Second Exam
February 29, 2008

First Page: Useful information and equations:

Law I $\Delta U = q + w$

$U = U(T,V)$

$$dU = \left(\frac{\partial U}{\partial T}\right)_V dT + \left(\frac{\partial U}{\partial V}\right)_T dV$$

LawII: $dS = \frac{q_{rev}}{T}$

$S = S(T,V)$

$$dS = \left(\frac{\partial S}{\partial T}\right)_V dT + \left(\frac{\partial S}{\partial V}\right)_T dV$$

Comb I,II: $dU = TdS - PdV$

$H = U + PV; \quad A = U + PV$

$G = H - TS; \quad dG = -SdT + VdP$

Thermodynamic Equation of State

$$\left(\frac{\partial H}{\partial P}\right)_T = V - T\left(\frac{\partial V}{\partial T}\right)_P$$

$$\left(\frac{\partial S}{\partial T}\right)_P = \frac{C_P}{T}; \quad \left(\frac{\partial S}{\partial P}\right)_T = -\left(\frac{\partial V}{\partial T}\right)_P;$$

$$\mu_A = \mu_A^o + RT\ln\frac{P_A}{P_o}$$

Dalton's Law

$P_A = \chi_A P; \quad P = \sum_A P_A; \quad G = \sum n_i \mu_i$

$$\Delta G_{mix} = RT\sum n_i \ln\left(\frac{P_i}{P_o}\right)$$

Calculus Identities:

$$\Delta Z = \int_{x_i}^{x_f} \left(\frac{\partial Z}{\partial x}\right)_y dx$$

$$\left(\frac{dx}{dy}\right)_z \left(\frac{dz}{dx}\right)_y \left(\frac{dy}{dz}\right)_x = -1$$

$$\frac{d(yz)}{dx} = z\frac{d(y)}{dx} + y\frac{d(z)}{dx}$$

$$\frac{dx}{dz} = \frac{dy}{dz}\frac{dx}{dy}; \quad \left(\frac{\partial x}{\partial z}\right)_a = \left(\frac{\partial y}{\partial z}\right)_a \left(\frac{\partial x}{\partial y}\right)_a$$

Thermal expansion and compression coefficient

$$\beta = \frac{1}{V}\left(\frac{\partial V}{\partial T}\right)_P \quad \kappa = \frac{-1}{V}\left(\frac{\partial V}{\partial P}\right)_T$$

vdW Gas EoS: $P = \frac{RT}{V_m - b} - \frac{a}{V_m{}^2}$

Reaction Info

$$\Delta H_{rxn}^o = \sum_i \nu_i \Delta H_f^o(i)$$

$$\Delta S_{rxn}^o = \sum_i \nu_i S_f^o(i)$$

$$dn_i = n_i - n_i^{Init} = \nu_i dX$$

$$\Delta C_{P,rxn} = \sum_i \nu_i C_{P,m}(i)$$

$$\Delta H^o = \Delta H_{rxn}^o dX$$

$$\Delta G_{rxn} = \Delta G_{rxn}^o + RT\ln Q_P = RT\ln\frac{Q_P}{K_P}$$

$$Q_P = \prod_{i=1}^{N}\left(\frac{P_i}{P_o}\right)^{\nu_i} \quad \text{@Eq } Q_P = K_P$$

$$K_P = \left(\frac{P}{P_o}\right)^{\Delta\nu} K_x = \left(\frac{c_o RT}{P_o}\right)^{\Delta\nu} K_c$$

Van't Hoff Eqn:

$$\ln\left(\frac{K_P(T_2)}{K_P(T_1)}\right) = -\frac{\Delta H_{rxn}^o}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$

Gas Constant:

$R = 8J / mol - K$

$R = 0.08L - atm / mol - K$

$R \cdot 300K = 2.5kJ / mol$

$1Atm \approx 1bar = 10^5\,Pa$

$T(K) = T(C) + 273$

Show your work throughout; clearly show what equations you are using, and always show units for computed quantities.

Show your work throughout, always write down the equations you are using before substituting in numerical values and always show units for computed quantities. You do not need to compute the final number if you do not want to but you must show where the numbers you are given can be used.
Use this page for additional space if you need it.

Name ______________________________

ID____________