

## Debye–Hückel equation

The chemical potential or activity of ions cannot be determined on a purely thermodynamic basis. This is due to the fact that the effects of an ion cannot be separated from the effects of the accompanying counter-ion, or in other terms, the electrochemical potential of the ion cannot be separated into the chemical and the electrical component. Such a separation must necessarily be based on a non-thermodynamic convention. The present convention is based on the assumption that the molal activity coefficient of the chloride ion in dilute aqueous solutions ( $I < 0.10 \text{ mol kg}^{-1}$ ) can be estimated by means of the Debye–Hückel equation:

$$-\log_{10}\gamma_{\text{B}} = \frac{z_{\text{B}}^2 A \sqrt{I}}{1 + a_{\text{B}} B \sqrt{I}}$$

where  $I$  is ionic strength,  $z$  is the charge number of the ion,  $a$  is ion size parameter and  $A$  and  $B$  are temperature-dependent constants. According to the Bates–Guggenheim convention  $a_{\text{B}}$  is taken to be  $1.5 \sqrt{\text{mol kg}^{-1}}$  at all temperatures and for all compositions of the solutions.

**See also:** pH

**Source:**

PAC, 1984, 56, 567 (*Physicochemical quantities and units in clinical chemistry with special emphasis on activities and activity coefficients (Recommendations 1983)*) on page 569