**Topic 1759**

**Gibbs Energies; solutes; cospheres**

The chemical potential of solute $j$ in aqueous solution, molality $m_j$, at temperature $T$ and pressure $p$ (which is close to ambient) is given by equation (a).

$$
\mu_j^{(aq)} = \mu_j^{(aq)}(T) + R \cdot T \cdot \ln(m_j \cdot \gamma_j) / m_j^0 \tag{a}
$$

In developing an understanding of factors which contribute to $\mu_j^{(aq)}$, a model for solutions developed by Gurney is often helpful [1].

A co-sphere is identified around each solute molecule $j$ where the organisation of solvent molecules differs from that in the bulk solvent at the same $T$ and $p$. In a solution where the thermodynamic properties of the solute $j$ are ideal, there are no solute-solute interactions such that the activity coefficient $\gamma_j$ is unity. In real solutions the fact that $\gamma_j \neq 1$ can be understood in terms of co-sphere---co-sphere interactions together for salt solutions strong charge-charge interactions.

The model [2] identifies two zones. Zone A describes solvent molecules close to the solute molecule, the number of such solvent molecules being the primary hydration number. Zone B describes the solvent molecules outside Zone A. Their organisation differs from that in the bulk solvent as a consequence of the presence of solute molecule (or, ion) $j$. Zone C lies beyond zone B where the organisation of solvent is effectively the same as that in pure solvent at the same $T$ and $p$. There is merit in not being too pedantic concerning the definitions of zones A, B and C.

For real solutions co-sphere---co-sphere interactions are accounted for using for example the term $[\partial \ln(\gamma_j) / \partial p]_T$ in the equation describing the partial molar volume $V_j^{(aq)}$ for solute $j$ in a real solution.

**Footnotes**
