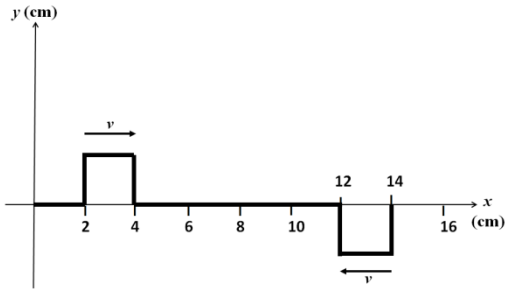
Q1.
A transverse sinusoidal wave travelling on a string is given by: ***y (x,t) = 0.20 sin (2.5 x – 80 t)*** (SI units). The length of the string is 2.0 m and its mass is 1.5 g. What is the magnitude of the tension in the string?

A) 0.77 N
B) 0.24 N
C) 0.63 N
D) 0.31 N
E) 0.86 N

Sec# Wave - I - The speed of a Traveling Wave
Grade# 55
Stat# A_96_DIS_0.08_PBS_0.17_B_2_C_1_D_1_E_1_EXP_55_NUM_235

Q2.
Two pulses having the same amplitude and the same speed ***v*** = 1.0 cm/s approach each other, as shown in **FIGURE 1**, which shows their positions at time ***t*** = 0. At what time will they completely cancel each other?

Fig#



A) 5.0 s
B) 1.0 s
C) 3.0 s
D) 7.0 s
E) 6.0 s

Sec# Wave - I - Interference of Waves
Grade# 43
Stat# A_52_DIS_0.37_PBS_0.30_B_3_C_22_D_8_E_16_EXP_43_NUM_235

Q3.
A string with a length of 2.50 m has two adjacent resonances at frequencies 112 Hz and 140 Hz. Determine the wavelength of the 112 Hz resonance.

A) 1.25 m
B) 1.00 m
C) 5.00 m
D) 2.50 m
E) 1.67 m

Sec# Wave - I - Standing Waves and Resonance
Grade# 48
Stat# A_72_DIS_0.54_PBS_0.46_B_4_C_12_D_9_E_3_EXP_48_NUM_235

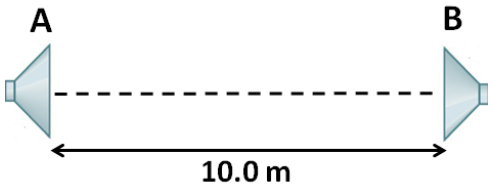
Q4.
A string of length L, mass per unit length μ, and tension τ, is vibrating at its fundamental frequency. If the length of the string is doubled, with all other factors held constant, what is the effect on the fundamental frequency?

A) It becomes one half as large.
B) It becomes two times larger.
C) It becomes $\sqrt{2}$ times as large.
D) It becomes $1/\sqrt{2}$ times as large.
E) It does not change.

Sec# Wave - I - Standing Waves and Resonance
Grade# 55
Stat# A_45_DIS_0.32_PBS_0.31_B_9_C_20_D_16_E_10_EXP_55_NUM_235

Q5.
Two speakers (**A** and **B**) are driven by the same oscillator with a frequency of 172 Hz, and are separated by 10.0 m, as shown in **FIGURE 2**. A person starts at **A** and moves toward **B** along the line joining the two speakers. At what distance from **A** will he observe the first minimum? Take the speed of sound to be 344 m/s.

Fig#



A) 4.50 m
B) 9.00 m
C) 4.00 m
D) 8.00 m
E) 2.50 m

Sec# Wave - II - Interference
Grade# 50
Stat# A_37_DIS_0.46_PBS_0.41_B_25_C_14_D_7_E_17_EXP_50_NUM_235

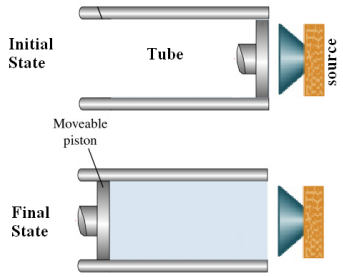
Q6.
The sound intensity at a distance of 16.0 m from a sound source is 0.250 W/m^2. What is the sound level at a distance of 28.0 m from the source?

A) 109 dB
B) 112 dB
C) 114 dB
D) 105 dB
E) 119 dB

Sec# Wave - II - Intensity and Sound Level
Grade# 48
Stat# A_62_DIS_0.47_PBS_0.43_B_7_C_14_D_6_E_11_EXP_48_NUM_235

Q7.
A sound source emitting sound with a frequency of 400 Hz is placed at the entrance of a tube that is attached to a moving piston, as shown in **FIGURE 3**. How many resonances can be heard as the piston is moved to the other end, which is a distance of 1.00 m from the entrance? Take the speed of sound to be 344 m/s.

Fig#



A) 2
B) 1
C) 3
D) 4
E) 0

Sec# Wave - II - Source of Musical Sound
Grade# 53
Stat# A_45_DIS_0.37_PBS_0.29_B_9_C_13_D_26_E_6_EXP_53_NUM_235

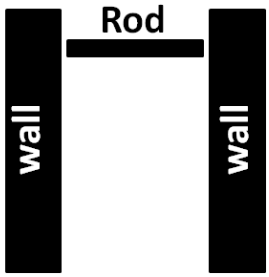
Q8.
Two cars have horns that emit sound with a frequency of 396 Hz. The cars are traveling toward each other, each with a speed of 9.00 m/s. What frequency do the passengers of the cars hear? Take the speed of sound to be 343 m/s.

A) 417 Hz
B) 396 Hz
C) 375 Hz
D) 406 Hz
E) 423 Hz

Sec# Wave - II - The Doppler Effect
Grade# 60
Stat# A_86_DIS_0.25_PBS_0.31_B_6_C_3_D_4_E_1_EXP_60_NUM_235

Q9.
A steel rod is placed between two parallel walls, as shown in **Figure 4**. At 20 ^{o}C, the rod has a length of 3.5 m and is separated by 1.0 mm from each wall. The rod is heated uniformly. At what temperature will it touch both walls? The coefficient of linear expansion of steel is 11 x 10^{-6} $^{o}C^{-1}$.

Fig#



A) 72 ºC
B) 52 ºC
C) 42 ºC
D) 62 ºC
E) 82 ºC

Sec# Temerature, Heat, and the First Law of Thermodynamics - Thermal Expansion
Grade# 53
Stat# A_82_DIS_0.44_PBS_0.47_B_7_C_7_D_3_E_2_EXP_53_NUM_235

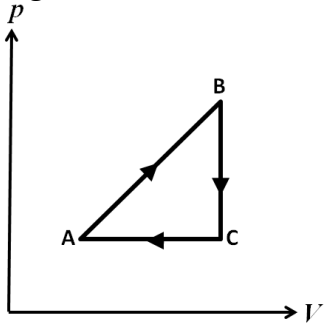
Q10.
A 1.0-kg of ice at 0.0 ºC is added to 1.0 kg of steam at 100 ºC. When thermal equilibrium is achieved, what is the final temperature of the system?

A) 100 ºC
B) 0.0 ºC
C) 50 ºC
D) 15 ºC
E) 85 ºC

Sec# Temerature, Heat, and the First Law of Thermodynamics - The Absorption of Heat by Solids and Liquids
Grade# 50
Stat# A_35_DIS_0.56_PBS_0.45_B_9_C_32_D_8_E_16_EXP_50_NUM_235

Q11.
Consider the cyclic process shown in **FIGURE 5**. If Q_{BC} is negative and $(\Delta E_{int})_{CA}$ is negative, which of the following statement is **CORRECT**?

Fig#



A) Q_{AB} is positive
B) Q_{AB} is negative
C) Q_{BC} is positive
D) Q_{CA} is positive

E) $Q_{net} = 0$

Sec# Temerature, Heat, and the First Law of Thermodynamics - The First Law of Thermodynamics
Grade# 43
Stat# A_76_DIS_0.36_PBS_0.31_B_8_C_2_D_6_E_8_EXP_43_NUM_235

Q12.
The walls of a container have a thickness of 2.00 cm and are made of a material that has a thermal conductivity of 0.0300 W/m.K. The total surface area of the container is 1.20 m^2. If the container is filled with 4.00 kg of ice at 0.00 ^oC, and the temperature outside the container is 20.0 ^oC, how long does it take the ice to completely melt?

A) 10.3 hours
B) 4.22 hours
C) 17.6 hours
D) 22.1 hours
E) 13.6 hours

Sec# Temerature, Heat, and the First Law of Thermodynamics - Heat Transfer Mechanisms
Grade# 50
Stat# A_66_DIS_0.73_PBS_0.56_B_7_C_5_D_5_E_16_EXP_50_NUM_235

Q13.
Consider two cylinders, one filled with oxygen and the other filled with nitrogen. If the gas molecules in the two cylinders have the same rms speed, which of the following statements is **CORRECT**?
[molar masses: $M_{O2} = 32$ g, $M_{N2} = 28$ g]

A) The temperature of nitrogen is less than the temperature of oxygen.
B) The temperature of nitrogen is greater than the temperature of oxygen.
C) The temperature of nitrogen is the same as the temperature of oxygen.
D) The average kinetic energy per molecule is the same for the two gases.
E) The average kinetic energy per nitrogen molecule is greater than that of an oxygen molecule.

Sec# The kinetic Theory of Gases - Pressure, Temperature and RMS Speed
Grade# 45
Stat# A_78_DIS_0.41_PBS_0.38_B_14_C_2_D_5_E_1_EXP_45_NUM_235

Q14.
A 2.0-mol sample of an ideal gas, at 0.0 ^oC, expands isobarically to twice its original volume. How much work is done in the process?

A) 4.5 kJ
B) 2.3 kJ
C) 6.8 kJ
D) 5.7 kJ
E) 3.5 kJ

Sec# The kinetic Theory of Gases - Ideal Gases
Grade# 60
Stat# A_60_DIS_0.51_PBS_0.39_B_8_C_5_D_3_E_24_EXP_60_NUM_235

Q15.
A 2.00-mol sample of an ideal monatomic gas expands adiabatically from a temperature of 300 K and a volume of 12.0 L to a final volume of 30.0 L. How much work is done in the process?

A) 3.42 kJ
B) 5.70 kJ
C) 1.14 kJ
D) 7.98 kJ
E) zero

Sec# The kinetic Theory of Gases - The Adiabatic Expansion of an Ideal Gas
Grade# 50
Stat# A_58_DIS_0.64_PBS_0.50_B_15_C_9_D_9_E_9_EXP_50_NUM_235

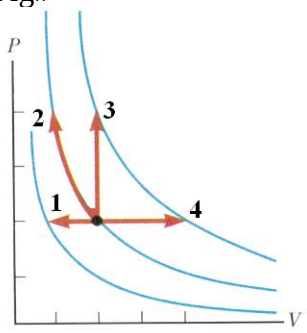
Q16.
An ideal gas is confined in a rigid tank (constant volume) at a pressure of 12.0 atm and a temperature of 25.0 ºC. If two-thirds of the gas is withdrawn and the temperature is raised to 75.0 ºC, what is the pressure of the gas remaining in the tank?

A) 4.67 atm
B) 9.34 atm
C) 12.0 atm
D) 24.0 atm
E) 42.1 atm

Sec# The kinetic Theory of Gases - Ideal Gases
Grade# 48
Stat# A_28_DIS_0.42_PBS_0.39_B_23_C_13_D_12_E_23_EXP_48_NUM_235

Q17.
The initial state of a monatomic ideal gas is represented by the dot in **FIGURE 6**. Arrows **1** through **4** represent isobaric, isothermal, and isochoric processes that the sample can undergo. Which process corresponds to the highest increase in the entropy of the gas.

Fig#



A) 4
B) 3
C) 2
D) 1
E) All process are the same

Sec# Entropy and the Second Law of Thermodynamics - Irreversible Processes and Entropy
Grade# 53
Stat# A_56_DIS_0.63_PBS_0.46_B_10_C_9_D_6_E_19_EXP_53_NUM_235

Q18.
A heat engine is connected to two heat reservoirs: one is steam at 100 °C, and the other is ice at 0.0 °C. The engine runs by condensing 1.0 g of steam and melting 5.0 g of ice. What is the efficiency of this engine?

A) 0.26
B) 0.74
C) 1.0
D) 0.35
E) 0.65

Sec# Entropy and the Second Law of Thermodynamics - Entropy in the Real World: Engines
Grade# 48
Stat# A_75_DIS_0.41_PBS_0.34_B_6_C_5_D_10_E_4_EXP_48_NUM_235

Q19.
A cup holding 125 g of hot water at 100 °C cools to room temperature, 20.0 °C. What is the change in entropy of the room? Neglect the specific heat of the cup.

A) + 143 J/K
B) + 154 J/K
C) – 143 J/K
D) + 1.01 kJ/K
E) – 1.01 kJ/K

Sec# Entropy and the Second Law of Thermodynamics - Irreversible Processes and Entropy
Grade# 48
Stat# A_40_DIS_0.49_PBS_0.37_B_6_C_25_D_16_E_13_EXP_48_NUM_235

Q20.
During each cycle, a refrigerator expels 625 kJ of heat to a high-temperature reservoir and takes 550 J of heat from a low-temperature reservoir. What is the coefficient of performance of the refrigerator?

A) 7.3
B) 2.1
C) 8.3
D) 1.1
E) 1.9

Sec# Entropy and the Second Law of Thermodynamics - Entropy in the Real World: Refrigerators
Grade# 55
Stat# A_83_DIS_0.31_PBS_0.31_B_4_C_5_D_6_E_3_EXP_55_NUM_235

Test Expected Average = 51
Test Actual Average = 61.7