Relationships that will be provided with Exam 1. You are responsible for knowing to what circumstance a relationship is applicable.

Constants and units

$R = 8.31451\ J\ K^{-1}\ mol^{-1} = 8.31451 \times 10^{-2}\ L\ bar\ K^{-1}\ mol^{-1} = 8.20578 \times 10^{-2}\ L\ atm\ K^{-1}\ mol^{-1}$

1 L bar = 100 J

1 atm = 1.01325 bar = 760 Torr

$1\ bar = 10^5\ Pa$

$1\ J = 1\ kg\ m^2\ s^{-2}$

$g = 9.81\ m\ s^{-2}$

$N_A = 6.022 \times 10^{23}\ mol^{-1}$

Gases and molecular speeds

$$Z = \frac{pV_m}{RT} = 1 + \frac{B}{V_m} + \frac{C}{V_m^2} + \ldots$$

$$p = \frac{RT}{V_m - b} - \frac{a}{V_m^2}$$

$$f = F(s)\Delta s$$

$$F(s) = 4\pi\left(\frac{M}{2\pi RT}\right)^{3/2} s^2 e^{-MS^2/2RT}$$

$$\lambda = \frac{RT}{2^{1/2} N_A \sigma p}$$

$c = \lambda z$

Thermodynamic relationships

$\Delta U = q + w$

$H = U + pV$

$w = -p_{ex}\Delta V$

$w = -nRT \ln (V_f/V_i)$

$C = q/\Delta T$

$\Delta H = C_p \Delta T$

$\Delta S = nR \ln (V_f/V_i)$

$\Delta S = C_p \ln (T_f/T_i)$

$\Delta S = \Delta_{trans}H/T_{trans}$

$\Delta S_{sur} = -q/T$

$\Delta_r C_{p,m} = \Sigma \nu C_{p,m}(\text{Products}) - \Sigma \nu C_{p,m}(\text{Reactants})$

$\Delta_r H(T) = \Delta_r H(T') + \Delta_r C_{p,m}(T-T')$

$G = H - TS$

Integrals

$$\int \frac{1}{x-a}\,dx = \ln(x-a) + C$$

$$\int x^n dx = \frac{1}{n+1} x^{n+1} + C \quad (n \neq -1)$$