These data are presented in the briefest possible manner but sufficiently clearly to enable anyone reading chemical literature to evaluate critically the values cited and those engaged in experimental work to give an estimate of accuracy of the values obtained by them.

Useful information appears in the Chapter "The Most Important Chemical Handbooks and Periodicals".

The chapter on the "Structure of Matter" occupies more than a third of the handbook and it is no accident that it is this chapter in particular that has been considerably enlarged both by inclusion of completely new tables, absent from the first edition (potential barriers in the internal rotation of molecules, the length of bonds, and stretching frequencies for various types of hydrogen bonds, polarisabilities, parachors, molecular refractions of organic compounds) and by extension of individual tables which had appeared in the first edition (molecular ionisation potentials, internuclear distances, vibration frequencies, dissociation energies).

The majority of the theoretical laws and the extensive adoption of automation in industry are based on our knowledge of the structure of matter which have, especially recently, developed considerably through advances in experimental technique. This development is reflected in the new edition of the handbook.

Approximately half the volume consists of tables of the thermodynamic and physical properties of the most important substances, including new tables (correlation of specific heat with temperature for the elements and inorganic compounds, the Debye functions, the Einstein functions, the Debye characteristic temperatures) and considerably extended tables of such important data as the correlation of saturated water vapour pressure with temperature, the critical parameters and thermodynamic properties of the elements, inorganic and organic compounds, dielectric constants, dipole moments, viscosities, and surface tension.

One of the failings of the handbook is that all the units are not expressed in the International System, especially since, on the whole, the handbook will be used at the time when this system will have become universally adopted. There is a special paragraph concerning the International System of Units for the main values with reprinted tables without special analysis. Such tables are at present almost always printed with the same defect. If the recalculation of all the values in the handbook would have unduly delayed its appearance, the compilers could have given a recalculation coefficient from the system used to the International one for every table. This would have helped considerably during the forthcoming difficult period of transition.

It is a great pity that the handbook does not contain a table showing the correlation of the specific heats of organic compounds with temperature in the form of empirical equations.

For some reason the Gibbs free energy is designated by the letter "F" in the tables of the thermodynamic properties of the elements and inorganic and organic compounds although this letter is usually used in Soviet literature for expressing the Helmholtz free energy. In the same table many of the omitted values could have been calculated by methods of approximation and included. A considerable number of such values, calculated by methods of approximation, are included, for example, in the "Tables of Some Thermodynamic Properties of Various Substances" published by M. Kh. Karapet'yants and M. L. Karapet'yants in the Trudy Moskovskogo Khimiko-Tekhnologicheskogo Instituta imeni D. I. Mendeleeva (No. 34, 1961).

A curious omission is that of a table of Tarasov functions which should have been included with those of Debye and Einstein functions.

The table giving bond energies should have been extended to include the results of V. M. Tatevskii's work on the influence of various kinds of substituents on the energy of rupture of a chemical bond. More extensive literature references for supplementary information on a given property should have been given. This has been done in only a few cases, and then not always sufficiently fully. Yet a few lines of text could have provided the reader with valuable information.

The compilers included the scientific publications of Universities in their list of chemical journals but for some reason omitted to give those of Institutes. Another curious feature is the inclusion of volume numbers of Soviet and foreign journals when very often the year of publication is not given, only the volume number being shown.

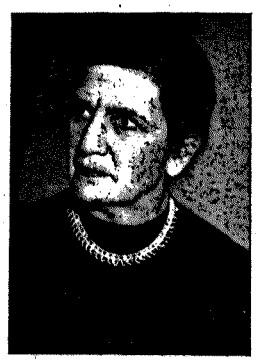
Individual misprints noted while using the handbook will be forwarded to the editorial board.

Finally, (and this is not the responsibility of the compilers) the table of thermodynamic values is extremely awkward to use because it occupies two pages which are, for the most part, out of vertical alignment.

Otherwise the handbook is most useful, carefully compiled, and superior both to the previous edition and to similar foreign handbooks.

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MISCELLANY



REVEKKA KHAIMOVNA BURSHTEIN
(On the occasion of her sixtieth birthday)

May 6th, 1964 is the sixtieth anniversary of the birth of the Director of the Institute of Electrochemistry of the Academy of Sciences of the USSR, Professor Revekka Khaimovna Burshtein, Doctor of Chemical Sciences.

Burshtein is one of the outstanding physical chemists in the Soviet Union. Her many-sided scientific work embraces various aspects of physical chemistry: activated adsorption, heterogeneous catalysis, electrochemistry, metal passivation and corrosion, as well as the surface properties of semiconductors. Professor Burshtein pioneered several lines of research in these fields which have proved extremely fruitful for the solution of scientific and technical problems.

Burshtein's scientific work began when she was still a student of the Faculty of Chemistry of the Leningrad State University. She developed an adsorption method of titration using sodium alizarinsulphonate as indicator. The results of this research have found their way into textbooks of analytical chemistry.

In 1928 Burshtein joined the laboratory of Academician A. N. Frumkin at the L. Ya. Karpov Physicochemical Institute. During the period 1928 to 1941 she carried out a series of fundamental investigations of the adsorption of electrolytes and gases on activated charcoal and the study of the mechanism of catalytic ortho–para conversions of hydrogen, exchange between heavy and light hydrogen, and hydrogenation of ethylene.

The studies devoted to the adsorption of electrolytes on charcoal showed the effect of the charge of gaseous hydrogen and oxygen on the adsorption of electrolytes. She showed that gas-free charcoal (treated under high vacuum) could not adsorb ions from dilute solutions. In the presence of small amounts of adsorbed oxygen the activated charcoal acquires the ability to adsorb anions. The solution of these experimentally extremely difficult problems was made possible by an imaginative combination of vacuum adsorption techniques and methods for determining the adsorption of electrolytes from solutions.

The investigation of the adsorption of gases on activated charcoal included studies of the kinetics of molecular and activated adsorption of oxygen, hydrogen, and carbon monoxide. The introduction of a promoter (Pt) was shown to accelerate the activated adsorption of hydrogen.

Studies of catalytic reactions demonstrated that the ortho–para conversion and the exchange between H and D were inhibited by hydrogen subjected to activation adsorption and that both reactions took place on a small number of centres constituting less than 1% of the charcoal surface. These two reactions were investigated under various conditions and the work on this subject is among the best kinetic studies in this field; the results have been incorporated into a number of monographs on heterogeneous catalysis.

The above research into the adsorption of electrolytes and the mechanism of catalytic reactions on activated charcoal formed the basis for the thesis for the degree of Doctor of Chemical Sciences submitted by R. Kh. Burshtein in 1941.

A study of the passivation of iron by adsorbed oxygen was undertaken during the period 1943–1946. The role of an oxygen film in the process of passivation had been widely noted in the literature but no one succeeded in carrying out experiments with a measured amount of oxygen applied to the metal surface. The methods developed by Burshtein and her colleagues elucidated the effect of small amounts of adsorbed oxygen on the electrochemical properties of the iron electrode under various conditions. Investigation of the kinetics of the adsorption of oxygen on iron led to the development of a method of determination of the true surface area of polished iron. The data obtained for the temperature dependence of adsorption indicate that at temperatures above 0°C there is a sharp change in the nature of the bond between the adsorbed oxygen and the surface.

Subsequently, the activating effect of extremely small amounts of oxygen on the electrochemical properties of the iron electrode was discovered for the first time, in the course of experiments designed to elucidate the mechanism of the passivation of iron by adsorbed oxygen. The minimum amount of oxygen which, having been adsorbed from the gaseous phase, led to the passivation of the electrode during anodic polarisation was also determined in this series of experiments.

Research into the effect of chemisorbed oxygen and oxide films on the contact potential was begun in 1946. The original apparatus developed by Burshtein and consisting of a diode with a movable anode made it possible to measure the effect of various forms of chemisorbed oxygen on the electron work function of iron.

During the same period the formation of water and hydrogen peroxide on activated charcoal in the process of adsorption of electrolytes in relation to the conditions of oxygen adsorption was investigated.

Since 1947 Burshtein has been working at the Institute of Physical Chemistry of the Academy of Sciences of the USSR and then at the Institute of Electrochemistry of the Academy of Sciences of the USSR, where she is head of the newly organised laboratory.

An extensive series of studies of the reaction of gases and vapours with metals and semiconductors using the contact potential method is being undertaken under Burshtein's direction. She has suggested a new apparatus for the condenser method used in these studies in which a metal electrode sealed in glass serves as a reference electrode. This method has been widely adopted in studies of contact potentials. The results of such studies have led to the elucidation of the mechanism of interaction of metals with gases and water vapour which is essential for the understanding of the passivation and corrosion of metals as well as that of the changes in the surface properties of semiconductors. It has been shown that the electron work function of a metal can increase or decrease depending on the conditions of its reaction with oxygen, this effect being determined during adsorption of electronegative gases (oxygen, chlorine, iodine, fluorine) on the surface of metals by the magnitude of the radius of the adsorbate and not, as was formerly thought, by its electronegativity.

The research into the effect of oxygen and water vapour on the electrical and physical properties of germanium and silicon has led to the development of a method for lowering the rate of surface recombination and stabilisation of silicon which is of great importance in improving the quality of semiconductor devices.

Throughout her scientific career Burshtein has always paid much attention to the study of chemical sources of current. In 1941–1943 she elucidated the mechanism of the processes occurring in the Leclanché cell at high temperatures and developed a method for ensuring normal working of the cell under these conditions. This work was awarded the State Prize in 1943.

During the Second World War Burshtein developed a chemical source of current (iron–carbon cell) independent of non-ferrous metals.

Since 1957 Burshtein has directed numerous studies on the construction of a gaseous hydrogen–oxygen cell; valuable practical results have been obtained and a cell with valuable electrochemical characteristics constructed.

In 1952 Burshtein was awarded the State Prize and the Order of the Red Banner of Labour for her work on special assignments and their application to industry.

Professor Burshtein has a characteristically profound understanding of the essence of the phenomena being investigated, an original approach to the solution of problems, and a high standard of experimental technique. Professor Burshtein's scientific research has been widely recognised both in the Soviet Union and abroad. She has published about 100 papers and received a series of patents.

Professor Burshtein has always taken part in community life. From 1939 until 1948 she was a delegate of the District Soviet of the Moscow workers (now Kirov district). She takes an active part in scientific meetings both in the USSR and abroad. She has supervised the work for 14 Candidates' Theses [Ph. D. equivalent (Ed. of Translation)].

We should like to wish Professor Burshtein many new and creative successes.

A.N. Frumkin, N.A. Shumilova, B.N. Kabanov, and S.D. Levina

R. E. LENTS (In Commemoration of the 130th Anniversary of his Birth)

Robert Emilievich Lents (1833–1903) devoted much fruitful work to the development of the electrochemistry of solutions, and as a result of his investigations he approached very closely to the concepts later enunciated by Arrhenius in his electrolytic dissociation theory. It is not, therefore, surprising that many scientists have referred to his work[1].

Lents was born on November 16th, 1833 at St. Petersburg. On graduating from the Faculty of Physics and Mathematics of the University in 1855, he was appointed to teach physics at the Technological Institute. In 1862 he was given the title of Professor and in 1876 he was elected a Corresponding Member of the Academy of Sciences.

Lents published his first papers on the electrochemistry of solutions in 1877.[2] He was the first to introduce the concept of normality† into the preparation of solutions. This innovation was most important, since it made it possible to relate conductivity and the properties of molecules in solution. He discussed the conductivity of solutions of over thirty inorganic salts, bases, and acids in an extensive paper published in 1878.[3] He introduced a new concept, that of equivalent conductance, and gave a formula for its calculation:

$$L = 1000/4pR_{18^\circ},$$

where L is the equivalent conductance, p the number of equivalents of solute in 1 litre, and R_{18° the resistance of a layer of liquid at 18°.

† Prior to this concentrations were expressed in wt.%.

Lents used his data to derive an equation expressing the dependence of equivalent conductance on concentration:

$$L = a(1 - bp)^m,$$

where L is the equivalent conductance, m a constant fractional number, different for different electrolytes, p the normal concentration, and a and b are constants.

It is interesting that Lents based upon this general equation a graphical method of calculation of the limiting conductance. In this equation the constant a expresses the limit towards which the conductance tends on dilution. The problem of the determination of limiting conductance was solved in 1879 by Kohlrausch who used the mobilities of ions for this purpose.

In 1884 Lents published a paper[4] on the conductivity of dilute alcoholic solutions. This work consisted of three parts, the first dealing with the conductivity of electrolytes as a function of the concentration of the solvent and of the dissolved salt, the second with ionic mobilities, and the third with diffusion phenomena. He deduced from the experimental data that the electrolyte molecules underwent spontaneous dissociation into ions. He considered that the solvent played the decisive role in this process. He stated: "... Therefore it must be assumed that the dissolution of some substances is accompanied by a chemical change consisting either of division of their particles (molecules – *E.B.*) into smaller ones or of association of small particles into more complex ones".

Evidently then, Lents visualised not only the dissociation of molecules into ions but also the formation of more complicated, complex ions during dissolution. This is still valid in our time.

Before Lents, the effect of various solvents on conductivity was studied by Mittorf, Wiedeman, and Matteuci, but their experimental data were fragmentary and conflicting, since they did not take into account the effect of temperature on conductivity, and expressed the concentration in percentages. The result of this work was the refutation of Matteuci's erroneous conclusion that alcoholic and aqueous solutions of the same salt having the same specific gravity had the same conductivity. Lents established that the conductivity of solutions falls rapidly with increasing concentration of alcohol. In the second part of his work, based on the work by Hittorf[5], Lents found a definite relationship between the transport numbers, conductivity, and structure of salts in solution. He found that for a CdS solution the transport numbers depended both on the concentration of dissolved alcohol and on the amount of dissolved salt: the curve passes through a minimum.

The studies carried out by Lents on the determination of transport numbers were among the first in electrochemistry; they emphasised the importance of Hittorf's work which helped to refute the erroneous view put forward by Berzelius that electric current decomposed salts into acids and bases. The idea of the formation of complex compounds in solutions was later developed by many scientists, in particular by V. A. Kistyakovskii, following the development of the theory of electrolytic dissociation.

In the third part of his work Lents investigated diffusion phenomena and noted independent movement of ions prior to the passage of current through the solution. Lents found, at the same time as Long[6], that diffusion is proportional to conductivity; he therefore concluded that the current merely "altered the direction of movement, making the ions move predominantly in two mutually opposite