PHYSICS-2
Elementary Physics of Energy

Homework 3
Due Date: APRIL 21, 2011

Problems from Chapter 3 of Ristinen and Kraushaar:

1. A typical room temperature is 68°F. What are the corresponding Celsius and Kelvin temperatures?

4. An inventor claims to have developed a wonderful new heat engine that operates with a relatively cool (and therefore nonpolluting) flame at 150°C and discharges waste heat to the environment at 20°C. His promotional literature advertises that 45% of the fuel energy is converted into useful work. Calculate the maximum efficiency that can be expected for such an engine and compare it to the inventor's claim.

9. An electrically powered heat pump can deliver more energy than it draws from the power line without violating the Principle of Energy Conservation. Explain how this can happen.

More problems:

1. Why does water evaporating off your skin make you feel colder?

2. Water is essential to the existence of all known life forms, and it has a specific heat that is relatively high compared to other common substances. What does it mean, in words, to have a high specific heat? If water had low specific heat, how would that change coastal climates such as what we enjoy here in Santa Cruz?

3. 5 kg of water at 20°C and 10 kg of Copper at 60°C are mixed, what is the final temperature? The specific heat of copper is 0.358 $\frac{J}{g \cdot °C}$.
Note: 1 J/g = 1 kJ/kg.

4. In the above mixture we add 2 Gallons of water at 50°C. Now what is the final temperature?

5. An unknown amount of water at 20°C is mixed with 6 ice cubes at 0°C, each with weight 30 grams. The mixture becomes cold water at 5°C. what is the weight of the total mixture?

6. Calculate the heat required in BTu to raise 1 tonne of water from 40°F to 120°C. The latent heat of boiling is 2.25 MJ/kG.

7. How much heat is liberated when 1 tonne of water goes from 5°C to ice at −15°C?

8. A shot of lead of unknown mass is dropped into 1 litre of water at 30°C and is at $T = 190^0$C. It is just hot enough to convert the water to steam at 120°C in equilibrium with the shot. Calculate the mass of the shot. The specific heat of lead 0.16 $\frac{J}{g \cdot ^\circ\mathrm{C}}$.