PHYSICS 215 - Thermodynamics and Modern Physics
Homework Assignment 3

1. Four moles of an ideal gas undergo a reversible isothermal expansion from volume V_1 to volume $V_2 = 2V_1$ at temperature T = 400 K. Find (a) the work done by the gas and (b) the entropy change of the gas. (c) If the expansion is reversible and adiabatic instead of isothermal, what is the entropy change of the gas?

2. An ideal gas undergoes a reversible isothermal expansion at 77° C. increasing its volume from 1.30 L to 3.40 L. The entropy change of the gas is 220 J/K. How many moles of gas are present?

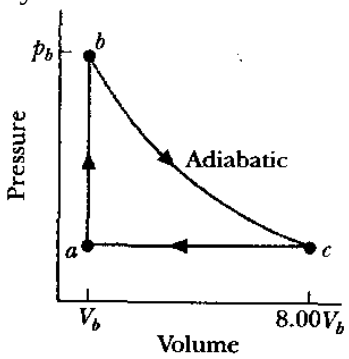
3. Find (a) the energy absorbed as heat and (b) the change in entropy of a 2.00 kg block of copper whose temperature is increased reversibly from 25°C to 100°C. The specific heal of copper is 386 J/kg K .

4. What is the entropy change of (a) a 12.0g ice cube that melts completely in a bucket of water whose temperature is just above the freezing point of water? (b) a 5.0 g spoonful of water that evaporates completely on a hot plate whose temperature is slightly above the boiling point of water?

5. A Carnot engine whose low-temperature reservoir is at 17°C has an efficiency of 40% . By how much should the temperature of the high-temperature reservoir be increased to increase the efficiency 50%?

6. A Carnot engine operates between 235°C and 115°C, absorbing 6.30 x 10^4 J per cycle at the higher temperature. (a) What is the efficiency of the engine? (b) How much work per cycle is this engine capable of performing?

7. One mole of a monatomic ideal gas is taken through the reversible cycle shown below. Process *bc* is an adiabatic expansions, with *Pb* = 10.0 atm and *Vb* = 1.00 x 10^{-3} m^3. Find (a) the energy added to the gas as heat (b) the energy leaving the gas as heat, (c) the net work done by the gas, and (d) the efficiency of the cycle.



8. Construct a table like that below for eight molecules.

	Configuration				Entropy
Label	n1	n2	W (multiplicity)	W calculation	(10^{-23} J/K)
I	6	0	1	6! / (6! 0!)	0
II	5	1	6	6! / (5! 1!)	2.47
III	4	2	15	6! / (4! 2!)	3.74
IV	3	3	20	6! / (3! 3!)	4.13
		Total microstates =	64		