the present literature applicable to synthesis of a variety of organophosphorus compounds from various forms of the element. No specific experimental details are provided, however, and it is necessary in many cases to go back to the original papers for an adequate presentation of the necessary conditions and similar details. Although the coverage of the literature is, on the whole, quite adequate, I noted some omissions. For example, in discussing the reaction products of phenol with phosphorus in the presence of water, the author fails to mention the isolation of an appreciable amount of triphenyl phosphate, with but minor amounts of phosphines, in reactions run under a set of certain conditions, a result that has been reported by Soviet workers. Because such a product has a distinctly practical possibility, this omission is relatively serious. The mode of nomenclature is somewhat uncertain in spots. On page 13 the author mentions the formation of tri-*n*-butyl trithiophosphite, a name not in accord with the presently accepted nomenclature used by our journals and by *Chemical Abstracts*.

The chapter on organometallic displacements on phosphorus presents a large body of material that has come into being in the past 15 years and, in a workmanlike fashion, covers some reactions related to such displacements. However, the authors' predilection for tagging various compounds with arabic numerals, a rather confusing style which also makes the reading less enjoyable, is, in my opinion, quite unnecessary in a publication of this length. The chapter is largely descriptive, quite complete in coverage, and useful as a literature compilation through about 1962.

The chapter on the Michaelis-Arbuzov reaction and its related topics is the best in this volume. It presents both the theory and the practice of this reaction with literature compilation through part of 1963. Some very recent work is missing, but this must be expected in a book. A wide range of reactions, many of them useful to the "ordinary" organic chemist, are provided in this chapter, which can be read with profit by anyone interested in modern organic chemistry.

The chapter on the lower oxo acids of phosphorus deals with the very difficult chemistry of condensed acids of phosphorus in the lower states of oxidation, a quite new area of phosphorus chemistry in which changes occur almost daily. The chapter is quite easy to read owing to the use of the relatively simple Blaser-Worms system of notation, of which an adequate description is given. The chapter, which is largely descriptive (as one would expect in view of the present state of the art) gives a vast amount of data from various physical and chemical measurements used in the exploration of these fascinating substances. The bibliography even includes one reference dated 1964. The entire topic is really only 5 or 6 years old; thus, the size of this chapter is a good index of the proliferation of research in this area.

The final chapter, which deals with condensed phosphates that contain links of silicon, sulfur, vanadium, and arsenic, is quite similar to the preceding chapter in its general approach. It is largely descriptive of groups of substances that have been prepared and recognized properly within the past 5 years.

On the whole this volume is a welcome addition to the literature on phosphorus chemistry. The book is well made and, although relatively expensive, should be welcome on the desk of any chemist who is interested in phosphorus chemistry. Since forthcoming volumes are indicated, one can expect a wider range of topics to be covered, although this will require a truly monumental amount of space at this time. Future volumes might provide condensed tables of compounds, for in a literature search such tables would allow one to quickly locate specific compounds. The tables could be included in each chapter.

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Keplerian Motion

Fundamentals of Orbital Mechanics. D. A. Pogorelov. Translated from the Russian edition (Moscow, 1961) by Morris Friedman. Julius J. Brandstatter, Translation Ed. Holden-Day, San Francisco, 1964. viii + 112 pp. Illus. Paper, $5.

Numerous equations for all five types of Keplerian motion—rectilinear, elliptic, circular, parabolic, and hyperbolic—are derived in this book, with a minimum of advanced mathematics. The first half of the book deals with flight velocity, altitude, range, and duration. Maximum range trajectories and minimum energy trajectories take up the third quarter of the book. The last quarter is devoted to the effects of injection errors and includes many explicit formulas for the relevant partial derivatives.

Solar and lunar perturbations and the effects of the earth's oblateness are not discussed, even though a book entitled *Fundamentals of Orbital Mechanics* can certainly be expected to cover them. But the fault is not the author's, for an accurate translation of the Russian title would include the words "Theory of Keplerian Motion." Without the word "Keplerian," the English title is misleading.

Nor is the English rendering of the text altogether happy. Some technical terms are translated literally, irrespective of the technical context: For example, the word *zavisimost'*, which occurs many times, is translated as *dependence*, although in mathematics it usually means *equation*; the term *kinetic heskii moment* is translated as *kinetic moment* rather than *angular momentum*. Sometimes the Russian text is misunderstood: For example, on page 28 the translation reads "seems to be indeterminate" instead of "proves to be indeterminate"; on page 87 the Russian word for "somewhat" is translated as "somewhere," leading to the curious statement that "we explained somewhere above," although the author meant something like "we explained a little earlier." There is also some awkward English usage: For example, on page 9 we learn that a certain constant has a certain numerical value "according to the data of many works"; on page 64 we "rewrite the obtained expression"; and on page 75 we "determine the mentioned angular range."

In short, although the Russian original is an unpretentious and patient exposition of idealized orbital motions, the English translation of the title suggests a much wider scope than that, and the translation of the text is careless.

In a book with so many equations, misprints are practically unavoidable. But, since Pogorelov's derivations are so detailed, a careful reader should have little difficulty in correcting the misprints in the translation, such as the unwanted vector arrows in Equation (2.3).

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