Equations: Exam 1 **Chemistry BC3252y**

You may remove this sheet from the exam. Do not write answers here.

Math facts

For any state function z(x, y) the total differential dz is $dz = \left(\frac{\partial z}{\partial x}\right)_y dx + \left(\frac{\partial z}{\partial y}\right)_x dy$

Euler Reciprocity Theorem (a.k.a. Clairault's theorem).

For any state function z(x, y): $\left(\frac{\partial^2 z}{\partial x\,\partial y}\right) = \left(\frac{\partial^2 z}{\partial y\,\partial x}\right)$

Cyclic Rule: $\left(\frac{\partial x}{\partial y}\right)_z \left(\frac{\partial y}{\partial z}\right)_x \left(\frac{\partial z}{\partial x}\right)_y = -1$

Definitions and key equations

Virial equation: $pV_m = RT + Bp + Cp^2 + \ldots$ **B(T) = second virial coefficient**

Work of expansion and compression (pV work): $dw \equiv -\,p_{ex}dV$

$dU \equiv dq + dw$

$H \equiv U + pV$

$C_V \equiv (\partial U/\partial T)_V$

$C_p \equiv (\partial H/\partial T)_p$

$\mu_{JT} \equiv (\partial T/\partial p)_H$

$dS \equiv dq_{rev}/T$

$A \equiv U - TS$

$G \equiv H - TS$

Inequality of Clausius: $(dq - TdS) \leq 0$

For an ideal gas:

$pV = nRT$, $C_p = C_V + nR$, $dU = C_V\,dT$, $dH = C_p\,dT$

Isothermal reversible expansion/compression (pV work only): $w = -nRT\ln(V_2/V_1)$

Adiabatic reversible expansion/compression (pV work only):

$VT^{C_V/nR} = \text{constant}$ ***and*** $pV^{\gamma} = \text{constant}$ **where** $\gamma = C_p/C_V$

Fundamental equations (closed systems, reversible, pV work only):

$dU = +TdS - pdV$

$dH = +TdS + Vdp$

$dA = -SdT - pdV$

$dG = -SdT + Vdp$