Multiple choice questions Part I. Each question is worth 2 points. Select the answer(s) which best satisfies the question.

1) The temperature of the Sun’s interior core is roughly 15 million °C according to a physics textbook. Which statement below is most correct?

   a) This temperature is nearly equivalent to 15 million °F.
   b) This temperature is nearly equivalent to 15 million Kelvin.
   c) Both a) and b) are correct.
   d) Neither a) nor b) are correct.

2) If a rectangular plastic block has dimensions of 1” by 3”, 1” by 4”, and 3” by 4”, then how would you orient the plastic block in order to minimize the deformation caused by the influence of its own weight?

   a) Place the block on the 4” by 3” face.
   b) Place the block on the 4” by 1” face.
   c) Place the block on the 3” by 1” face.
   d) Not enough information.

3) Consider a thermodynamic system in which \( Q = -200 \text{ J} \) and \( W = +200 \text{ J} \). The internal energy change is:

   a) \( \Delta U = -400 \text{ J} \).
   b) \( \Delta U = 0 \text{ J} \).
   c) \( \Delta U = +400 \text{ J} \).
   d) None of the above.

4) If \( T_C \) is three-fourteenths of \( T_H \) then the Carnot efficiency \( e_C \) is most nearly:

   a) 0.21.
   b) 0.23.
   c) 0.77.
   d) 0.79

5) Which type of motion most accurately describes a tennis ball being bounced up and down via a tennis racket? Assume the ball experiences a constant period \( T \).

   a) Periodic motion.
   b) Simple Harmonic motion.
   c) Longitudinal wave motion.
   d) Transverse wave motion.

6) By what factor will the amplitude of a simple harmonic oscillator change if the frequency is tripled?

   a) Increases by a factor of three.
   b) Decreases by a factor of three.
   c) Remains unchanged.
   d) Increases by a factor of one-third.
   e) Decreases by a factor of one-third.
7) A solid iron sphere and a washer made from copper are in thermal equilibrium. Let the diameter of the ball be larger than the inner radius of the washer. If the sphere and the washer are always kept at the same temperature, then what should be done to the temperature so that the ball can fit through the washer?

a) Heat both objects up by the same increase in temperature.
b) Cool both objects down by the same decrease in temperature.
c) Not enough information given to answer the question.

8) Which of the following below is correctly identified with the condensing phase change latent heat?

a) $L_V$, the latent heat of vaporization.
b) $L_F$, the latent heat of fusion.
c) $L_S$, the latent heat of sublimation.
d) $L_L$, the latent heat of liquidation.

9) The statement that it is impossible to lower the temperature of an object to absolute zero in a finite number of steps is known as:

a) The First Law of Thermodynamics.
c) The Third Law of Thermodynamics.

10) The speed of a wave on a stretched ideal string does not depend which of the quantities listed below:

a) The mass of the string.
b) The length of the string.
c) The tension in the string.
d) The frequency of the wave in the string.
Problems Part II. Each problem is worth 10 points. Show ALL WORK to get full credit.

11) One mole of Oxygen has a pressure of 12 atm. at 48 °C. If the gas is heated at constant volume and the pressure triples, then what is the final temperature?

12) If the frequency of a wave is 4 kHz, and if the wave velocity is 1200 m/s, then what is the wavelength?

13) What is the radiated power of a sphere of radius 1.0 m at 300 K? Assume that the emissivity is 1 and the Stefan-Boltzmann constant $\alpha$ is $6 \times 10^{-8} \frac{W}{m^2 \cdot K^4}$.

14) Suppose a string is rigidly attached to a pole, and pulses of amplitude 0.15 m are sent down the string. What is the amplitude at the point where the two pulses cross?

15) Normally the equilibrium position for a mass-spring system is given as the position where the system is horizontally not subject to a restoring force. Suppose now the mass-spring system is hung vertically from a ceiling. What is the "new" equilibrium position for this vertical system?

16) A pendulum of length L is originally at sea level with $g = 9.8 \frac{m}{s^2}$. Now consider moving the entire pendulum system to the top of Mount YourLastNamus where $g' = 9.77 \frac{m}{s^2}$. What is the change in the period of this pendulum?

17) Consider an ideal heat pump that is used to heat an office which is at 303 K. If the pump does 250 J of work, how much heat does it supply to the office if the outside air temperature is 276 K?

18) If you increase the period of a vibrating object by a factor of 8, then by how much does the new frequency change?