1. Using data found at <http://chem.libretexts.org/Reference/Reference_Tables/Thermodynamics_Tables/T1%3A_Standard_Thermodynamic_Quantities>, calculate the standard reaction Gibbs functions (Go) for the following reactions at 298 K.
   1. CH3CH2OH(l) + 3 O2(g) 🡪 2 CO2(g) + 3 H2O(l)
   2. C6H12O6(s) + 6 O2 🡪 6 CO2(g) + 6 H2O(l)
   3. 2 POCl3(l) 🡪 2 PCl3(l) + O2(g)
   4. 2 KBr(s) + Cl2(g) 🡪 2 KCl(s) + Br2(l)
   5. SiH4(g) + 2 Cl(g) 🡪 SiCl4(l) + 2 H2(g)
2. Estimate G at 1000 K from its value at 298 K for the reaction

C(s) + 2 H2(g) 🡪 CH4(g) G = -50.75 kJ at 298 K

1. The standard Gibbs function for formation (Gfo) of PbO2(s) is -217.4 kJ/mol at 298 K. Assuming O2 is an ideal gas, find the standard Helmholtz function for formation (Afo) for PbO2 at 298K.

Afo can be calculated from Gfo using the relationship

1. Calculate the entropy change for 1.00 mol of an ideal monatomic gas (CV = 3/2 R) undergoing an expansion and simultaneous temperature increase from 10.0 L at 298 K to 205.0 L at 455 K.
2. Consider a gas that obeys the equation of state
   1. Find expressions for  and T for this gas.
   2. Evaluate the difference between Cp and CV for the gas.
3. Show that for an ideal gas.
4. Derive the thermodynamic equation of state

Starting from the definition of enthalpy

differentiating yields

And substitution of the relationship which comes from combining the first and second laws yields

Now, dividing by *dp* and constraining to constant T

This simplifies to

And using the Maxwell Relation on G

The result is

1. Derive the thermodynamic equation of state
2. The “Joule Coefficient” is defined by

Show that

and evaluate the expression for an ideal gas.

1. Derive expressions for the pressure derivatives of U, H, A, G, and S at constant temperature in terms of measurable properties. (The derivation of was done in problem 7.) Evaluate the expressions for ,, and for a van der Waals gas.
2. Derive expressions for the volume derivatives of U, H, A, G, and S at constant temperature in terms of measurable properties. (The derivation of was done in problem 8.) Evaluate the expressions for and for a van der Walls gas.
3. Evaluate the difference between Cp and CV for a gas that obeys the equation of state
4. The adiabatic compressibility (S) is defined by

Show that for an ideal gas,