**Born-Bjerrum Equation: Salt Solutions**

It is generally assumed that the Born Equation yields a difference in Gibbs energies rather than Helmholtz energies and so one can use the Gibbs-Helmholtz Equation for the dependence on temperature at fixed pressure to yield the Born-Bjerrum Equation, assuming that $(\partial r_j / \partial T)$ is zero.

\[
\Delta (pfg \rightarrow s \ln) H_j(c_j = 1 \text{ mol dm}^{-3}; \text{id}; T; p) =
\]

\[
-N_A \cdot (z_j \cdot e)^2 / 8 \cdot \pi \cdot r_j \cdot \epsilon_0 \cdot \left[ 1 - (1 / \epsilon_r) - (T / \epsilon_r) \cdot (\partial \ln \epsilon_r / \partial T) \right]
\]

(a)

In fact an early calorimetric study showed that in terms of predicting the enthalpies of solution for salts, the Born equation is inadequate, often predicting the wrong sign. [1,2]

Differentiation of equation (a) with respect to temperature yields an equation for the partial molar isobaric heat capacity of ion j in a solution having ideal thermodynamic properties.

\[
C_{pj}(\text{sln}; c_j = 1 \text{ mol dm}^{-3}; \text{id}; T; p)
\]

\[
= -N_A \cdot (z_j \cdot e)^2 / 8 \cdot \pi \cdot r_j \cdot \epsilon_0 \cdot \left[ \partial \{(1 / \epsilon_r) + (T / \epsilon_r) \cdot (\partial \ln \epsilon_r / \partial T)\} / \partial T \right]
\]

(b)

**Footnotes**
