Lecture 7

April 16, 2012

First Law

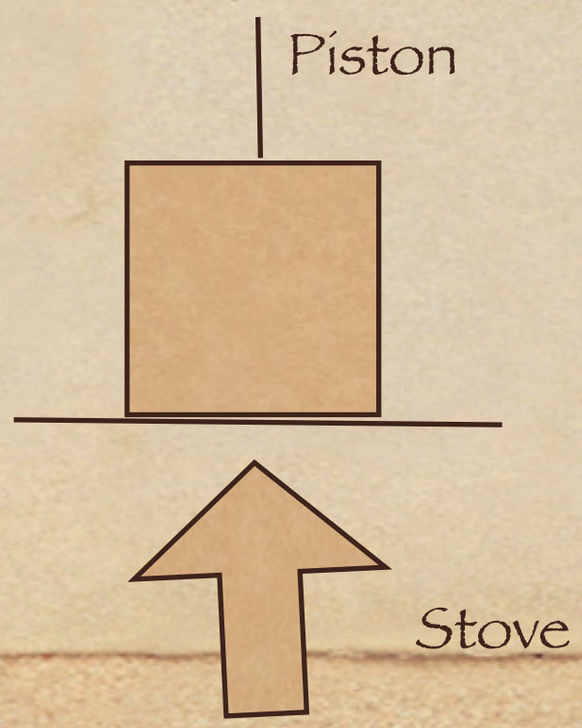
Heat is energy and energy is conserved!!

$$\Delta E = \Delta Q + \Delta W$$

We can increase the energy by either working on a system or by adding heat energy to it. Hence work done and heat have identical units:

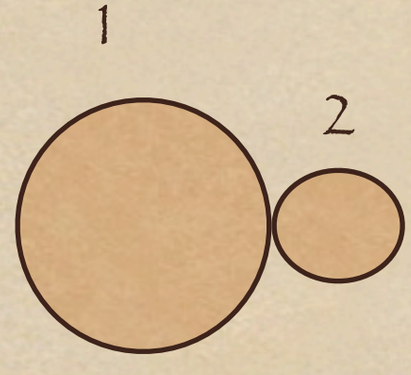
$1 calorie = 4.2 J$

$J = Newton\ meter$



Since energy is conserved, we have many applications of this idea.

Mixtures: two bodies with masses M1 and M2 are brought together with temperatures T1 and T2 what is the final temperature? (T1>T2)



$$\Delta Q_1 = M_1 c_1 \Delta T_1 \qquad \Delta T_1 = T_1 - T_f$$

$$\Delta Q_2 = M_2 c_2 \Delta T_2 \qquad \Delta T_2 = T_f - T_2$$

$$\Delta Q_1 = \Delta Q_2 \qquad T_f = \frac{M_1 c_1 T_1 + M_2 c_2 T_2}{M_1 c_1 + M_2 c_2}$$

Mixing Problems and solution

A 2 kg block of copper at 90C° is dumped into 2 gallon bucket of water at 20 C°. What is the final temperature of the water?

$$T_f = \frac{M_1 c_1 T_1 + M_2 c_2 T_2}{M_1 c_1 + M_2 c_2}$$

Answer: First convert 2 gallons = 2x 3.78 Litre = 7560 cm^3. Its weight is 7560 gm since density is 1 gm/cm^3
Next use the formula given in last slide.

In applying this:
M1= 2kg ; c1= .27 kJ/kg C°; T1= 90 C° Copper
M2= 7.56kg; c2= 4.2 kJ/kg C°; T2= 20 C° Water

Hence T_f = 21.7C°

Next 30 mins Quiz-1