The results of a calculation relating to the viscosity and thermal conductivity of hydrogen at pressures of 1-1000 bars and temperatures of 2000-10,000°K are presented.

At pressures of 10-10^3 bars and temperatures of 2000-10,000°K, and also at a pressure of 1 bar and temperatures of 2000-8000°K, hardly any ionization occurs in hydrogen [1]. However, dissociation occurs very considerably over the same range of temperature and pressure.

In this paper we shall calculate the viscosity, thermal conductivity, and diffusion coefficient of dissociated hydrogen over the range in question.

The results of similar calculations (without allowing for ionization) were presented earlier for lower pressures [2].

A reference book on the thermal conductivity of gases and liquids [3] gives an analysis of experimental investigations into the thermal conductivity of hydrogen at high pressures; at 600°K, according to this book, the thermal conductivity of hydrogen changes by only 6% on raising the pressure from 1 to 600 bars, the effect of the real nature of the gas (its nonideal properties) on the thermal conductivity diminishing with increasing temperature.
The thermal conductivity of hydrogen was also considered in [4] up to a pressure of 800 bars. Analysis of the latter experimental data, together with all the preceding results, using the method of [3] and extrapolating the relationship between the excess thermal conductivity of hydrogen and its density obtained from the experimental points in the high-temperature direction shows that at 1000 K, for example, the thermal conductivity of hydrogen changes by only 3% on raising the pressure from 1 to 1000 bars.

We may conclude from these data that at T > 2000 K the transfer properties of dissociated hydrogen may be calculated up to pressures of $10^3$ bars by simply using the theory of transfer phenomena developed for mixtures of reacting ideal gases. The basic relationships of this theory were given in [5].

The mutual diffusion coefficient of gases 1 and 2 is (to a first approximation) independent of concentration and is determined by the equation