NOTE

The Free Energy Change in the Reaction between Nitrogen Peroxide and Solid Potassium Chloride

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The free energy change in the reaction

$$KCl(s) + 2NO_2(g) = KNO_3(s) + NOCl(g) \qquad (1)$$

was calculated in a previous publication[1] to be −5623 calories at 298.1°K. Owing to lack of data which would permit the direct calculation of the free energy of formation of solid potassium nitrate it was necessary to arrive at a value for (1) by an involved procedure using freezing point data and activity. It was necessary also to calculate the free energy of formation of solid potassium chloride by means of the value for sodium chloride.

Recently Southard and Nelson[2] have determined the molal heat capacities of KCl(s) and KNO_3(s) from 15 to 285°K. and by means of these data and the entropy of potassium obtained by Kelly,[3] the entropies of oxygen, chlorine and nitrogen given by Giauque and co-workers[4] and the heats of formation given in the "I. C. T.," Vol. V, have calculated the free energy of formation of KCl(s) to be −97,700 cal. at 298.16°K. and that of KNO_3(s) to be −95,000 calories.

Giauque and Clayton[5] have also very recently obtained new data from which they calculate an improved value of 20,650 calories for the free energy of formation of NO(g) at 298.1°K.

The free energy change in (1) at 298.1°K. may now be evaluated by direct combination of free energy equations using the improved values mentioned above and those formerly used for the reactions between nitric oxide and oxygen to give nitrogen dioxide and for the reaction between nitric oxide and chlorine to give nitrosyl chloride. The value so obtained is −6042 calories, or if N_2O_4 is used instead of NO_2 −4915 calories. If Dixon's[6] recent value of −4300 calories for the formation of nitrosyl chloride from nitric oxide and chlorine is used, these values become, respectively, −5502 and −4375 calories.

Since the larger quantities in this calculation are now known with considerable certainty, all reasonable doubt as to the magnitude or sign of the free energy change in (1) has been removed.

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(1) Whittaker, Lundstrom and Merz, *Ind. Eng. Chem.*, **23**, 1410 (1931).

(2) Southard and Nelson, THIS JOURNAL, **55**, 4865 (1933).

(3) Kelly, Bureau of Mines Bulletin 350 (1932).

(4) Giauque and Johnston, THIS JOURNAL, **51**, 2300 (1929); Giauque and Overstreet, *ibid.*, **54**, 1731 (1932); Clayton and Giauque, *ibid.*, **54**, 2610 (1932).

(5) Giauque and Clayton, *ibid.*, **55**, 4875 (1933).

(6) Dixon, *Z. physik. Chem.*, Bodenstein Festband, 679 (1931).

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The Effect of Non-Electrolytes upon Diffusion in Gelatin Gels

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In an earlier investigation[1] it was observed that the presence of a non-electrolyte in a gelatin gel in which urea was diffusing would affect the diffusion velocity of the urea. The gels had been prepared to contain 1.5% of the non-electrolyte and urea was permitted to diffuse from a solution containing a like concentration of the same non-electrolyte into the gel. Of the ten non-electrolytes used, four caused a decrease in the diffusion velocity of urea and six caused an increase. The greatest decrease was 11.9% produced by methanol and the greatest increase was 32.7% by sucrose. The present investigation was undertaken to determine the reasons for the changes in the diffusion velocity of urea brought about by the presence of the non-electrolytes in the gels.

Experimental Procedure

Gels were prepared of electrodialyzed calf-skin gelatin to contain 3% of gelatin and varying amounts of the non-electrolytes, methanol, urea, glycerol, glucose and sucrose. The diffusion velocity of urea from a 3% solution, also containing an equilibrium amount of the non-electrolyte being studied, was determined by the method of Friedman and Kraemer.[2] All experiments were performed at 5°.

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(1) Friedman, THIS JOURNAL, **52**, 1305 (1930)

(2) Friedman and Kraemer, *ibid.*, **52**, 1295 (1930).