SOLUTE - SOLVENT INTERACTIONS
IN 2 - AND 3 - COMPONENT SYSTEMS

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SUMMARY

Solute-solvent interactions may be studied through their contribution to the viscosity $B$-coefficient of the solute. Values of the $B$-coefficient for seven alkali halides in aqueous solution, and in 20 percent sucrose solution as solvent, at $25^\circ$C., are presented. That the coefficients for the 3-component systems are an additive property of the electrolyte ions, is demonstrated. On the basis of a criterion formerly applied to the 2-component systems, these coefficients are divided into their ionic contributions. Correlations are drawn between ionic $B$-coefficients and the limiting equivalent conductances, in aqueous solution and in 20 percent sucrose solution, of the corresponding ions, and between ionic $B$-coefficients and the cubes of recent values of the crystal ionic radii.

Flared-capillary viscometers, in which the flow exhibited no apparent kinetic energy effect, were produced, and used for the necessary solution viscosity measurements. This represents the first recorded application of the technique proposed and developed by Caw and Wylie. The flow was photo-electrically timed. In the course of the calibration of these viscometers, certain interesting conclusions were reached, concerning the values, for the viscosity of sucrose solutions, normally
accepted as calibration standards.

Ancillary data, on the densities of the aqueous, and 20 percent sucrose, electrolyte solutions, are presented, and the corresponding limiting apparent molar volumes, at 25°C., derived. However, it was not possible, without extending some of the measurements to higher dilutions, to obtain reliable data for all the systems studied.

Since an examination of the basis for a correction made to viscosity data, recently reported in the literature, for two tetra-(n-propyl)-ammonium halides in aqueous solution at 25°C., failed to indicate the necessity of such a correction, a re-investigation of these systems was undertaken, the results of which are presented.

The effect of incomplete dissociation on the viscosity of electrolyte solutions is discussed, and illustrated by a treatment of data for magnesium sulphate in a 20 percent dioxan - water mixture at 35°C., which were drawn from the literature.

Another aspect of solute - solvent interactions, namely the interaction of a macro-ion (D.N.A.) with its solvent, as manifested in the value of the partial specific volume of that species in aqueous solution, was the subject of an independent study.

In order that a meaningful value of this partial specific
volume might be obtained from precise measurements of the density of dilute solutions of sodium deoxyribonucleate at 25°C., it was necessary to develop an effective method of weight analysis of the stock solutions from which these were prepared. A description of this method is given. The densities were measured by the Magnetic Float technique. Several aspects of this technique are discussed in detail, and in particular, a theoretical analysis of the extrapolation procedure employed, is presented. The process of denaturation is discussed briefly, and corroborative evidence for its occurrence, in the concentration range studied, is reported.