terests in reaction rates and ionization processes. The coverage of areas outside of their interests is sparse. The value of the book lies mainly in the treatment of radiations, ionizing processes, and closely related subjects. On peripheral topics, such as atmospheric motions, the treatment tends to be less penetrating. The typography, illustrations and style of writing are clear, and the monograph will be a useful introduction and reference work in the field.

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Computability Theory

The present book, **Enumerability, Decidability, and Computability** (Academic Press, New York; Springer, Berlin, 1965. 255 pp., $9.75) is a translation by G. T. Herman and O. Plassmann of a work by Hans Hermes which was originally published in German in 1961. Hermes is well known for the lucidity of his exposition, and as one would expect, his book is a masterly introduction to the subject. It does not go far into the remoter reaches of its field, but what it does it does with great clarity and thoroughness. A beginning student will find most developments well motivated, and many points that the original papers tend to take for granted are explained in detail; the expert will find it useful for recalling details concerning fundamental theorems.

The book begins with a general discussion of algorithms and formal methods. The next three chapters deal with μ-recursiveness—that is, with functions generated in standard fashion by the primitive recursive operations and the μ-operation—and general recursive functions as defined by systems of equations. The fundamental theorems for these kinds of functions, due mostly to Kleene, are proved, including the equivalence of each type of computability with the preceding type. However, only everywhere-defined functions are treated; partial recursive functions are barely mentioned. There follows a chapter on the application of these results to the undecidability theorems which have become more or less standard. The final chapter treats a number of supplementary topics, including the universal Turing machine, the basic properties of enumerable and arithmetical predicates, brief sketches of alternate formulations of computability, and recursive analysis.

The chapter on general recursiveness is capable of improvement in one respect. There are some advantages to stating the rule of replacement without involving substitution (thus emphasizing that it deals only with constants), and allowing only one occurrence, and that on the right, to be replaced. This gives the evaluation of a function an algorithmic character. The equation scheme given for $\mu y(g(x, y) = 0)$, on page 126, seems clumsy, and in any event could not give an algorithm in the sense just explained, because two different equation schemes have the same left side. It is possible, however, to satisfy that requirement as well as those stated in the book; this is done by the following equation schemes, where h can be, for example, the h^* of the book (or g if one is not concerned about having Φ a total function), and δ, Φ are new auxiliary functions:

$$\delta(x,y,0) = x, \qquad \delta(x,y,z') = y,$$
$$\Phi(x,y) = \delta(y,\Phi(x,y'), h(x,y)),$$
$$f(x) = \Phi(x,0)$$

The translation has been very well done. However, there are a few Germanisms that might bother a reader who knows no German. One example is the translation of the German word "Paragraph" as "paragraph," whereas the German term, as used by Hermes, indicates a much larger section of the text than what we customarily call a paragraph. There are other such cases, and a number of misprints, but these should not bother a reasonably alert reader.

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Organic Synthesis

The author, Robert L. Augustine, states that his book, **"Catalytic Hydrogenation** [Dekker, New York, 1965. 200 pp., $8.75] is designed as a guide for those interested in using hydrogenation as a synthetic tool." For this purpose it is excellent.

The book presents (i) discussion of different types of apparatus available in many organic chemistry laboratories and provides operating instructions for this equipment; (ii) discussion of catalysts, the effect of variables such as temperature and pressure on the outcome of a hydrogenation, the choice of catalyst for the specific hydrogenation to be carried out, and the preparation of the common catalysts and (iii) recommended procedures for the hydrogenation and hydrogenolysis of functional groups. Although many references are included at the end of each chapter, this book is designed to provide sufficient information so that in most cases it will not be necessary to consult and study these articles before carrying out the hydrogenation experiment. I believe that the author has accomplished his objective.

Chapter 2, on apparatus and techniques, is limited, and the section on high pressure equipment somewhat out of date. Several equipment manufacturers have available stirred autoclaves which may be operated up to 7000 to 8000 pounds per square inch and which have better agitation and heat control than the rocker-type high pressure unit. Neither of the units described has any provisions for cooling. Because almost all hydrogenations are exothermic, in the apparatus described it is often necessary to carry out the reactions at the lowest possible temperature range in which the reaction can be obtained in order to control the temperature. In selective hydrogenations, I have found that this is neither convenient nor desirable. In addition, lengthening the hydrogenation time from minutes to hours may cause undesirable side reactions, particularly that of the hydrogenation product with the reactant.

As is customary in academic articles, safety is treated lightly and inadequately. Instead of merely mentioning that "some hydrogenations are highly exothermic," it would have been preferable to point out, in the safety section and in the detailed section on hydrogenation of functional groups, the places where special precautions should be taken. For instance, it should have been emphasized that catalytic hydrogenation of nitro groups must be carried out in a unit provided with cooling and at as low a pressure and temperature as possible, or a runaway reaction will probably occur. Other systems such as those in which telomerization as well as hydrogenation may occur also require special precautions.

In the discussion of catalyst and conditions (chapter 3), there is no mention of the effect of agitation on either rate or selectivity of the hydro-