

Quiz #4

Name Key

$R = 1.987 \text{ cal K}^{-1} \text{ mol}^{-1} = 8.314 \text{ J K}^{-1} \text{ mol}^{-1} = 0.08206 \text{ L atm K}^{-1} \text{ mol}^{-1}$   
 $K = ^\circ\text{C} + 273.15$

1. Matching (Use a letter only once)

For a constant T,  $\Delta G$  changes versus pressure according to g.

For an ideal solution of two liquids,  $\Delta H_{\text{mix}}$  is j.

$\Delta H_{\text{vap}}$  may be determined by measuring the vapor pressure of a liquid versus c.

For a reversible process,  $dG$  equals i.

For equilibrium between phases  $\alpha$  and  $\beta$ , the a of the two phases are equal.

- a. chemical potential
- b.  $[\Delta H_{\text{vap}}/R] [\ln(P_2/P_1)]$
- c. T
- d. positive
- e. entropy
- f.  $dq_{\text{rev}}/T$
- g.  $nRT \ln(P_2/P_1)$
- h. V
- i.  $VdP - SdT$
- j. zero

2. For the reaction  $\text{C}_2\text{H}_4 + \text{H}_2 \leftrightarrow \text{C}_2\text{H}_6$ , at 298 K  $\Delta G_f^\circ$  is 68.12 kJ/mol for  $\text{C}_2\text{H}_4$ , -32.9 kJ/mol for  $\text{C}_2\text{H}_6$ , and 0.0 kJ/mol for  $\text{H}_2$ . Calculate  $\Delta G_r^\circ$  for the reaction at 298 K.

$$\Delta G_r^\circ = -32.9 - (+68.12) = -101.0 \text{ kJ}$$

3. A quantity of 0.50 moles of an ideal gas at 315 K is expanded from 2.0 L to 6.0 L isothermally and reversibly.

- +0.5 a. Give the expression for  $w$  for this expansion

$$w = -nRT \ln V_2/V_1$$

$$\frac{V_2}{V_1} = \frac{P_1}{P_2}$$

$$= -14.20 \text{ L-atm} = -1,438 \text{ J}$$

- b. Calculate the values for  $w$ ,  $q$ ,  $\Delta U$ ,  $\Delta H$ ,  $\Delta S$ , and  $\Delta G$ . ← +0.5 for each

Isothermal

$$\Delta U = 0$$

$$\Delta H = 0$$

$$\Delta U = 0$$

$$q = -w$$

$$= 14.20 \text{ L-atm} = 1,438 \text{ J}$$

$$\Delta S = \frac{q}{T} = nR \ln V_2/V_1$$

$$= +0.0451 \text{ L-atm/K}$$

$$= +4.565 \text{ J/K}$$

$$\Delta G = -T\Delta S = -nR \ln V_2/V_1$$

$$= nR \ln P_2/P_1$$

$$= -14.20 \text{ L-atm} = -1,438 \text{ J}$$