Reminders 11-21-07:
-Homework 10 Due 11/26
-Homework 11 Due 11/29
-Homework 12 Due 12/4
-Exam 4 12/5.

Objectives:
-Heating and Cooling Processes
-Heat Transfer Processes
- -Convection
- -Conduction
- -Radiation

$$P = P_{atm} + \rho g h$$

$$= [h_{atm} + (h_R - h_L)] \rho g$$

$$[76.01\,cm + (12.25 - 9.80)]$$

- **A student eats 4 burritos for dinner (2000 Calories of food). He wishes to do an equivalent amount of work by lifting a 50 kg mass. Assume he raises the mass a distance of 2.00m and that no work is done when the weight is dropped to the floor. Assume perfect conversion of chemical energy into mechanical energy (not true by a factor of 6!). How many times must he lift the mass? How long will it take him if he lifts the weight every 5 seconds?**

$2000\ \text{Cal} \cdot 1000 \frac{\text{cal}}{\text{C}} = 2.0\times10^6\ \text{cal}$

$2.0\times10^6\ \text{cal} \cdot 4.186 \frac{\text{J}}{\text{cal}} = 8.37\times10^6\ \text{J}$

Work required to lift mass.

$W = \Delta PE = mgh$

$= (50)(9.8)(2) = 980\ \text{J/lift}$

lifts needed

$\frac{\text{Total Energy}}{\text{work/lift}} = \frac{8.37\times10^6\ \text{J}}{980\ \text{J/lift}}$

$= 8540$ lifts

Take into account inefficiency of converting.

$\frac{8540}{6} \approx 1400$ lifts

7000 s almost 2 hours

Heat gained = Heat lost

$$m_1 c_1 (T_f - T_{1i}) = m_2 c_2 (T_{2i} - T_f)$$

Energy conserved

$$\Sigma Q = 0$$

$$m_1 c_1 (T_f - T_{1i}) + m_2 c_2 (T_f - T_{2i}) = 0$$

Nov 21-1:05 PM

- A 100 piece of copper at 95°C is dropped into 200 g of water that is in a 280g Al container. Both are initially at 15°C. What is the final temperature of the system?

$$\Sigma Q's = 0$$

$$m_{Cu} c_{Cu} (T_f - 95^\circ) + m_{H_2O} c_{H_2O} (T_f - 15) + m_{Al} c_{Al} (T_f - 15) = 0$$

$$T_f \left[m_{Cu} c_{Cu} + m_{H_2O} c_{H_2O} + m_{Al} c_{Al} \right] = 95 m_{Cu} c_{Cu} + 15 \left[m_{H_2O} c_{H_2O} + m_{Al} c_{Al} \right]$$

$$T_f = \frac{95 m_{Cu} c_{Cu} + 15 \left[m_{H_2O} c_{H_2O} + m_{Al} c_{Al} \right]}{m_{Cu} c_{Cu} + m_{H_2O} c_{H_2O} + m_{Al} c_{Al}}$$

$c_{Al} = 0.215$ cal/g C°

$c_{Cu} = 0.0924$ cal/g C°

$c_{H_2O} = 1.00$ cal/g°C

$$T_f = 17.7^\circ C$$

- A 40 g block is cooled to -78°C. It is added to 560g of water in an 80 g Cu calorimeter at a temperature of 25°C. Determine the final temperature of the system. Does all the ice melt? If not how much is left over?

Does all the ice melt?

If yes, find the final temp. of system.

If no, find out how much ice melted and how much is left over and final is zero. If not, find the temp. that is below zero.

How much energy required to melt the ice.

$Q = 40\,g\, c_{ice}(0 - {-78}) + 40\,g(79.7\,cal/g)$

$c_{ice} = 0.5\,cal/g°C$

$Q = 40\,g(.5)(78) + 40(79.7) = \underline{4748}\,cal$

How much energy can calorimeter provide if it gets down to 0°C?

$Q = 560\,g\,(1\,cal/g°C)(25°C) + (80)(.0924)(25)$

$= \underline{14,185}\,cal$

since 14,185 > 4748 all ice melts.

Nov 18-10:36 PM

$$\Sigma Q's = 0$$

$$m_{ice} c_{ice} (78) + m_{ice} L_f + m_{melt\,ice} c_{H_2O} (T_f - 0) + m_{H_2O} c_{H_2O} (T_f - 25) + m_{cu} c_{cu} (T_f - 25) = 0$$

now do the algebra and solve for T_f.

$T_f = 16°C$

Nov 21-1:38 PM