THE VISCOSITY OF LIQUIDS

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WITH DIAGRAMS

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Monographs on Inorganic and Physical Chemistry

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PREFACE.

THE development of a physical property may follow two paths. Either the intrinsic importance of the property may lead to investigation from a purely physical standpoint, or its application to the elucidation of chemical constitution may cause improvements to be sought for in method, degree of accuracy, and ease of application. In the majority of physical properties utilized by the chemist, progress has gone on uniformly in each direction and a standardization of apparatus and technique has been arrived at, but in spite of a century of experimental work no very definite method has been set up for the measurement of viscosity, and no general agreement has been arrived at for the setting forth and interpretation of the results obtained. To a certain extent the inherent difficulty of understanding the strict physical meaning of viscosity is the cause of this lack of progress. The viscosity of a liquid is at least a dual phenomenon; there is first of all the mechanical friction of molecule against molecule, and this must depend on relative molecular surface and volume; then there is the resistance to deformation brought about by the mutual attraction of the molecules.

It follows at once that viscosity must be largely a constitutive property, and perhaps it is this fact—that so little additivity is to be looked for—that has led investigators to turn their attention to properties where a mole-

cular value can readily be synthesized from atomic constants.

It should be borne in mind, however, that mere additivity is comparatively useless for the purpose of the chemist, who is searching for a physical confirmation of erratic chemical behaviour. When one considers, for example, such questions as the enol-keto tautomerism, the benzene problem, the effect of ring formation, and the contiguity of unsaturated groups, and the various physical methods which have been utilized for their elucidation, it will be obvious that it was the failure of the additive nature of such properties as refractive index, molecular volume, molecular magnetic rotation, and so on which turned out to be valuable. Viscosity stands out as an eminently constitutive property of the same order as optical rotatory power and the solution absorption of light. It is, therefore, of considerable importance to know how viscosity can be measured, and how the property can be utilized in the study of chemistry.

In the following pages will be given a brief description of some of the more important earlier researches which laid down the foundations of the subject, the development of a working formula, and the corrections which have been applied to it, the various apparatus which has been used at different times, and a series of chapters dealing with recent lines of work in which viscosity is playing an important part.

The authors desire to thank the Councils of the Royal Society, the Chemical Society, and the Faraday Society for permission to reproduce diagrams which have appeared in their respective Transactions; they are indebted to Prof. Washburn for Fig. 2.

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