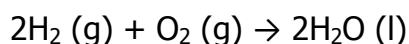


### Problem Session # 8

- 1) Calculate the change in the Helmholtz energy for the reversible isothermal compression of 1 mole of an ideal gas from 100.0 L to 22.4 L. Assume that the temperature is 298 K.
- 2) Determine  $\Delta G_r$  (25°C=298 K) for the following chemical reaction using both methods for determining  $\Delta G_r$ , and show that they yield the same answer. Assume standard conditions.



	<b>H<sub>2</sub> (g)</b>	<b>O<sub>2</sub> (g)</b>	<b>H<sub>2</sub>O (l)</b>
<b><math>\Delta H_f</math></b> <b>kJ/mol</b>	0	0	-285.83
<b>S, J/mol.K</b>	130.68	205.14	69.91
<b><math>\Delta G_f</math></b> <b>kJ/mol</b>	0	0	-237.13

- 3) Helium is expanded isothermally and reversibly at 100°C from a pressure of 2 bar to 10 bar. Calculate
  - a) Q per mole
  - b) W per mole
  - c)  $\Delta \bar{G}$
  - d)  $\Delta \bar{A}$
  - e)  $\Delta \bar{H}$
  - f)  $\Delta \bar{E}$
  - g)  $\Delta \bar{S}$
- 4) Toluene is vaporized at its boiling point, 111°C. The heat of vaporization at this temperature is 361.9 J.g<sup>-1</sup>. For the vaporization of toluene, calculate
  - a) W per mole
  - b) Q per mole
  - c)  $\Delta \bar{H}$
  - d)  $\Delta \bar{E}$

**e)**  $\Delta \bar{G}$

**f)**  $\Delta \bar{S}$

- 5) a)** Liquid water at 100°C is in equilibrium with water vapor at 1 atm pressure. If the enthalpy change associated with the vaporization of liquid water at 100°C is 40.60 kJ.mol<sup>-1</sup>, what are  $\Delta G$  and  $\Delta S$ ?
- b)** Suppose that water at 100°C is in contact with water vapor at 0.900 atm. Calculate  $\Delta G$  and  $\Delta S$  for the vaporization process.