Relation between K_c & K_x

If mole fraction is taken as active mass in place of concentration then equilibrium constant is denoted by K_x and mole fraction of A is equal to

$$\frac{[A]}{[A]+[B]+[C]+[D]}$$

i.e $x_A = \frac{[A]}{\sum n}$ where —

$\sum n$ = total no. of moles.

Similarly $x_B = \frac{[B]}{\sum n}$,

$x_c = \frac{[C]}{\sum n}$ and

$x_D = \frac{[D]}{\sum n}$

$$K_x = \frac{x_c^x \cdot x_D^y}{x_A^n \cdot x_B^m}$$

$$\text{or } K_n = \frac{\left[\frac{[C]}{\xi n}\right]^x \left[\frac{[D]}{\xi n}\right]^y}{\left[\frac{[A]}{\xi n}\right]^n \left[\frac{[B]}{\xi n}\right]^m}$$

$$= \frac{[C]^x \cdot [D]^y}{[A]^n [B]^m} \cdot (\xi n)^{(m+n)-(x+y)}$$

$$\text{or } K_n = K_c (\xi n)^{-\Delta n}$$

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