

TABLE II. Viscosity of *n*-decane. Values of $\log t/t_0$ where t_0 is the time of fall at 30°C and atmospheric pressure ($\log t_0 = 0.826$).

Pressure (kg/cm ²)	Log t/t_0	
	30°	75°
1	0.000	0.208
500	0.184	0.005
1000	0.356	
2000	0.659	0.359
3000	0.939	0.585
4000	1.212	0.785
6000		1.163

$\log_{10} t_0$,⁵ and the pressures in kg/cm² are given in Table II for *n*-decane, and with the molar concentrations in Table III for the six binary mixtures. In the course of these experiments, the viscosities of the pure liquids were redetermined and the values found to be in good agreement with those of Bridgman, the disagreement in any case not amounting to over two percent.

As Table III does not show the interesting and unusual features exhibited by these results, isobaric viscosity-concentration diagrams are given in several instances in order that the significance of the data may be better visualized.

It is difficult to estimate the error in these experiments. The total percentage error estimated for a typical mixture of *n*-hexane chlorobenzene at a pressure of 500 kg/cm² at 30° amounted to about two percent, and increased to three percent at 75°. At higher pressures these errors became less. However, on estimating that part of the error contributed by the data of Table III by considering how well the experimental points fitted a smooth curve, the maximum deviation of a plotted point from the smooth viscosity-pressure curve for the same mixture at 30° corresponded to an error of 0.5 percent in the fall time. The remaining 7 points fitted the curve within the error of drawing. The similar curve at 75° showed that all the points fitted it without any noticeable deviations. Consequently, since the greater part of the total error came from the errors in the quantities of Table III, it is reasonable to expect that the total error amounted to less than that estimated as the percentage error.

⁵ The viscometer was not designed for high accuracy in the time of fall, t_0 at atmospheric pressure; hence these values should be used with caution in further applications.

DISCUSSION OF RESULTS

(1) Viscosity of *n*-decane at various pressures and temperatures

The viscosity of *n*-pentane, *n*-hexane and *n*-octane of the methane series has been investigated under various pressure and temperature conditions by Bridgman.² The data of this paper extend these measurements to include *n*-decane. In general, the pressure coefficient of viscosity, as well as the temperature coefficient, is similar to those of the other paraffins that have been studied. The relation between the logarithm of viscosity and molecular weight is apparently simple for the members of this series at high pressures. By plotting log viscosity against molecular weight for these liquids at 4000 kg/cm² and 30°, it will be found that the points lie on a curve which closely approaches a straight line. Also, at 75° a similar curve at 6000 kg/cm² approaches linearity.

(2) Viscosity-concentration curves at constant pressure, at 30° and 75°

The isobaric viscosity-concentration curves, plotted from the data of Table III, may be conveniently divided into two classes. First, the curves for which the log relative viscosity is a linear function of the molar concentration through the entire pressure range at 30° and 75°, representing the mixtures *n*-hexane carbon disulphide and *n*-hexane *n*-decane, Figs. 1 and 2, the curves at 75° being omitted as they are qualitatively similar. Secondly, the curves of the remaining mixtures under similar conditions for which the log relative viscosity varies in a complicated way with the molar concentration, Figs. 3 to 9 inclusive.

The components of the mixtures of the first group are similar in that they are simple nonpolar liquids which would be expected to dissolve in solution without the complications due to non-uniform molecular fields. *A priori*, it might be thought that the tendency of the molecules would be toward an end-to-end arrangement, contributing to an orientation more or less parallel to the lines of flow, the viscosity being the resistance of these parallel layers of molecules

varying

Dens.
0.748
0.837
0.693
0.657
0.787
0.725
0.672
0.617
0.869
0.707
0.765
0.809
0.716

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