

Name: _____
150 points
Dr. Jay H. Baltisberger

Test 1
Chemistry 261
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Answer three of the following four multiple choice questions for 15 points each:

1. A sample of 87 mg of ideal gas at 0.600 bar pressure had its volume doubled and its absolute temperature tripled. Calculate the final pressure.
A) 0.400 bar B) 0.600 bar C) 0.900 bar D) 1.200 bar E) 3.600 bar
2. What is the most work which could be produced if 500 J of energy is transferred from a 600 K hot bath to a 250 K cold bath?
A) 208 J B) 292 J C) 500 J D) 857 J E) 1200 J
3. For an ideal gas, $C_v = 3 n R / 2$. What is the final temperature if an ideal gas at 500 K is adiabatically and reversibly expanded from 1 L to 3 L?
A) 167 K B) 240 K C) 500 K D) 1040 K E) 1500 K
4. Find ΔS when 1.00 mol of water vapor initially at 200 °C and 1.00 bar undergoes a cyclic process for which $q = -1450$ J.
A) -7.25 J / K B) -3.06 J / K C) 0.00 J / K D) 3.06 J / K E) 7.25 J / K

Choose two of the following three problems for 45 points each:

5. Starting from the expression for dH derive $(\partial H / \partial V)_T = (\partial T / \partial V)_S - (1 / \alpha)$.
6. A system consists of 1.00 mg of ClF gas. A mass spectrometer separates the gas into the species ^{35}ClF and ^{37}ClF . Calculate ΔS . Isotopic abundances: $^{19}\text{F} = 100\%$, $^{35}\text{Cl} = 75.8\%$, $^{37}\text{Cl} = 24.2\%$.
7. Calculate ΔU and ΔH for each of the following changes in state of 2.50 mol of a perfect monatomic gas with $C_{v,m} = 1.5 R$ for all temperatures: (a) (1.50 atm, 400 K) \rightarrow (3.00 atm, 600 K) and (b) (28.5 L, 400 K) \rightarrow (42.0L, 400 K).

Using a short essay answer the following question:

8. Consider that a refrigerator is just an engine running in reverse (work is put into the engine to pump heat from cold to hot). Using a Carnot cycle, show that it is impossible to attain absolute zero temperature of the cold bath. (15 points)