INTRODUCTION

Reactivity and chemical properties of substances manifest themselves in chemical reactions. The number of chemical reactions occurring with the participation of each substance in enormous. Nevertheless, there are always some theoretical or practical criteria that provide the selection of most important reactions and structurization of the whole set of chemical information.

In the general case, the chemical properties of a substance can be divided into several groups of chemical reactions, namely:

(1) Thermal decomposition;
(2) Formation of crystal hydrates, their dehydration, and decomposition;
(3) Reactions with water, *viz.*, electrolytic dissociation, reversible or irreversible protolysis and hydrolysis, and other reactions with cold and hot water and steam;
(4) Reactions with most widely used acids, *viz.*, hydrochloric, sulfuric, and nitric (as a rule, if these reactions are of the same type, it is sufficient to consider the reactions with the hydrochloric acid alone);
(5) Reactions with alkalies (with the sodium hydroxide as a model alkali);
(6) Reactions with ammonia hydrate;
(7) Reactions with hydrogen;
(8) Reactions with oxygen;
(9) Reactions with other nonmetals;
(10) Reactions with metals;
(11) Exchange reactions;
(12) Redox reactions;
(13) Complex-formation reactions;
(14) Reactions with ethanol and other organic substances;
(15) Electrochemical reactions (electrolysis in solution and melt);
(16) Various substance transformations in the solid, liquid, and gaseous states, *viz.*, polymorphic transitions, ionic dissociation in the melt, molecular association and dissociation, etc.

In each entry, the types of interactions described in the chemical literature and characterizing the title substance are listed in the above indicated order.

The equations of chemical reactions are written in the conventional "reagents = products" form. As a rule, the reaction equations are molecular, except of the cases where the chemical interaction can be described by the ionic equation alone (electrolytic dissociation, protolysis, salt hydrolysis, ionic dissociation in melt).

The equations of chemical reactions include the formulas of reactants and the products and also some data concerning the conditions of their conduction and the course of the reactions in all the cases where when these data are important for understanding the chemical aspect and the degree of irreversibility of these reactions.

These data include:

(a) the aggregate state of the substance in the cases where it is not obvious, e.g. in equilibrium heterogeneous reactions in solution, conversion of insoluble substances into the solution, etc.;
(b) the state of the solution, *viz.*, diluted, concentrated, or saturated (sometimes with the indication of mass fraction of the substance or the solution molarity) in the cases when the type of the occurring reaction and the composition of the products depend on the solution state;
(c) reaction duration in time, if this factor characterizes the chemical passivity of the reactant in the reaction;
(d) for the reactions in solutions, the formation of a precipitate or a gas, which makes the reaction in an open system almost irreversible;
(e) for the reactions proceeding in aqueous solution, the name of the precipitant for the product (if the latter is not the only product remaining in the solution upon the reaction);
(f) for the reactions proceeding in nonaqueous solutions, the name of the solvent (water in not indicated as a solvent for aqueous solutions, although, as a rule, it is implied that it plays this part);
(g) the physical parameters and the conditions of reaction occurrence, *viz.*, the temperature range, excess pressure, vacuum, electrical discharge, UV irradiation, etc.;
(h) possible impurities or side products of the reaction, if their formulas are not included into the reaction equation;
(i) necessary refinement of the formulas of the reaction products with the aim of more precise description of their structure;
(j) the indication of the substance color, if it was not indicated in the substance characteristic, but might be of interest for the synthesis and analytical chemistry.

Such an arrangement of the material makes the Handbook rather informative. The Handbook will satisfy the various needs of the reader because it can answer any specific question as well as provide the detail information about the chemical properties of a substance. This book can be useful to lecturers and students, and also to researchers and engineers who have immediate need to know the properties of a substance to be able to take a correct decision in each concrete scientific or technological situation.