dation," and to have preceded the present canyon-cutting cycle. Much importance was attached to the form of valleys on the Kaibab and Coconino Plateaus. In contrast to the deep, narrow canyons of the Colorado River and its immediate tributaries, valleys on the plateau summits are generally shallow and open, which led Davis to conclude that they represent mature valley forms remaining from the earlier cycle. Robinson employed similar evidence to support a hypothesis of peneplanation in the San Francisco Plateau farther south.

Field study of the valleys and park-like depressions of the Kaibab and Coconino Plateaus by the writer has revealed facts that are incompatible with the two-cycle hypothesis but seem to be the normal consequences of a continuous erosion cycle. The entire area is underlain by the Permian Kaibab and Toroweap limestones. The valleys are of three distinct types, each closely related to a zone of climate and vegetation determined primarily by altitude. The lower flanks of the plateaus, in the semi-arid pinyon-juniper woodland zone below 7,000 feet,[5] have young canyons being actively degraded by intermittent streams. The western yellow pine zone, 7,000 to 8,000 feet, has steep-walled, flat-floored valleys, lacking surface stream channels; fans of slope-wash are built out across the valleys and the valley fill likewise consists of locally derived slope-wash. The Douglas fir zone, above 8,000 feet on the Kaibab Plateau, has a cool, humid climate supporting dense forests of fir, spruce, pine and aspen; valley walls and floors are thickly mantled by slope-wash and rock outcrops are largely concealed; abundant sinkholes occupy both the valley floors and the interstream areas; surface streams are virtually absent and valley bottoms are often undulating, reversing the normal down-valley slope.

A hypothesis of valley abandonment due to the increasing effects of limestone solution at higher elevations adequately explains the above facts. Valleys initially carved by vigorous, youthful streams were deserted as underground drainage dismembered the surface streams. Valleys fell into decay, accumulating a mantle of slope-wash, and were carved by sinks. At progressively lower and drier levels, the effects of solution rapidly diminish, and in the semi-arid pinyon-juniper and lower climatic zones intermittent surface streams continue to incise the valleys.

Davis, Johnson and Robinson considered the contrast between valleys at higher and lower elevations as the result of two erosion cycles. This hypothesis seems unsatisfactory because it fails to explain the close correlation of the three-fold classification of valleys with zones of climate and vegetation. Moreover, it does not consider the abundant features of limestone solution and the absence of stream channels in the waste-choked valleys.

Parks of the Kaibab Plateau are elongate closed depressions forming a north-south trending chain coinciding closely with the structural crest of the Kaibab arch. They may have originated as valleys of longitudinal subsequent streams formed while the resistant Kaibab limestone of the arch was being stripped of its Mesozoic cover, or as subsequent valleys along a series of minor fault lines. Development of underground drainage resulted in diversion of the surface streams, and the valleys became enlarged and deepened into the present solution basins.

If the hypothesis of valley development controlled by limestone solution is accepted in place of the explanation offered by Davis, one of the major lines of evidence for the plateau cycle or great denudation, closing in the development of a widespread peneplane, must be discarded. The results of the writer's study are, therefore, of critical significance in the geomorphic history of the entire Grand Canyon district.

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SCIENTIFIC BOOKS

TEXT-BOOKS OF PHYSICS

Student's Handbook of Elementary Physics. By ROBERT BRUCE LINDSAY. xv + 382 pp. The Dryden Press, Inc. 1943. $2.25.

Electrical Engineering: Basic Analysis. By EVERETT M. STRONG. xii + 391 pp. + 7 plates. John Wiley and Sons, Inc. 1943. $4.00.

Electronic Physics. By L. GRANT HECTOR, HERBERT S. LEIN and CLIFFORD E. SCOUTEN. viii + 355 pp. The Blakiston Company. 1943. $3.75.

University Physics: Part Four, Wave-Motion and Sound. By F. C. CHAMPION. iii + 67 pp. Blackie and Son, Ltd. Interscience Publishers, Inc. 1942. $1.65.

Simplified Physics. By S. A. SMALL and C. R. CLARKE. x + 428 pp. E. P. Dutton and Company, Inc. 1943. $3.00.

General Physics: A Textbook for Colleges. By OSWALD BLACKWOOD. viii + 622 pp. John Wiley and Sons, Inc. 1943. $3.75.

Physics: A Textbook for Colleges. Fourth edition.

[5] G. A. Pearson, *U. S. Dept. Agr., Tech. Bull.*, 247: 5–14, 1931.

By OSCAR M. STEWART. x + 785 pp. Ginn and Company. 1944.

Fundamental Physics. By L. W. TAYLOR with the collaboration of F. G. TUCKER. xii + 663 pp. + Appendix XL. Houghton Mifflin Company. 1943. $4.00.

Physics. By ERICH HAUSMANN and EDGAR P. SLACK. *United States Naval Academy Edition.* Revision by The Physics Staff, Department of Electrical Engineering, U. S. Naval Academy. vii + 857 pp. D. Van Nostrand Company, Inc. 1944. $5.50.

"AND some few to be read wholly with diligence and attention." Professor R. B. Lindsay's "Handbook of Elementary Physics" is one of the few. This book makes its author the roommate and campus buddy of every undergrad that owns a copy. Is a bull session on physics in order? If so, call the bunch together, then open Lindsay's Handbook and read aloud. Ask your questions and they will be answered, for one of the ripest scholars and choicest spirits among teachers of college physics is sitting in.

The life experience of a great teacher of general physics is distilled into these pages. One hundred and thirty of them make "a primer of general physics." Does he mean prim-er or prime-er? Both perhaps, for all is fundamental and simple and clear, and when it has been mastered the mind is primed for much that may turn up in lecture or in text-book or in laboratory or in the big world beyond the walls.

Then one hundred and forty pages make "an illustrated dictionary of terms." If you meet the term or phrase and don't understand it, here it is explained. Nothing is too simple or too abstruse—"Normal to a surface," then "Nuclear atom model." The old and new are dealt with impartially. Archimedes' principle and wave mechanics each receives its inch.

Next follow about thirty pages of "chronological history of physics" from 3000 B.C. to 1940 A.D. Three parallel columns present "developments or discoveries in physics," "contemporary developments in other sciences" and "contemporary political and social events" —a sort of condensed "Nichol's Tables" (2 volumes). Physics has been made by men—men who have lived in the real world, who have "stood upon the shoulders of giants" and have looked far ahead. What an idea to acquire when one is a freshman!

Then ten pages of suggested collateral reading list all the books that one has read or wishes he had read, and owns or wishes that he might own. One lends these books to his pupils and they always come back. Now hand the pupils a printed list and encourage more reading.

A collection of useful formulas, and tables physical, chemical and mathematical, answers to selected problems, and an index complete the book. What a book to have at hand, whether one be a freshman or a senior, a green instructor or an old oldtimer with Indian summer not so far ahead!

Strong's "Electrical Engineering—Basic Analysis" may not be flattered by its inclusion in a list of textbooks of physics, for it is decidedly a book for students of electrical engineering, and it presupposes "mathematics through calculus and one year of physics." It is altogether salutary for teachers of physics to keep in touch with books like this one.

For one thing, books of this type reveal the superstructure that the "one year of physics" will be called upon immediately to help support. And then the engineer sees the world of electrical phenomena from an angle somewhat different from that from which the physicist views it. "One of the distinctive characteristics of a good engineer is his ability to strike an economic balance between purely mental idealism and purely physical accomplishment."

And the teacher of engineering has to reckon with the human factors that present themselves in great variety in the pupils that face him. And when a determined and enlightened effort is made, as in this book, to meet and to direct the human factors, then it is worth while for the teacher of physics to know what the engineer is doing. Let him read the preface and the introduction to this text.

For forty years the reviewer has kept engineering texts on shelves by his desk and has used them. Strong's "Electrical Engineering—Basic Analysis" will be a valuable addition to his collection.

"Electronic Physics," by Hector, Lein and Scouten, has been written for beginners, for school boys and girls, for radio classes, for ground school cadets, for pharmacy classes and for some college freshmen and sophomores. It attempts to present fundamental phenomena of electric charges, of electric currents, of magnetism, of the ultimate structure of matter, of light, x-rays and radio, of natural radioactivity and of transmutation of the elements, and to unify them by employing the electron and proton concepts from title page to index.

The book is well printed and beautifully illustrated. Line diagrams in black and red cause salient features to "stand out on the horizon of" one's comprehension "like Mars at perihelion"—as Elbert Hubbard once wrote from East Aurora.

The book has a highly modern flavor. Galileo and Newton receive no mention. However, its roots strike deep into the past. Gilbert, Roemer, Volta, Galvani, Faraday and Henry are in their usual places of honor.

The book has every appearance of being a praiseworthy attempt to present some of the elements of

physics in terms of concepts of recent origin. In the hands of competent teaching personnel of broad and sound outlook it is probably a highly useful tool of instruction.

Again from "mighty London" comes a part of Professor F. C. Champion's "University Physics." This year it is part four—"Wave Motion and Sound." The contents are well presented in eight short chapters about as one finds these topics presented in our best American text-books for sophomores.

The preface contains a prophecy that is news to the reviewer. He passes it along to his readers.

> Finally, it is becoming more and more recognized, at least as an ideal, that material usually given in formal lectures can be quite as well acquired from good text-books and that lectures will gradually develop into a tuitional tutorial system under which the time and energy of the lecturer can be devoted to the detailed elucidation of difficult points, apt illustrations and demonstrations, the discussion of essays and exercises done by the student, and the exercise of personality to engender an enthusiasm without which a subject remains "dry bones."

"Simplified Physics," a clear explanation of modern science with easily made apparatus and many simple experiments, profusely illustrated by the authors and Charles E. Cartwright, with a chapter on color photography by Lieutenant Charles S. Small, U.S.N.R., is a revised edition of "The Boy's Book of Physics."

In the reviewer's boyhood home, in a closet full of old books, was a copy of "Peck's Ganot." A near relative had studied natural philosophy from "Peck's Ganot" as a school girl in the early 1870's. Her teacher had been Dr. Franklin Taylor, a cousin of the famous Bayard Taylor.

When the reviewer opened "Simplified Physics" and looked at the frontispiece entitled "How a Glass of Water Comes to You" and saw the ocean, and the sun drawing water, and the clouds shedding rain, and the mountain stream, and the reservoir, and the water-works, and the aqueduct, and the suburban houses, and the boy drawing water from the faucet, the door of the old closet opened, "Peck's Ganot" came off the shelf, and the old days of 1890 came to life.

Something went out of young lives when books like "Peck's Ganot" were supplanted by books of a different type. "Simplified Physics" aims to bring that something back. Vivat, crescat, floreat!

There appear to be two schools of thought about freshmen current among physicists. One school appears to see in them a means of support for the graduate students of the department who will be paid to "teach" them. And among the freshmen will be found some with aptitudes for physics and inclinations towards it. They are to be captured and trained by the straight and narrow route to help in the research program of the department even before their undergraduate days are over. Their names will soon be appearing on papers ground out by the departmental mill.

The other school looks upon freshmen as young humans who are to be educated to see human culture at least almost whole, as future citizens who will exhibit broad sympathies and wide interests, as to-morrow's specialists of horizon and balance, as those fortunate young people who are to carry through their lives the real advantages of a truly liberal education.

The next three books to be reviewed are written by men of the latter school.

Blackwood's "Introductory College Physics" has developed through the efforts of its author and the constructive criticisms of his many friends in college and school into the current volume—"General Physics." Open the book and the signs of a broad outlook and general culture are at once evident. "The Slow Progress of Civilization," "The Scientific Method," "Faith in the Uniformity of Nature," these are no plants that grow in shallow soil.

The automobile and the driving of it are called in aid from cover to cover. It is real teaching to convert hobbies, sports and recreations into the tools of a liberal education. The book gives every promise of retaining all the old friends and of making many new ones.

The world of higher education mourns the passing of Professor Oscar Milton Stewart. A great author, a great teacher, a man who brought honor upon the profession of teaching physics has gone to the land of memory. His "Physics—A Text-book for Colleges," first published twenty years ago, has just reached its fourth edition. In it the author has included its best review:

> An appreciation of the facts that we are now living in a world which is fashioned largely by science and that the process has only begun leads many to be ambitious to understand modern scientific methods of thinking and the concepts, principles, and theories of science.
>
> Unfortunately the path of knowledge is rather long and tortuous. These concepts, principles, and methods must be learned step by step. Only through the consideration of many specific cases are the more general ones understood. Technical methods can be understood only after one learns to think technically.
>
> THERE IS NO SHORT CUT.
> BUT TO ONE WHO HAS PATIENCE,
> THE END IS WELL WORTH THE JOURNEY.

Master teacher! Hail and farewell!

From a distinguished college of liberal arts have come Taylor's "Physics: the Pioneer Science," written

for a world at peace, and "Fundamental Physics," its sequel stripped for wartime action. Both books are dedicated to the principle that physics is of its very nature and background a liberal and a cultural subject. And if physicists will teach their science in this spirit then it has a contribution to make to education that as yet is only partly realized. Physics is the foundation of much of technology. And the stories of its coming into being and its present-day content are the stories and the creations of men who strove during recent generations, and who strive to-day, to make the scientific method and the scientific outlook a vital part of human thinking and action.

Teachers of physics have not failed to heed the work of the author of these books. They have called him to positions of leadership and have invited him to expound his philosophy before gatherings that have considered major problems of policy.

Even if the teacher does not select "Fundamental Physics" for his classes, he should read and read again the preface and the epilogue and should absorb much of the spirit that quickens the book.

Hausmann and Slack's "Physics" was first published in 1935. It reached a second edition in 1939. Two years later a special edition for use at the U. S. Naval Academy was brought out by E. W. Thomson. And now the staff in physics at the Naval Academy has revised the special edition.

The members of the staff have aimed to adapt the book still better to the education of a midshipman. They have reconsidered the topics to be treated, the order of their presentation and their adaptation to the more advanced courses in mathematics, engineering, ordnance and navigation that the midshipman will pursue.

And the staff has aimed to introduce "desirable corrections." Their efforts in this direction will appeal to all who, like the reviewer, have taught from the regular edition of the text. One of its arresting characteristics is the large number of "corrections" that need to be made.

As instances (all taken from the second edition, twelfth printing):

(*a*) The physical pendulum oscillates, its center of mass *accelerates*, under equal and opposite forces, that is, under *no force!* (p. 158).

(*b*) The center of oscillation of a physical pendulum is that point at which the concentration of the whole mass of the pendulum would cause no change in its moment of inertia! (p. 159).

(*c*) The pressure arising from weight at a depth h in a liquid of uniform density d, in a uniform field g, is (1) hdg if metric absolute units are used, (2) but hd if British gravitational units be employed! (pp. 183–184).

Have the British at last found a screen against gravitation?!

(*d*) And so on! and on! and ON!

Since "the crimes of Clapham are chaste in Martaban" it may be that such statements are accepted as sound science on the east bank of East River. On other shores, however, these are plain blunders and who uses the book is honor bound to warn his pupils to "weigh and consider" all that they see in print.

The men of the Navy have led the way, let the civilians follow it. Let the cargo of the good ship Hausmann and Slack (of the civilian fleet) be thoroughly inspected. Let all errors, blunders and other questionable goods found on board be jettisoned. And let the space thus cleared be stocked with sterling physics.

And may the men of the Navy continue their conquests, both of islands infested with Japs and of textbooks infested with errors!

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SPECIAL ARTICLES

FURTHER STUDIES ON THE RELATIONSHIP BETWEEN XANTHOPTERIN, FOLIC ACID AND VITAMIN M*

A NUMBER of more or less contradictory reports concerning the hemopoietic activity of xanthopterin (uropterin) have appeared in the literature in recent years. Tschesche and Wolf[1] found a reticulocyte and red blood cell increase following administration of a very small dose of uropterin to milk-anemic rats. Koschara and Hrubesch[2] stated that uropterin from the sample used by Tschesche and Wolf was assayed by Rominger and found to be entirely inactive. The effects of synthetic xanthopterin[3] and xanthopterin isolated from liver were tested in anemic salmon by Simmons and Norris.[4] Both preparations were highly active. Totter and Day[5] reported that xanthopterin

* Research paper No. 543, Journal Series, University of Arkansas. The expenses of this work were defrayed in part by a grant-in-aid from the Nutrition Foundation. Accepted for publication December 5, 1943.

[1] R. Tschesche and H. J. Wolf, *Zeit. f. physiol. Chem.*, 248: 34, 1937.

[2] W. Koschara and A. Hrubesch, *Zeit. f. physiol. Chem.*, 258: 39, 1939.

[3] R. Purrmann, *Ann. Chem.*, 546: 98, 1940.

[4] R. W. Simmons and E. R. Norris, *Jour. Biol. Chem.*, 140: 679, 1941.

[5] J. R. Totter and Paul L. Day, *Jour. Biol. Chem.*, 147: 257, 1943.