Multiple Choice questions. Circle the correct answer. No work needs to be shown.

(6 pts) 1. A wire of length 0.900 m is stretched between two posts. What is the wavelength of the second overtone standing wave for this wire?

(a) 0.300 m  
(b) 0.400 m  
(c) 0.600 m  
(d) 0.900 m  
(e) 1.20 m  
(f) 1.80 m  
(g) none of the above answers

(6 pts) 2. Speakers A and B emit sound waves that have the same frequency $f$ and that are in phase. Speaker B is 15.00 m to the right of speaker A and point P is 5.0 m to the right of speaker B. The speed of sound in air is 345 m/s. What is the smallest nonzero value of the frequency $f$ for which the sound waves from the two speakers will interfere destructively at point P?

(a) 11.5 Hz  
(b) 17.25 Hz  
(c) 23.0 Hz  
(d) 34.5 Hz  
(e) 69.0 Hz  
(f) none of the above answers

(6 pts) 3. A monatomic ideal gas has $C_V = 3R/2$ and $C_p = 5R/2$. What is the change in the internal energy of 2.00 moles of this gas when it is heated at constant pressure from 27.0°C to 127.0°C?

(a) zero  
(b) 8314 J  
(c) 4988 J  
(d) 4157 J  
(e) 2494 J  
(f) none of the above answers
(6 pts) 4. A source of sound waves emits uniformly in all directions. At a distance of 30.0 m from the source the sound intensity level is 34.0 dB. What is the sound intensity level at a distance of 60.0 m from the source?

(a) 8.5 dB  
(b) 10.0 dB  
(c) 40.0 dB  
(d) 46.0 dB  
(e) 28.0 dB  
(f) 34.0 dB  
(g) none of the above answers

(6 pts) 5. A Carnot heat engine operates between a high-temperature reservoir at $T_H = 800$ K and a low-temperature reservoir at $T_C = 200$ K. In one cycle the engine rejects 400 J of heat energy to the low temperature reservoir. How much work does the engine perform in one cycle?

(a) 900 J  
(b) 1200 J  
(c) 225 J  
(d) 300 J  
(e) 1500 J  
(f) 2000 J  
(g) none of the above answers

On the following problems show all your work. Partial credit will be given if earned. Write your answers in the blanks provided.

(16 pts) 6. Five moles of a monatomic ideal gas undergoes a reversible isothermal compression at a constant temperature of 30.0°C. During the compression, 1800 J of work is done on the gas.

a) What is the change in the entropy of the gas?

Ans. ________________

b) Does the entropy of the gas increase or decrease?

Ans. ________________
When a rock is suspended in air by a light string, the tension in the string is 49.0 N. When the rock is totally immersed in water, the tension in the string is 17.0 N. What is the volume of the rock? (The density of water is 1000 kg/m³.)

Ans. _______
8. A large pot with an aluminum bottom 6.00 mm thick rests on a hot stove. The area of the bottom of the pot is 0.200 m². The thermal conductivity of aluminum is 205 W/(m·K). The water inside the pot is at 100.0°C and 5.00 kg of water evaporates (changes phase) every 2.00 minutes. Find the temperature of the lower surface of the pot, which is in contact with the stove. (Note: For water $c = 4190\text{ J/(kg·K)}$, $L_f = 3.34 \times 10^5\text{ J/kg}$ and $L_v = 2.26 \times 10^6\text{ J/kg}$.)

Ans. ____________________
(18 pts) 9. A monatomic ideal gas is compressed so that its final volume is one-fourth its original volume \( V_2 = V_1/4 \). For this gas \( C_V = 3R/2 \) and \( C_p = 5R/2 \). During the compression, 500 J of work is done on the gas. Calculate \( \Delta U \) and \( Q \) for the gas (be sure to indicate whether your answer is positive or negative) if the process is

a) isothermal \((\Delta T = 0)\)

Ans. \( \Delta U \)  

\[ Q \]  

b) isobaric \((\Delta p = 0)\)

Ans. \( \Delta U \)  

\[ Q \]