The selling advance is the real profit, which in this case will be $20, the difference between the purchase and the sale.

(7341) A. E. H. asks: 1. How long will a zinc last in an ordinary gravity battery of four cells, charging storage cells in parallel? The zinc being covered with copper deposit, it is difficult to tell just when it is completely worn out A. A zinc of regular weight will last for six months in a gravity cell. Take it out once in a while and scrape or wash off the muddy coating. 2. Is it not better to amalgamate the zincs in the above gravity cells? A. The zincs are not usually amalgamated in the gravity cell. They are made, however, of an amalgam, so that the mercury extends throughout the whole mass. Such zincs are called composite zincs and are in the market. 3. What is the right density of the solution around the zincs (specific gravity) in a gravity battery to obtain the maximum current; and does a small percentage of iron sulphate, which is contained in commercial copper sulphate, affect the output of the battery? A. The solution around the zinc becomes saturated in a short time, and the excess of zinc sulphate then crystallizes out at the top around the sides of the glass. This should be removed occasionally. The iron has no effect. The largest current will be had with a very weak zinc sulphate solution, say sp. gr. = 1·02, but this cannot last long, since the action of the cell will raise the density of the solution around the zinc and reduce the current. An equally important condition for large current is to keep the zinc clean. This, too, is equally difficult to maintain, even if the zinc be amalgamated.

(7342) A. F. S. writes: I am building an arc lamp with a carbon $\frac{1}{8}$ inch diameter, to be used on a 110 volt circuit. I want to feed the carbon in the usual way, i. e., by a break and magnet to reduce the same. 1. Is it proper to connect the magnet in parallel with the lamp? A. Yes; that is the usual way. 2. Of what resistance shall it be, what size wire shall I use to get the same? The coil is 2 inches long by 1 inch diameter, core $\frac{3}{8}$ inch diameter. A. Give the shunt coil 100 times the resistance of the direct circuit through the carbons. With $\frac{1}{8}$ inch carbon the resistance of the arc is 5 or 6 ohms; hence, you will require 600 ohms in the shunt circuit. Use No. 30, wind your spool full and put the rest in a separate coil within the lamp. 3. Would you recommend an extra resistance coil to be used in addition to that of the magnet? A. Yes, as above. 4. What is the resistance of an arc flame at a gap of $\frac{1}{16}$ inch; also that of $\frac{1}{4}$ inch with $\frac{1}{16}$ inch carbons? A. For $\frac{1}{16}$ inch arc, about 7 ohms; for $\frac{1}{4}$ inch arc, about 6 ohms.

(7343) D. O S. writes: On page 408 of your book, "Experimental Science," there is decribed a battery, concerning which I am in want of some information. First: What is the precise chemical change which takes place between the solution and the zinc and iron elements? Second: What is the office of the black oxide of copper, placed within the cell? Third: Will wrought iron serve as well as cast iron? and, fourth, When this battery becomes exhausted, to what is this exhaustion due? I want a battery to run a small motor, and was attracted to this one by the simplicity of its construction and the statement that it "will operate several months without replenishing." I have tried a bichromate battery, but the frequent renewals necessary compelled me to abandon it. A. The cell in question is the Lalande-Chaperon cell, which has been improved in the United States under the name Edison-Lalande cell. You will find the chemical changes fully worked out in "Primary Batteries," H. S. Carhart; price $1.50, by mail. Briefly, the action of the cell is to break up the caustic soda, zinc taking the place of the hydrogen in it. The hydrogen then takes oxygen from the copper oxide at or near the iron, the negative plate forming water, and leaving the copper in a metallic state. The object is to get rid of the hydrogen, which, if allowed to accumulate on the negative plate, would stop the current in a short time. The copper oxide is put there to furnish its oxygen for the hydrogen. Wrought iron is used in some forms of this cell. In this, as in all other cells, exhaustion is due to the chemical decomposition of the materials. Here the zinc is changed into a sodium zincate, Na_2ZnO_2 and the copper oxide $CuO + H_2$ becomes $H_2O + Cu$. When all the materials are changed, the battery stops its working. There is in it no source of energy remaining. The iron is not affected by these changes, and an iron pail will last indefinitely, so far as the electric action is concerned. It will be exposed to rust from the action of the water in which the soda is dissolved.

(7344) A. J. L. asks for a formula for a polish for polishing the nickel on bicycles, or if you have already published such a formula before, please give the number of the paper that it was in. A. Rub the bright parts with rouge and lard oil. You can purchase from any dealer in bicycle sundries preparations for cleaning the nickel parts of a bicycle in an expeditious and safe manner. The polishing cloths now on the market answer admirably to keep the nickel bright.

(7345) C. A. C. asks: How canvas can be made mildewproof without injuring the fabric. A. Dissolve 1 pound of zinc sulphate in 40 gallons of water; then add 1 pound of sodium carbonate; when dissolved add 2 ounces of tartaric acid. This holds the partially separated zinc carbonate without neutralizing the excess of the alkali used. The canvas, etc., should be soaked in this solution for 24 hours and then dried without wringing.

(7346) C. B. W. asks how the paper is prepared of which dresses of dolls are made so that the color changes with the weather. A. Cobalt chloride dissolved in alcohol applied to artificial flowers or to the dresses of dolls to which you refer turns the paper or fabric pink when the air is humid; when the air is warm and dry, the paper will be purple or blue. A solution of the same constitutes one of the sympathetic inks.

(7347) T. P. B. says: Can you tell me if the phenomenon of lightning during a snow storm is possible? A. The phenomenon to which you refer has occurred when the atmosphere has become suddenly warmed above the season's average normal temperature. Lightning never occurs in cold weather without a current of warm air in the upper atmosphere.

NEW BOOKS, ETC.

THE SOCIAL MIND AND EDUCATION. By George Edgar Vincent. New York: The Macmillan Company. Pp. 154. Price $1.25.

To give "greater unity and clearer purpose to our higher education" is the design suggested in "barest outline" in this book. It treats social philosophy as the "science of sciences," notes the development of social and of individual thought, and discusses "the integration of studies," and a "tentative curriculum," from the view point of a professor of sociology in the University of Chicago, the author endeavoring to bring conceptions from social philosophy to bear upon the problem of education.

TODD'S NEW ASTRONOMY. By David P. Todd, M.A., Ph.D., Professor of Astronomy and Director of the Observatory, Amherst College. New York, Cincinnati, and Chicago: American Book Company. Pp. 500. Illustrated. Cloth, 12mo. Price $1.30.

This small textbook which Prof. Todd has just prepared is an elementary work for students. The clearness of explanation and profuseness of illustration, together with the care which has been taken to give a thorough and accurate conspectus of the latest advance all along the lines of recent investigation, which includes such a wealth of new knowledge in every department, and notably in that of astrophysics, render this work not only an ideal textbook for beginners, but the best comprehensive review of astronomy up to date for those who have studied that science before the spectroscope and the latest immense telescopes had contributed their quota of information as to the structure and composition of the universe. The beautiful pictures of the sun, moon and planets convey lessons to the youngest reader; and the simple and practical methods of making elementary experiments of observation, such as the finding of the true north pole (pp. 22, 116), and all the points of the compass, and the measuring of the diameter of the sun (p. 259) and moon (p. 239), without costly apparatus, should make many a youth an amateur astronomer. A beautiful instance of simplifying subjects which may puzzle the student is the tub and hoop experiment to illustrate precession of the equinoxes, described and illustrated on page 128. From the very beginning the practical value of astronomy is made evident, and a conspicuous application of science to everyday use is found in chapter viii, on the Astronomy of Navigation: in which the author applies the science particularly to the voyage of the yacht "Coronet," in which he sailed for Japan, in 1896, to observe the eclipse of the sun. The book is dedicated to the Messrs. James, who provided this yacht, and one of whom accompanied Prof. Todd in it to Japan.

INTRODUCTORY COURSE IN MECHANICAL DRAWING. By C. J. Tracy and E. H. Lockwood, Instructors in Sheffield Scientific School, Yale University. With numerous illustrations and full page plates. New York: Harper & Brothers. Pp. 115. Price $1.80.

This is a book for beginners, to prepare students for a more extended course, assuming a working knowledge of the elements of geometry, but omitting machine and bridge drawing, and the more advanced applications of mechanical drawing. The book also has a chapter comprehensively treating of perspective.

THE BAROMETRICAL DETERMINATION OF HEIGHTS. By F. J. B. Cordeiro, Surgeon United States Navy. New York: Spon & Chamberlain. Price $1.

This brief monograph affords a practical method of barometrical leveling and hypsometry for surveyors and mountain climbers, presenting formulæ therefor which are free from errors, which cannot be said of some of those heretofore in use, and a new method designed in practice to give reliable results under all conditions.

THE SUN'S PLACE IN NATURE. By Sir Norman Lockyer. London and New York: Macmillan Company. Pp. 360. Price $2.75.

The interest in this book will be greatly heightened by the fact that its author has been at the head of one of the expeditions sent out to India to observe the recent solar eclipse, and the care which was taken to equip the party of which Sir Norman was the head is but the result of his long series of studies in this special line, the volume before us being only one of his numerous contributions on the subject. Since the author's publication, in 1887, of "The Chemistry of the Sun," when approximate estimates of the temperature of the sun's photosphere were carefully considered, there has been such great improvement made in the instruments used, and such a large accumulation of independent observations, that the basis on which the problem is approached has been very much broadened, and yet without giving us sufficient data upon which to reach satisfactory conclusions. All of the more recent authoritative investigations touching this subject are here considered, in connection with numerous examinations and analyses of spectra of the sun and different stars and photographic representations of nebulæ. The meteoritic hypothesis is especially considered in its many bearings as affording the most ample data for fixing the place of the sun among its fellow stars.

STREET CLEANING, AND THE DISPOSAL OF A CITY'S WASTES. By George E. Waring, Jr. New York: Doubleday & McClure Company. Pp. 230. Price $1.25.

It is not too much to say that the late Commissioner of Street Cleaning of the City of New York has made for himself a world-wide reputation in this particular line. Coming to the task of the supervision of the cleaning of the streets of New York at a time when they were sadly in need of thorough and energetic work, and when the department had been for a long time suffering from a want of anything like efficient organization, he introduced system and order into the business, and effected such an immediate change in the looks of our thoroughfares that the subject became at once matter of general comment. During the two years of Col. Waring's administration of the office the death rate showed a large decrease—a fact which leading physicians attribute mainly to the better condition of the streets. As to the disposal of the city's wastes, which is also treated of in this volume, our readers will remember the full illustrations and description of Col. Waring's plant and process which appeared in the SCIENTIFIC AMERICAN of August last. It is interesting to note that Col. Waring estimates that in the near future the revenue derived from the city's wastes will pay half the expenses of the work.

OIL ANALYSIS. By Augustus H. Gill. Philadelphia: J. B. Lippincott Company. Pp. 139. Price $1.50.

To meet the needs of a professor teaching oil and gas analysis in the Massachusetts Institute of Technology was the primary object in preparing this monogram, in which only the more commonly occurring oils are discussed, considering their preparation, properties, analytical constants, uses and adulterants. It is an excellent book for one desiring right elementary guidance in the judging of oils, or for beginning the study with the view of becoming an expert.

ARITHMETIC OF THE STEAM ENGINE. By E. Sherman Gould. New York: D. Van Nostrand Company. Pp. 77. Price $1.

The author, a member of the American Society of Civil Engineers, presents here a collection of simple and accurate facts and rules in readily accessible shape for practical use, touching the fundamental principles of the practical operation of the steam engine.

A REPORT UPON SALMON INVESTIGATIONS IN THE COLUMBIA RIVER BASIN AND ELSEWHERE ON THE PACIFIC COAST IN 1896. By Barton Warren Evermann and Seth Eugene Meek, United States Commission of Fish and Fisheries. Washington. 1898.

THE FISHES OF THE KLAMATH RIVER BASIN. By Charles H. Gilbert, United States Commission of Fish and Fisheries. Washington. 1898.

THE FISHES FOUND IN THE VICINITY OF WOOD'S HOLL. By Hugh M. Smith, United States Commission of Fish and Fisheries. Washington. 1898.

THE JACK RABBITS OF THE UNITED STATES. By T. S. Palmer, M. D., United States Department of Agriculture, Division of Biological Survey. Washington. 1897. Pp. 88.

OUTLINES OF RURAL HYGIENE. By Harvey B. Bashore, M.D. Philadelphia: The F. A. Davis Company. Pp. 84. Price 75 cents.

The author, an Inspector of the Pennsylvania State Board of Health, here sets forth, for physicians, students and sanitarians, the conclusions reached through his own experiences relative to water supply and waste disposal, the soil, habitations, and disposal of the dead. An appendix on "The Normal Distribution of Chlorine" is contributed by Prof. Herbert E. Smith, of Yale University.

The wonderful variety and the great beauty of many of the specimens of calendar work brought before the public with the commencement of each new year is a marked feature of the development of modern processes of illustration. The National Chemigraph Company, of St. Louis, Mo., Charles B. Woodward, president, send us a beautiful sample of their work in this line, the year's calendar consisting of six large plate pictures, 18 by 22 inches each, and each well worth framing, being specimens of chemigraph photo-reproduction. The same company also send us a beautiful bass relief of the Davenant bust of Shakespeare.

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