PE Chemical Reference Handbook, version 2.4 errors

section 1.2.3.27 surface tension

The row and column for g/cm should be removed because that is not a correct set of units for surface tension.

section 3.2.2.4 Gibbs Free Energy

The statement "Gibbs free energy indicates the potential for reversible work that a system can do at constant pressure and temperature." is not true. It should be replaced with the following:

The Gibbs Free Energy indicates the potential PV work for an isothermal open process.

explanation

$dg = VdP - SdT$

If process is both constant pressure and constant temperature, $dg = 0$. The constant pressure constraint must be removed in order for PV work to occur.

section 3.2.2.5 Helmholtz Free Energy

The statement "The Helmholtz free energy is the potential to do work in a closed system at constant volume and temperature." is not true. It should be replaced with the following:

The Helmholtz Free Energy indicates the potential PV work for an isothermal closed process.

explanation

$da = -P \cdot dV - s \cdot dT$

If process is both constant volume and constant temperature, $da = 0$. The constant volume constraint must be removed in order for PV work to occur.

section 3.4.2.7 Brayton Cycle

The efficiency of the Brayton cycle <u>with regeneration</u> should have the temperatures inverted to Tmin/Tmax.

A derivation may be found at the link below.

https://users.encs.concordia.ca/~kadem/Brayton%20cycle%20with%20regeneration.pdf

section 5.3.2   Multiple Reactor Networks

The following is incorrect:

Multiple continuous stirred tank reactors in series may be replaced by a single continuous stirred tank reactor. The residence time
of the single continuous stirred tank reactor will be equal to the sum of the residence times for the individual continuous stirred
tank reactors

The correct statement follows:

Multiple continuous stirred tank reactors in series may be replaced by a single plug flow reactor. The residence time of the plug flow reactor
will be equal to the sum of the residence times for the individual continuous stirred tank reactors.

section 7.2.5

The relationships given for the mass transfer coefficients in concentrated systems imply (because of the equal signs) that they can be computed from the coefficients used for dilute systems. That is not true. Those are merely substitution relations for converting the equation for the dilute system overall coefficient to the concentrated system overall coefficient.

explanation

The handbook states that

$$k_x^{hat} = k'_x \cdot x_{BM}$$ where k_x^{hat} is liquid mass transfer coefficient in concentrated system

and k'_x is liquid mass transfer coefficient in dilute system

Using that assumption, it can be shown that the flux in the two systems will be equal..

$$k'_x \cdot \left(x - x_i\right) = \frac{k_x^{hat}}{x_{BM}} \cdot \left(x - x_i\right)$$

But the fluxes are not equal for the two systems If they were equal, then there would be no need to use $\dfrac{k_x^{hat}}{x_{BM}}$.

correction

Use the following:

Replace k'_x with $\dfrac{k_x^{hat}}{x_{BM}}$ in the liquid flux relationship.

Replace k'_y with $\dfrac{k_y^{hat}}{y_{BM}}$ in the gas flux relationship.

section 7.4.2.4 Number of Liquid-Phase Transfer Units

The arguments in the ln term need to be inverted, otherwise the term will be negative. See Treybal, *Mass Transfer Operations* (1955), eq 8.43

$$n_{OL} = 0.5 \cdot \ln\left(\frac{1 - x_{Ai}}{1 - x_{A0}}\right) + \int_{x_{Ai}}^{x_{A0}} \frac{1}{\left(x_{eq} - x\right)} \, dx$$

section 7.11 Leaching

The formula for the number of stages has two errors.

First error:

The concentrations used in the formula indicate that the constant overflow assumption has included stage 1 also. Otherwise, x_1 and y_2 would have been used in the formula. Thus, the formula on the right side provides the total number of stages, including stage 1. This means the 1 on the left side is not needed.

Second error:

The ln term in the numerator has an incorrect concentration. The y_a in the denominator of that term needs to be replaced with y_b.

correct formula:

$$N = \frac{\ln\left(\frac{y_b - x_b}{y_b - x_a}\right)}{\ln\left(\frac{y_b - y_a}{x_b - x_a}\right)}$$

This formula was derived using the KSB formula.