ess it provides us with a great deal of interesting data and many fascinating pictures. The book is so up-to-date that it describes satellite telemetry and masers, but it neglects to explain how a simple telephone works or how a standard radio receiver operates; it tells us about binary codes for computers and photolithography but does not describe an ordinary printing press. This book is supposed to answer the "questions that intelligent children ask their parents." Well, let's face it, children are asking different questions nowadays. But their intelligent questions deserve more than superficial answers.

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History of Technology

Engineers, Inventors, and Workers. P. W. Kingsford. St. Martin's Press, New York, 1964. 272 pp. Illus. $4.95.

This easily read book traces certain aspects of the technical and industrial development of Great Britain during the past 250 years. Kingsford gives about two dozen short biographical sketches of such men as Newcomen and Watt, who designed the steam engine; the Darbys, who were ironmakers; Bramah, Maudslay, and others, who were builders of machine tools in the period between 1775 and 1860; and George Stephenson and his son Robert, who were builders of railroads and locomotives. Throughout the book a change of pace is developed by presenting two or three biographies and then providing glimpses of successive stages of the trade union movement.

It is, as Kingsford suggests, necessary to know something about antecedents if one is to understand the technological facts of the present. There are occasional flashes of light that illuminate the questions raised by a mechanized present—a remark made at age 30 by Thomas Telford (1757–1834), the prominent civil engineer, "I think I have observed that there has always been a bustle where I was," and another quoted by the author, who after recording the loss of 100 lives in the building of the Box tunnel of the Great Western Railroad, quotes a glowing appreciation of the builder, an appreciation which closes with the observation that "great things are not done by those who sit down and count the cost of every thought and act." In general, however, the book provides a rather uncritical recounting of a standard but superficial story. The standard errors and some absurdities are also present. To give but one example, Hero in 130 B.C. built a steam turbine; Branca in the 17th century invented another turbine; the latter "was too crude to be successful and nothing more was done until the nineteenth century." This, unfortunately, is the accepted way of saying that we happen to know of the two examples of turbines (one a description, the other a picture); nobody has yet looked into the question carefully, so we can, unencumbered by data, draw a conclusion.

In writing a book, it is quite impossible to avoid all errors, but an author who discusses technical devices should be well enough informed to recognize and reject improbable statements made by earlier authors.

The sections on trade unions are interesting, but their connection with the rest of the book is tenuous. The machines and processes developed by the men discussed in this book did change radically the work required of craftsmen and laborers, but in the long run the conditions of employment were set by the entrepreneurs and men of capital, not by the machines or the inventors and engineers.

The story of the industrialization of Great Britain is inherently exciting and significant. Properly told, plausibly and critically, it can help us to understand how and why technological imperatives tend to shoulder aside mere human considerations. But I fear this book will do little to enhance that understanding. It should be noted that the book, which was published and printed in England, sells in England for 18s. (about $2.54).

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Undergraduate Textbook

Physical Chemistry. Gilbert W. Castellan. Addison-Wesley, Reading, Mass., 1964. xvi + 717 pp. Illus. $12.50.

In this book Castellan continues the trend that is characteristic of other physical chemistry textbooks published during the past 5 years—the trend toward a more rigorous and mathematically sophisticated approach in modern undergraduate physical chemistry courses. He recognizes the impossibility of adequately covering all areas touched by physical chemistry, and attempts to treat basic fundamentals with only some applications in depth.

In the first five chapters, the author deals primarily with some very basic chemical concepts, macroscopic and microscopic properties of gases, and some related macroscopic properties of condensed phases. Thermodynamics is introduced in chapter 6; the laws of thermodynamics and the general conditions for equilibrium are developed in the next four chapters, and are applied to chemical and phase equilibria for ideal systems in chapters 11 and 12. The next three chapters consider solutions and equilibria in ideal condensed phases. The treatments of the concept of activity and electrolytic solutions (chapter 16) lead logically to electrochemistry (chapter 17). The next seven chapters are devoted primarily to studies of the structure of matter and elementary quantum mechanics applied to intramolecular and intermolecular forces, and to the interpretations of macroscopic and thermodynamic properties of systems from the microscopic behavior of individual components. Surface phenomena, transport properties, and conduction are considered in the following chapters. The final three chapters cover chemical kinetics, including adsorption, electrolysis, and photochemistry.

Problems, most of which are rather straightforward, are included at the end of each chapter, and answers to all the problems are provided at the end of the book. A reasonable number of pertinent and logically worked numerical examples are given in the text, particularly in the chapters on thermodynamics, and derivations are, for the most part, mathematically rigorous and complete.

The book is clearly written and contains excellent discussions of many basic principles and concepts of physical chemistry. Certain misleading or wrong concepts are carried over from earlier textbooks (for example, the discussion of the minimum work in an isothermal compression), but fortunately these are few. Modern symbols are used throughout, following in general the recommendations of the International Union of Pure and Applied Chemistry's Commission on Physicochemical Symbols and Termi-

nology. This book will be an excellent textbook, particularly for the basic course in physical chemistry that follows a modern general chemistry program.

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Interdisciplinary Summary

Water Metabolism in Plants. Theodore T. Kozlowski. Harper and Row, New York, 1964. xx + 227 pp. Illus. Paper, $3.95.

Water is an expendible resource of limited supply. Competition for water in domestic, industrial, and agricultural use is increasing. In many parts of the world land use is limited by water shortage. Consequently, research on ways to promote efficient use and to eliminate waste of water is of vital importance. Kozlowski's *Water Metabolism in Plants* is timely, and it will prove useful to botanists, horticulturists, foresters, engineers, and public officials entrusted with responsibility for just and efficient use of water.

Following a brief introduction in which he cites the principal reviews, Kozlowski discusses xerophytism in some detail, pointing out the various means by which plants endure drought. Water balance in plants is then treated. There are 119 references in chapter 1, 93 of which cite work published since 1949, the publication date of two books which thoroughly reviewed this subject. Similar coverage is provided other topics in subsequent chapters. Thus, Kozlowski's volume is very valuable in its coverage of the current literature.

Chapter 2 discusses water relations of cells and tissues, briefly reviewing classical aspects, and describing current ideas. Terminology is discussed, and methods for measuring osmotic quantities are described. Finally, active water uptake is given detailed consideration.

Absorption of water is covered in chapter 3. Available water and soil moisture constants are discussed, terminology is considered, and water uptake by healthy and by diseased plants is described.

Various theories of water transport are discussed in chapter 4. The pros and cons of the cohesion theory are given. Evidence for tensions in water columns, continuity of water in plants, hydrostatic gradients, and the tensile strength of water is reviewed.

Chapter 5 considers water loss by guttation and transpiration. Factors regulating transpiration are given detailed treatment. Experiments on evapotranspiration are described, and the significance of transpiration in ion uptake, mineral distribution, and mineral loss from plants is discussed.

The effects of water deficits on plants are detailed in chapter 6. Water availability and moisture stress are considered. The effects of water deficit on physiological processes are described. The role of water in plant growth is documented, particularly with respect to trees. As a forester, Kozlowski speaks with authority in this field, and much of the evidence is from his own researches. He is to be complimented for producing a text and reference volume of great usefulness.

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Marine Algae

Seaweed Symposium, Proceedings. The fourth international symposium, held at Biarritz, France, in September 1961. Ad. Davy de Virville and J. Feldmann, Eds. Pergamon, London; Macmillan, New York, 1964. xxiv + 467 pp. Illus. $15.

The volume contains some 80 papers. Two general conferences were presented: "Growing marine seaweeds" by L. Provasoli and "Algal polysaccharides and their biological relationship" by E. Percival. The other papers are about equally divided among the following topics: biology (life histories and taxonomy), ecology, chemistry, and utilization. The reports are mostly in French or English, with a few in German.

Among the shorter papers may be mentioned "Photosynthesis and growth in *Macrocystis pyrifera*" by the late K. A. Clendenning; "Sur un nouveau procédé de cartographie des algues marines" by Davy de Virville; and "Auxins and gibberellins in marine algae" by J. A. Mowat. (The latter does not acknowledge, however, the much earlier work by van Overbeek).

Floristic and ecological surveys include the Southern Gulf of Mexico (H. J. Humm); Vietnam (Pham Hoang Ho); the North Pacific (R. F. Scagel); Yoron Island, South Japan (T. Tanaka); and northwest Greenland (R. T. Wilce). Reports on life history and taxonomy range from phytoplankton through temperate and tropical benthic algae to the giant kelps, in chapters too numerous to cite.

Chemical studies cover nitrogen metabolism, polysaccharides (including the enzymatic transfer of sulfate to these), carbohydrases, bromophenols, ascorbic acid, and the sugar components of phycobilins. There is a discussion of the fatty acids of red algae, as determined by gas chromatography.

Industrial utilization of algae is described in Iceland, Denmark, Poland, Germany, Scotland, Canada, France, and Norway. An interesting British application is described in the paper entitled "Liquid seaweed as a fertilizer."

The book concludes with an appendix, by the Food and Agricultural Organisation of the United Nations, on statistics of the seaweed industries of the world.

There is no subject index.

It is a striking commentary on the increased study of algae that the reports of the international conferences on seaweeds have grown from a small paperbound book issued after the first symposium (Edinburgh, 1952) to this substantial volume. No doubt an even larger book will follow the Halifax conference that is scheduled for 1965—hopefully in less than 3 years after the meetings.

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Nesmeyanov Jubilee Volume

Selected Works in Organic Chemistry. A. N. Nesmeyanov. Translated from the Russian edition (Moscow, 1959) by Avraham Birron and Z. S. Cole. David P. Gelfand, Ed. Pergamon, London; Macmillan, New York, 1964. xvi + 1172 pp. Illus. $30.

Some four years ago it was my pleasure, as a member of the National Academy of Sciences and as Science Adviser to the Secretary of State, to accompany Detlev W. Bronk, who was at that time President of the National Academy of Sciences of the U.S., on a trip to the Soviet Union; the purpose of the trip was to meet with the president of the Academy of Sciences of the U.S.S.R., A. N. Nesmeyanov, and to