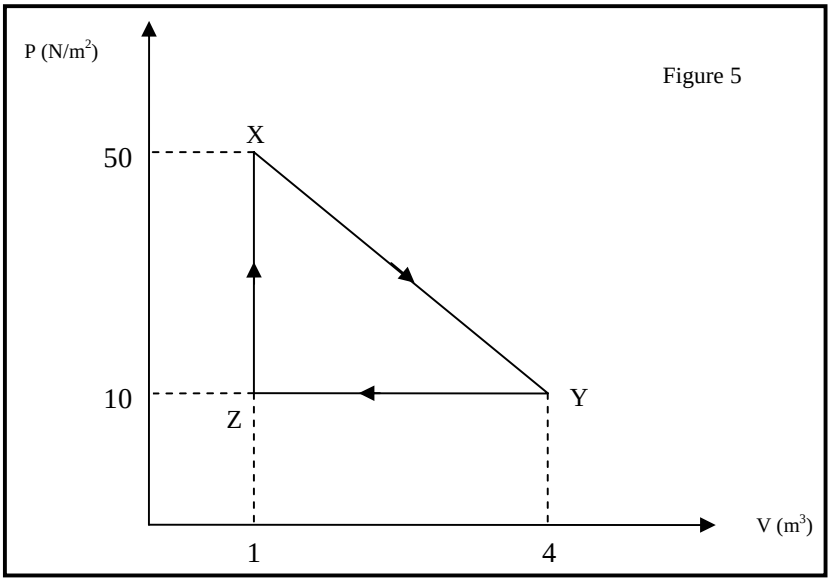

Figure 5