Name: ________________________________  Test 1
60 points  Chemistry 261
Dr. Jay H. Baltisberger  March 6, 1996

Answer all 4 multiple choice questions (1-4).

1. For a spontaneous adiabatic process which of the following must increase (may be more than
one response). (5 points)
   A) Internal energy (E)  B) Entropy (S)  C) Volume (V)
   D) Enthalpy (H)  E) Helmholtz free energy (A)

2. If an ideal gas is heated under constant pressure which of the following state functions must
increase in size (may be more than one response). (5 points)
   A) Internal energy (E)  B) Heat (q)  C) Volume (V)
   D) Work (w)  E) Entropy (S)

3. For a gas, entropy (S) is most strongly dependent on which of the following state variables.
(5 points)
   A) Temperature (T)  B) Pressure (p)  C) Density (ρ)

4. How much heat (from the hot bath) is needed to generate 100 J of work by transferring heat
from a hot bath to a cold bath using a reversible Carnot cycle engine operating between 400 K
and 300 K. (5 points)
   A) 100J  B) 25J  C) 75J  D) 400J  E) 125J

Choose 2 of the following three problems (5-7):

5. 100.0 g of liquid H₂O at 55.0˚ C are mixed with 10.0 g of ice at –10˚ C. The pressure is kept
constant and no heat is allowed to leave the system. Calculate the final temperature for the
system and ΔS for this process. (15 points)

6. For 1.00 mole of an ideal gas calculate the work and heat for each step in a reversible cycle
consisting of an adiabatic expansion from 1.00 atm and 373 K to 300 K followed by a constant
pressure expansion to 373 K followed by a reversible isothermal compression back to 1.00 atm.
(15 points)

7. Consider the reversible, isothermal, constant-pressure freezing of 1.00 mol of water at 0.0˚ C
and 1.00 atm. Calculate ΔE, ΔH, ΔS, ΔG, q and w for the system. (15 points)

Using a short essay answer the following question:

8. Explain what would happen if you had two flasks (one with N₂ the other O₂) of equal size,
volume and pressure which are connected via a stopcock and you allowed them to mix (by
opening the stopcock)? Use thermodynamic arguments to describe whether this is reversible or
not. (10 points)