Exam 4
Fall 2011

Name: _____

1. Answer one of the following:
   a. In winter why does the temperature usually stay a few degrees within freezing as long as there is snow cover?
   b. Why are statistics such a "sure" thing when considering thermodynamic processes?
   c. Define Entropy.

2. a. Rank the size of Celcius, Kelvin and Fahrenheit degrees.
   b. What does it mean if something is at -20K?

3. A sample of Helium (6.647×10^{-27}kg) is at 20°C and is considered to behave ideally.
   a. What is the average kinetic energy per molecule?
   b. What is the rms speed of a helium molecule at this temperature?

4. The surface area of a certain lead brick is 0.05 m^2. The emissivity of grey lead is 0.28. Determine the rate that energy is radiated off of a hot lead brick (110°C) that is placed outside in the snow at 0°C.

5. A waterfall is 200 m high. If all the gravitational potential energy of the water were converted into internal energy, by how much would the temperature of the water increase after hitting the water at the bottom of the falls?

6. A container holds 5 kg of steam at 150°C which is put in thermal contact with 1 kg of water at 0°C. What is the final temperature of the system? What is the final mass of steam? What is the final mass of water? c_{water} = 4186 J/kg°C, c_{ice} =2090 J/kg°C, c_{steam} = 2010 J/kg°C, L_f=3.33 x 10^5J/Kg, L_v = 2.26 x 10^6J/kg

KE = ½ mv^2 | $PE = mgh$ | g = 9.8 m/s^2

$KE_T = 3/2\ k_B T$ | $KE_R = k_B T$ | k_B = 1.38 x 10^{-23} J/K | $v_{rms} = \sqrt{v}$

$T = T_C + 273.15$ | $T_F = 9/5T_C + 32$

$\Delta L = \alpha L_o \Delta T$ | $\Delta A = \gamma A_o \Delta T$ | $\Delta V = \beta V_o \Delta T$

Coefficient of linear expansion: $\alpha_{lead} = 2.89 \times 10^{-5}\ ^oC^{-1}$

$P = \sigma Ae(T^4 - T_o^4)$ | Stephan Boltzmann Constant $\sigma = 5.669 \times 10^{-8}\ W/m^2K^4$

$Q = mc\Delta T$ | $Q = mL$