Homework Discussion, Week 12

Physics 1301 Dr. Andersen

Chapter 16

19) a) Aluminum has a higher coefficient of expansion than does copper, so the aluminum cube will enclose more volume at higher temperature. b) Find the change in volume for each using $\Delta V = 3\alpha V_0 \Delta T$, and take the difference.

36) a) The total heat lost by horse shoe must equal the total gained by the water

$$Q_{horseshoe} + Q_{water} = 0.$$

For each, $Q = cm\Delta T = cm(T_f - T_i)$, since they will end up at the same temperature, plug into the first equation and solve for T_f. b) Increasing the mass of the horse shoe would mean more heat must be transferred to lower its temperature by the same amount, so the water would end up absorbing more heat, and thus end up at a higher temperature.
Answer 24° C.

Chapter 17

13) In this case, we need the definition of the density $\rho = m/V$, and the ideal gas law $pV = NkT$. Notice that we can write the density as $\rho = Nm_{ave}/V$, where m_{ave} mass per gas molecule, so the ideal gas law can also be written as

$$p = \frac{\rho kT}{m_{ave}}.$$

This means that

$$\frac{p}{\rho T} = constant$$

Since the pressure inside and outside the balloon should be equal,

$$\frac{T_{inside}}{\rho_{inside}} = \frac{T_{outside}}{\rho_{outside}}.$$

Solve for the ratio of densities, and plug in the numbers.

21) a) Since $1/2mv_{rms}^2 = 3/2kT$, molecules with lower mass will have higher rms speeds at a given temperature, so the water will have a higher rms speed

than the oxygen. b) Use the equation above; since T is the same for both, equate their average kinetic energies and solve.
59) The total amount of heat to heat the water to $100^\circ\ C$ and vaporize it will be $Q = mc\Delta T + mL_v$, where in this case $DeltaT = 100^\circ\ C - 20^\circ\ C$. If this is less than the total amount of heat the iron must give up to drop to $100^\circ\ C$, then the there will be some water left, otherwise it will all vaporize. In this case, there is enough energy to vaporize all the water. Setting the heat lost by the iron to get to that stage equal to the heat absorbed by the water

$$m_{Fe} c_{Fe} \Delta T = 116,000\ J - 104,000\ J$$

we can solve for the temperature at which all the water is vaporized. From this point, it is a typical specific heat problem to find the equilibrium temperature (think problem 36 above), remembering that the specific heat of steam is different than that of liquid water.