TABLE III

Gas	$\bar{v}$	L (in cm^3)	$\bar{v}$
N_2	36.4	39.1	35.0
H_2	24.3	26.6	28.6
O_2	27.1	32.3	28.1
CH_4	35.3	42.7	37.7
CO	35.7	39.9	36.0

From the data of this table it follows that the $\bar{v}$ values of the gases in water at their freezing point also approach the molar volumes v of the liquid gases at p = 1 atm.

Further investigations are required to deal with this question.

929 If we knew the partial molar volumes of the dissolved gases it would be possible with the help of these to ascertain all the other quantities in the fundamental equation of the theory of regular solutions. This is apparent from the following simple procedures.

From eqn. (5) we obtain

$$\log \frac{f_1}{N_1} - \frac{\bar{v}_1\,(p-p_2^o)}{2.303\,RT} = \log f_1^o + \frac{\bar{v}_1}{4.58T}\left(\frac{N_2\,\bar{v}_2}{N_1\,\bar{v}_1 + N_2\,\bar{v}_2}\right)^2\left(\frac{\sqrt{a_1}}{\bar{v}_1} - \frac{\sqrt{a_2}}{\bar{v}_2}\right)^2_{p=0}$$

If we plot graphically the values of $\log \frac{f_1}{N_1} - \frac{\bar{v}_1\,(p-p_2^o)}{2.303\,RT}$ against those of $\left(\frac{N_2\,\bar{v}_2}{N_1\,\bar{v}_1 + N_2\,\bar{v}_2}\right)^2$ we should obtain a straight line whose intercept with the ordinate gives the value of $\log f_1^o$. From the slope of this line $\left(\frac{\sqrt{a_1}}{\bar{v}_1} - \frac{\sqrt{a_2}}{\bar{v}_2}\right)^2_{p=0}$ can be calculated.[16]

In subsequent work we intend to test by this method the applicability of the derived equations above for other gases with help of the most probable $\bar{v}$ values.

Summary

1. An equation was proposed which describes gas/non-polar liquid equilibrium at high concentrations and pressures.

2. The applicability of this equation to solutions of hydrogen in liquid N_2, CO, CH_4 and C_2H_4 at high pressures and concentrations of the dissolved gas was shewn.

3. It was shewn that under certain conditions, the values of the partial molar volumes of the dissolved hydrogen in the solvents investigated lie close to one another and to the molar volume of liquid hydrogen at p = 1 atm.