Reminders 1-16-08:
-Read Syllabus
-Log onto Mastering Physics ASAP, MPCALABRESE0003!!!
-Obtain Lab software from desktop of computers in lab.
-Check course web page once a week.[S]
-Sign prerequisite certificate form (Phy 4A, Math 31)
-Log in/out when entering Physics Tutoring Center & lab S-107
-Read Chapter 17
-Sign up for Physics 4Z. 1st meeting next Wednesday. Homework and problem solving will be discussed in this class.

Outline:
-Calorimetry
-Heat Transfer Processes

Suppose you are designing a highway. To increase its strength you reinforce the concrete by embedding steel rods in the concrete. How should the average coefficients of linear expansion for the two materials compare?

If the coefficient of volume expansion is $\beta = a + bT$, where T is temperature, how do you calculate a change in volume if the temperature changes from T_1 to T_2?

$\beta = \frac{1}{V_0}\frac{\Delta V}{\Delta T}$ $\beta = \frac{1}{V_0}\frac{dV}{dT} = a + bT$

The integral goes from

T_1 to T_2

$$dQ = m c \, dT$$

$$\int dQ = \int m c \, dT$$

c depends on temperature

- Suppose we have 1g of ice at -50°C, and we want to convert it to steam at 150°C, how much energy is required to do this?

$$Q = m_{ice}c_{ice}(50°C) + m_{ice}L_f + m_w c_w(100°C) + m_w L_v + m_{steam}c_{steam}(50°C)$$

$m = 1g \quad c_{ice} = .5 cal/g C°$

$L_f = 79.7 cal/g$

$c_w = 1 cal/g C°$

$L_v = 540 cal/g$

$c_s = .48 cal/g C°$

- **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? What if the mass of the ice was 125g?**

$Q_{ice} + Q_{water} + Q_{container} = 0$

How do I know if the ice melts?

How much energy required to melt the ice?

$Q_{ice} = m_{ice} C_{ice} \Delta T + m_{ice} L_f$

$= (40g)(2.09 J/g°C)(78) + (40)(333 J/g)$

$= 19.2 KJ$

How much energy can the water and calorimeter provide?

$Q_w + Q_c = (560g)(4.186)(-25) + (80g)(390)(-25)$

$= -59.21 KJ$

All ice melts.

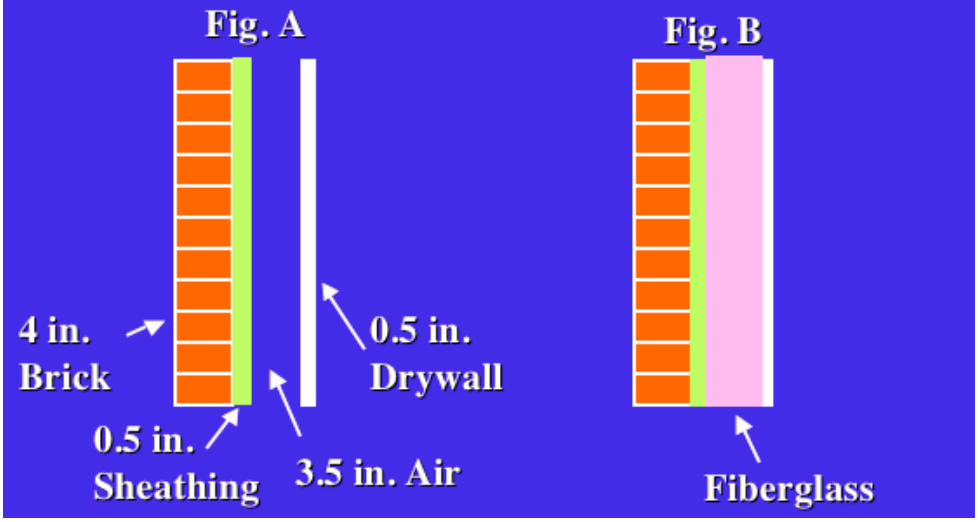
$$Q_{ice} + Q_w + Q_c = 0$$

$$m_{ice} c_{ice} (78) + m_{ice} L_f + m_{ice} c_{water} (T_f - 0)$$
$$+ m_w c_w (T_f - 25^\circ C) + m_{can} c_{can} (T_f - 25) = 0$$

Solve for T_f

$$T_f = 16^\circ C$$

Calculate the total R value for a wall constructed as shown in Figure A below. If a layer of fiberglass batting replaces the dead-air space as shown in Figure B, what is the new R value? By what factor is the thermal energy loss reduced?



- Two rods of copper and aluminum, each of length 50 cm and radius 1.0 cm, are placed in contact end to end. The sides of the rods are insulated. The other end of the Cu rod is at 80 ºC and that of the Al is 10 ºC. What is the temperature at the junction?