Fall 2001: PSC2121 Homework Assignments
Solutions due Oct 2, Ch. 7 and 8

Ch. 7:

3. °F = (9/5)°C + 32 = (9/5) (-79) + 32 = -142.2 + 32 = **-110.2 °F**

7. (a) °C = (5/9) (°F - 32) = (5/9) (68 - 32) = (5/9) (36) = **20 °C**
(b) K = °C + 273 = 20 + 273 = **293 K**

12. The Absolute (Kelvin) temperature of a gas is proportional to the average kinetic energy of its molecules.

15. (a) $v^2 = 3kT/m = 3\,(1.38\times10^{-23}\text{ J/K})\,(300\text{ K}) / (2\times10^{-5}\text{ kg}) = 6.21\times10^{-16}\text{ m}^2/\text{s}^2$
so $\mathbf{v = 2.49\times10^{-8}\ m/s}$
The book has a different answer, which would be correct if m were 2.00×10^{-15}kg.
(b) $KE = 3/2\,kT = 3/2\,(1.38\times10^{-23}\text{ J/K})\,(300\text{ K}) = \mathbf{6.21\times10^{-21}\ J}$

19. $H = m\,c\,(T_2 - T_1)$ for copper c = 0.094 cal/g°C so
$T_2 - T_1 = H/mc = (1000\text{ cal}) / (1000\text{ g})\,(0.094\text{ cal/g°C}) =$ **10.64 °C**

24. To melt 100 g ice:
H = m Lf = (100 g)(80 cal/g) = 8000 cal
To vaporize 100 g of water:
H = m Lv = (100 g)(540 cal/g) = 54000 cal
difference = 54000 cal - 8000 cal = **46000 cal**

30. An ice cube at 0°C can absorb more heat, the heat of fusion, than the same quantity of water at 0 C, and for this reason is more effective in cooling.

35. For linear expansion $\Delta L = \alpha L\,(T_2 - T_1)$ for steel $\alpha = 13\times10^{-6}$/°C
T_2 = 95 °F = 35°C while T_1 = -20 °F = -28.9 °C
so $\Delta L = (13\times10^{-6}/°C)\,(300\text{ ft})\,(35°C - (-28.9°C)) =$ **0.25 ft**

38. Higher. At higher pressure it is more difficult for the water molecules to leave the liquid and enter the gas. More energy is required corresponding to a higher boiling point.

45. Heat is lost through radiational cooling more quickly when the sky is clear. Clouds act like a blanket. They prevent radiation from reaching the earth (a cloudy day is cooler than a sunny one) and they reduce the radiation leaving at night.

46. A. (c) B. (d) C. (c) D. (b) E. (d)
F. (b) G. (a) H. (c) I. (b) J. (c)

Ch. 8:

3. PE = mgh = (75 kg)(9.8 m/s^2)(7 m) = 5145 J to convert to calories we use 1 J = 4.186 cal
so = (5145 J)(1 cal/4.186 J) = **1229 cal**

4. W = 3000 kcal = (3000 kcal)(4186 J / 1 kcal) = 1.26×10^7 J
W = PE = mgh so h = W/mg = (1.26×10^7 J)/(75 kg)(9.8 m/s^2) = **1.70×10^4 m**

6. Some examples are: (a) An electric heater, toaster, or blanket.
(b) Car brakes. (c) A gas or oil furnace.

12. A kilogram of water has more entropy than a kilogram of ice.
At 0°C heat must be added to ice to form water and the molecules in water are more disordered than those in ice.

13. An example of order going to disorder: Structures or buildings crumble with time. Their original shapes are very ordered, but as time passes they deteriorate. Order is lost, entropy is increased.

15. Equivalent work from heat input = (5000 cal)(4.186 J/cal) = 20930 J
Efficiency = useful work / energy input = (2000 J)/(20930 J) = 0.096 = **9.6%**

19. Remember to use absolute temperature K = °C + 273
T_H = (300) + 273 = 573 K T_C = (40) + 273 = 313 K
Efficiency = $(T_H - T_C)/T_H$ = (573 K - 313 K) / 533 K = 260 K / 573 K = 0.454 = **45.4%**

27. A. (d) B. (a) C. (c) D. (a) E. (b)
F. (c) G. (c) H. (d) I. (c) J. (b)