Proceedings of the Iowa Academy of Science

Volume 41 | Annual Issue Article 33

1934

The Influence of Salts on the Velocity of Inversion of Sucrose at 25°

J. N. Pearce
State University of Iowa

Margaret Thomas
State University of Iowa

THE INFLUENCE OF SALTS ON THE VELOCITY OF INVERSION OF SUCROSE AT 25°

J. N. Pearce and Margaret Thomas

The velocity of inversion of sucrose has been determined in the presence of salts of different ion-types at 25°. In the solutions used the concentrations of three components are definitely fixed, namely: sucrose 0.1 m., hydrochloric acid 1.0 m., and water 1000 grams. The salt concentration is the only variable. The salts used wer LiCl, NaCl, KCl, $BaCl_2$ and $Al(No_3)_3$. For equal molal concentrations of the different salts the velocity coefficients increase in the order: $KCl < NaCl < LiCl < BaCl_2 < Al(NO_3)_3$. The salt effect appears to be explained best on the basis of ionic hydration due to the attraction between the ions and the water dipoles. While it was not possible at the time to determine the activity of the solvent in the inversion solutions, the reaction velocity increases inversely and practically linearly with decrease in the activity of the solvent due to the salt alone.

Department of Chemistry,
State University of Iowa,
Iowa City, Iowa.

THE CHEMICAL BOND IN GENERAL CHEMISTRY

Ben H. Peterson

A Discussion of Application of Electro-Valent and Co-valent Types of Chemical Bond Adapted to Beginning Students.

Department of Chemistry,
Coe College,
Cedar Rapids, Iowa.

THE THERMAL DECOMPOSITION OF HEXANE AT HIGH PRESSURES

J. N. Pearce and J. W. Newsome

The thermal decomposition of n-hexane has been studied at pressures between 14,000 and 15,000 lbs., at temperatures between 430° and 520°, and for heating periods varying from a few minutes to two hours.

Previous investigators have found that at low pressures of one atm., or less about one-half of the gaseous decomposition products are unsaturated hydrocarbons with no products boiling higher than hexane itself. It has been found that under high pressures the low boiling olefins are practically completely converted by polymerization and hydrogenation either to saturated aliphatic hydrocarbons or to cyclic and aromatic hydrocarbons.

The percentages of CH_4, C_2H_6, C_3H_8 and C_4H_{10} in the gaseous products remain practically constant at ten-degree intervals between 460° and 490°, namely, 25, 47, 15 and 7 per cent, respectively. At 460° the respective proportions of H_2, C_2H_4, C_3H_6 and butenes in the gaseous products are 2.1, 1.4, 1.5 and 2.1 per cent. These decrease with further rise in temperature.

497° both hydrogen and ethylene have completely disappeared, and the percentages of propane, butanes, propene and butene have dropped to 5.5, 4.0, 0.04 and 0.16 percent, respectively. At this temperature the abundant formation of carbon begins; the proportion of methane is noticeably increased and continues to increase with further rise in temperature. Irrespective of time or temperature, the proportion of ethane takes a sudden jump at this point and then drops back to its original practically constant value.

Owing to the small capacity of the bomb it was not possible to obtain at this time sufficient quantity of the liquid products to make an accurate quantitative analysis of the liquid products. However, microdistillations and other qualitative tests showed the presence of cycloparaffins, benzene, subsituted benzenes, and unsaturated higher forms.

THE ADSORPTION OF CERTAIN KETONES AND ESTERS BY ACTIVATED CHARCOAL

J. N. Pearce and A. C. Hanson

The adsorption of acetone, methyl-ethyl ketone, diethyl ketone, ethyl formate, ethyl acetate, n-propyl acetate and methyl propionate by activated charcoal has been measured for temperatures between 0° and that of decomposition. The Langmuir isotherms, obtained by plotting $p/\frac{x}{m}$ against the pressure p, are rectilinear at the lower temperatures and up to 60 mm. pressure. At higher temperatures and pressures the isotherms tend to deviate from the straight line and bend toward the pressure axis. The amount of vapor adsorbed per gram of charcoal decreases with increase in the

complexity of the adsorbed vapor molecules; further it is found to decrease with increase in the value of the van der Waals constant, *b*.

The heats of adsorption ΔH, calculated from the adsorption isosteres were found to be: acetone -10690 cal., methyl-ethyl ketone -11225 cal., diethyl ketone -11820 cal., ethyl formate -13140 cal., methyl acetate -11520 cal., ethyl acetate -11920 cal., n-propyl acetate -13200 cal., methyl propionate -14030 cal. As is generally found, the heats of adsorption for the ketones, thus calculated, are lower than those which have been determined experimentally.

DEPARTMENT OF CHEMISTRY,
STATE UNIVERSITY OF IOWA,
IOWA CITY, IOWA.

SOME OBSERVATIONS OF THE BOILING POINTS OF TERNARY LIQUID MIXTURES

JOHN DUNHAM AND W. C. OELKE

An exposition of an apparatus for the determination of the boiling points of liquid mixtures under constant pressure, and the results of preliminary investigations upon ternary mixtures of some common organic liquids.

GRINNELL COLLEGE,
GRINNELL, IOWA.

THE USE OF ELECTRON TUBES AS SUPER-SENSITIVE RELAYS

W. C. OELKE

A brief discussion of the use of electron tubes in relay circuits controlling physical apparatus. The construction and operation of several relay units were shown.

GRINNELL COLLEGE,
GRINNELL, IOWA.

THE DIPOLE MOMENTS OF CERTAIN ORGANIC COMPOUNDS

J. N. PEARCE AND L. F. BERHENKE

The dielectric constants and densities of dilute solutions of p-brombenaldehyde, p-tolualdehyde, p-hydroxybenzaldehyde and

p-anisaldehyde in dioxane were measured at 25°. From the total polarization and the molecular refractivities the dipole moments were calculated to be 2.20, 3.27, 4.18 and 3.70×10^{-18} e.s.u., respectively. The angle between the aldehyde group moment direction and the line through the 1, 4 C atoms of the benzene nucleus is calculated to be 51°. The angles between the directions of the OH and CHO group moments, and between the CH_3O and CHO group moments are 50° and 49°, respectively. The angle between the plane passing through the 1, 4 C atoms and those in which the moment vectors lie are 45° and 37°, respectively, for p-hydroxybenzaldehyde and p-anisaldehyde.

Department of Chemistry,
State University of Iowa,
Iowa City, Iowa.