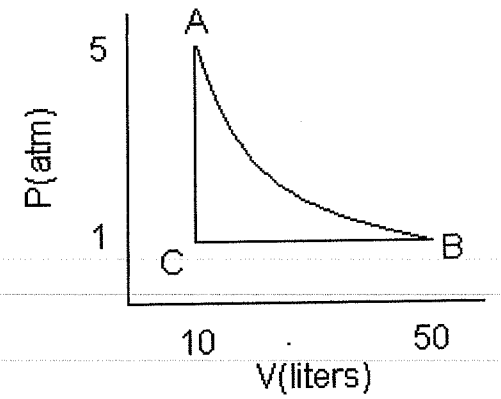
Physics 111 Homework Set #4

1) A heat engine absorbs 360 J of thermal energy and performs 25 J of work in each cycle. Find (a) the efficiency of the engine and (b) the thermal energy expelled in each cycle.
2) A ideal gas is compressed to ½ of its initial volume while T remains constant. (a) If 1000 J is removed from the gas during the compression, how much work is done ***on*** the gas? (b) What is the change in internal energy of the gas?
3) An engine absorbs Q_H=1600 J and expels Q_C=1000 J in each cycle. (a) What is the efficiency of the engine? (b) How much work is done by the engine in each cycle? (c) What is the power output if each cycle lasts 0.3 s?
4) A power plant operates at 32% efficiency during the summer when the sea water for cooling is at 20°C. The plant uses 350°C steam to drive the turbines. If the plant's actual efficiency changes in the same proportion as the ideal efficiency, what is the efficiency if the sea water is 10°C?
5) A Carnot engine has e=0.25 if T_H=500°C. If we want e=0.30, what must we make T_H if all else remains constant?
6) A 1.6 *l* gasoline engine with a compression ratio of 6.2 has a power output of 102 hp. Modeling the engine as an Otto cycle operating on an ideal gas, how much heat is absorbed and exhausted by the engine each second?
7) The surface of the sun is approximately 5700K and the surface of the earth is 290K. What is the change in entropy (ΔS) if 1000J of energy is transported from the sun to the earth?
8) A 2 *l* container is divided in two with 0.044 moles of H_2 on the left and 0.044 moles of O_2 on the right. Both are at 1atm and room temperature. If the gasses are allowed to mix, what is the entropy increase?
9) One mole of an ideal monatomic gas is taken through the cycle shown. Calculate (a) the net work done by the gas, (b) the thermal energy added to the gas, (c) the thermal energy expelled by the gas and (d) the efficiency of the cycle.



10) A system consisting of n moles of an ideal gas undergoes a reversible isobaric process from V_0 to $3V_0$. Find ΔS for the gas.