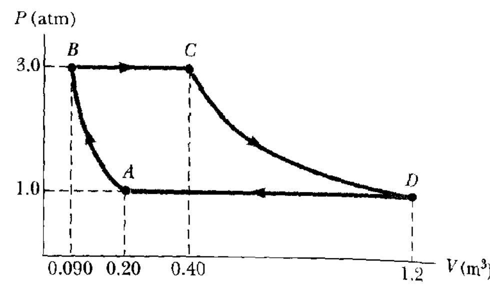
ENGINEERING 2C3 Assignment #5

1. [Serway Chapter 20 Problem 2, pg 577]
An 80 kg weight watcher wishes to climb a mountain to work off the equivalent of a large piece of chocolate cake rated at 700 (food) Calories. How high must the person climb?

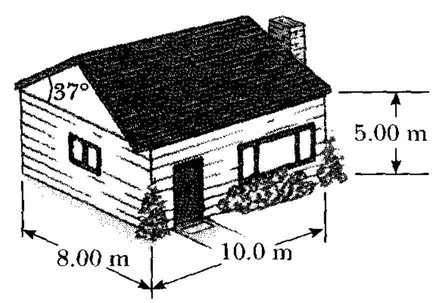
2. [Serway Chapter 20 Problem 15, pg 578]
A water heater is operated by solar power. If the solar collector has an area of 6.0 $m^2$ and the power delivered by sunlight is 550 $W/m^2$, how long does it take to increase the temperature of 1.0 $m^3$ of water from 20 °C to 60 °C?

3. [Serway Chapter 20 Problem 40, pg 580]
An ideal gas system goes through the process shown in the figure.
   - From A to B, the process is adiabatic.
   - From B to C, the process is isobaric with 100 kJ of heat flowing into the system.
   - From C to D, the process is isothermal.
   - From D to A, the process is isobaric with 150 kJ of heat flowing out of the system.

Determine the difference in internal energy $U_B - U_A$.




4. [Serway Chapter 20 Problem 72, pg 583]
The average thermal conductivity of the walls (including the windows) and roof of the house shown is 0.48 W / m °C, and their average thickness is 21 cm. The house is heated with natural gas having a heat of combustion (heat given off per cubic meter of gas burned) of 9600 kcal / $m^3$. How many cubic meters of gas must be burned each day to maintain an inside temperature of 25.0 °C if the outside temperature is 0.0 °C? Disregard radiation and heat loss through the ground.




5. [Serway Chapter 20 Problem 82, pg 584]
A pond of water at 0 °C is covered with a layer of ice 4.0 cm thick. If the air temperature stays constant at -10 °C, how long will it take before the ice thickens to 8.0 cm? (Hint: To solve this problem, utilize $dQ/dt = kA\ \Delta T/x$ and note that the incremental heat dQ extracted from the water through the thickness x of ice is the amount required to freeze a thickness dx of ice. That is $dQ = L\rho A dx$, where $\rho$ is the density of the ice, A is the area, and L is the latent heat of freezing.)