

ENRICHED TEACHING OF SCIENCE IN THE HIGH SCHOOL

A SOURCE BOOK FOR TEACHERS OF SCIENCE
LISTING CHIEFLY FREE AND LOW COST
ILLUSTRATIVE AND SUPPLEMENTARY MATERIALS

WOODRING—OAKES—BROWN

Enriched Teaching of Science In the High School

A SOURCE BOOK FOR TEACHERS OF GENERAL SCIENCE,
BIOLOGY, PHYSICS, CHEMISTRY, AND OTHER SCIENCES,
LISTING CHIEFLY FREE AND LOW COST ILLUSTRATIVE
AND SUPPLEMENTARY MATERIALS

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ENRICHED TEACHING OF SCIENCE
IN THE HIGH SCHOOL

ENRICHED TEACHING SERIES

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- No. 4. ENRICHED TEACHING OF COMMERCIAL SUBJECTS IN THE HIGH SCHOOL. MAXIE N. WOODRING and GILBERT HAROLD (Instructor in Finance, Drexel Institute, Philadelphia, Pennsylvania). In press.

Numbers listing materials on Social Studies, Latin, French, Spanish,
Home Economics, and Physical Education
In Preparation

P R E F A C E

The increasing demand that school activities be related to the everyday life of pupils has resulted in the necessity of providing the means for investigation along the lines of individual interests. Consequently, in every high school subject there is an urgent need for an extensive guide to sources of supplementary and enrichment materials which may be obtained at low cost. This is particularly true in the field of science.

Many administrators interested in science teaching, as well as many science teachers themselves, feel that much of the so-called laboratory work in schools is sterile, and that there is a real need of avoiding both bookishness and a formalized laboratory procedure in science courses. It is for the purpose of meeting this need that this handbook has been written.

The compilers have examined the greater part of the materials listed, most of which are accessible in the department of Secondary Education of Teachers College, Columbia University. The items have all been used in the classroom or appraised elsewhere in print.

Names of publishers, addresses, prices, etc., have been checked to date, but it should be kept in mind that these details are constantly changing. It is wise, therefore, to verify prices before ordering. Much of the material listed is offered free for classroom use. In regard to requests for things of this type a few general suggestions may be of value. It is best to order only material for which there is a real need, specifying the name of the sample, chart, or booklet which can be used and the name of the class which will use it, rather than to make a blanket request for "all the pamphlets issued by your firm for science classes." Better results will be obtained if the school letterhead is used and if the teacher signs the letter. When the material arrives, it is only fair to the sender that it be acknowledged, at least with a post card. Seeming discourtesy, carelessness, or abuse of materials has led certain companies to become cautious about sending materials to schools, and in some cases to discontinue the service entirely.

Objection is sometimes raised to the using of free booklets, since they are likely to be of the nature of propaganda, which

has come to mean biased fact and opinion. Much, however, that our pupils are reading in newspapers, magazines, advertisements, and even books is propaganda; and who better than the science teacher can train pupils "to weigh and consider," to demand facts, and to form their own conclusions based on evidence? Thus, entirely aside from the rich fund of facts that may be mined in them, free pamphlets present a challenging experience in living both to teacher and to pupil.

A teacher of any science subject, especially a teacher of general science, will undoubtedly find material of value in all the sectional divisions of this handbook. The attempt has been made to compile a fairly comprehensive list of the best available enrichment materials in teaching the high school sciences. The authors will be greatly indebted to anyone who points out errors that may be found, whether they are errors in statement of fact, or in listing material of little value (a real danger), or in omitting anything that is important.

A feature which should make this compilation especially useful is the annotation of the items. This has been done with the intention of making it possible for the user to know the nature of the material, so that from a wide selection it will be possible to choose what best suits the particular needs of the case.

This list is by no means exhaustive. A blank page is inserted at the end of each division in order that notes and new materials may be added from time to time, thus making the handbook an ever-growing, accumulative "worklist." Teachers will find many suggestions for additional materials in the advertising sections of magazines. In order that newly discovered materials may reach other science teachers, the compilers request that new and worthwhile sources and proved devices be called to their attention. These suggestions will be organized and published as a supplement to this handbook.

It would have been an endless, if not impossible, task to collect the amount and kind of materials listed herein without the assistance and cooperation of science teachers who have been members of Education Courses 35A, 36A, 235F, 236F, S235G, S235F, and Em236 (High School Methods), at Teachers College, Columbia University. The compilers acknowledge their indebtedness to these students; to high school pupils who have assisted in preparing the manuscript; to many librarians who gave valuable suggestions and information; to

the publishers who submitted materials for examination; to the universities and state and federal agencies which supplied bulletins and handbooks; and to associations and commercial firms who through us announce free materials for teachers.

Acknowledgment is gratefully made to Dr. S. R. Powers, Professor of Natural Sciences, Teachers College, Columbia University; to Dr. Gerald S. Craig, Associate in Natural Sciences, Teachers College, Columbia University; and to Mr. C. J. Pieper, Assistant Professor of Education, New York University, for their valuable criticisms and suggestions.

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*Teachers College,
Columbia University,
July 23, 1928.*

AN APPROPRIATE CAUTION

Quoted by permission from *Popular Books in Science* of the American Library Association:

"The user of this list may well be reminded at the outset that the field of science cannot be sharply divided into little compartments labelled 'chemistry,' 'botany,' and the like. On the contrary, there is but one vast field of human knowledge, and facts concerning any part of that field have a bearing on every other part. The usual subdivisions, which are those employed here, are not fundamental; they are largely accidental and have arisen merely as a matter of human convenience."

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I. MODELS, SAMPLES, EXHIBITS

The ideas and impressions that a student carries away from a science course are undoubtedly most vivid and real when the textbook account has been made more significant by the actual use of a model, an exhibit, or a sample of the subject under discussion. It is not to be wondered at, then, that the use of these three types of enrichment material is widespread. This section attempts to bring together sources of free and inexpensive material of this nature.

There is one field that this report does not and probably could not cover—that of homemade models and exhibits. It is an excellent form of project for a student to make a model of some recent engineering achievement, or to arrange an exhibit to show the stages of some chemical process, or the life history of, say, a frog. During the past year, in one high school, different members of the physics classes constructed an excellent model of the Hudson vehicular tunnel; a model, with power houses and transformer stations, to show the various voltage transformations through which the electric current passes in reaching the homes of the community; a model to show the difference between “open” and “BX” wiring, and the methods of installation; and two compartments, identical in size and equipped with lights of the same wattage in the same relative position, but with one interior painted black, the other white, to show the difference in resulting illumination. Although not many students have the knack for this work, in any class there are always a few mechanically inclined who would be glad to undertake this sort of thing for extra credit, in place of a more conventional experiment, or simply for the joy of doing it. Not only does that individual add something of value to the science equipment, but he also is adding a great deal to his own experience.

In the comments which accompany each item, *free* means that the material is given outright; a price indicates the price of outright purchase. When material is lent, transportation will have to be paid by the borrower, as a general rule, in at least one direction.

A. GENERAL SCIENCE AND BIOLOGY

Foods

Chocolate and Cocoa. Hershey Chocolate Co., Hershey, Pa.
Free to schools.

Set of 7 bottles showing the cocoa bean, its parts and products.

The Common Barberry Bush. Conference for the Prevention of Grain Rust, 510 McKnight Bldg., Minneapolis, Minn.
Free.

A specimen (twig) of "the grain farmer's worst enemy" put up in an envelope with celluloid front. Shows the cluster-cup stage of the black stem rust. Charts also obtainable.

Coffee from Plantation to User. C. F. Blanke Tea and Coffee Co., 7th and Clark Ave., St. Louis, Mo. Free.

Set of 25 bottles of specimens showing the types of raw bean and the various processes of preparation.

Corn Products. Associated Corn Products Manufacturers, 208 So. LaSalle St., Chicago, Ill. 50c postpaid.

Set of 10 three-ounce bottles containing samples of the corn grain and such products as corn meal, starch, cooking oil, etc.

Corn Products. Corn Products Refining Co., Edgewater, N. J. Free.

Set of 12 bottles containing specimens of the products of maize (Indian corn). Also larger set of 25 bottles for colleges and libraries.

Flour. Russell-Miller Milling Co., Minneapolis, Minn. Free.

Exhibit on flour manufacture. Vials of wheat, bran, and different kinds of flour.

Wheat to Flour. Northwestern Consolidated Milling Co., Minneapolis, Minn. Free.

24 samples of wheat in various stages of manufacture into flour.

Wheat to Flour. Hecker-Jones-Jewell Milling Co., 40 Corlears St., New York City. Free.

An excellent display card with 5 small vials of samples, and a map showing wheat-raising regions.

Also pamphlet "Adventures of a Grain of Wheat."

Grains and Grasses. Commissioner of Immigration, Winnipeg, Canada. Free.

Box of samples of various cereal crops.

Horlick's Malted Milk. Horlick's Malted Milk Corp., Racine, Wisc. Free.

Set of 12 bottles of raw materials and products, accompanied by descriptive booklets.

Packing-House By-Products. Morris and Co., Advertising Dept., Chicago, Ill. Free.

Samples of tallow, glue, and other by-products of the meat packing industry.

Peanut Butter. Beech-nut Packing Co., Canajoharie, N. Y. Free.

An exhibit showing the substances used and the stages in the manufacture of peanut butter.

Rolled Oats. Armour Grain Co., 208 South LaSalle St., Chicago, Ill. Free.

The conversion of farm oats into the finished product.

Spice Samples. D. L. Slade Co., 189 State St., Boston, Mass. Free.

Card with 37 bottles of spice samples, seeds, etc., each labelled.

What Milk Is. Sheffield Farms Co., 524 West 57th St., New York City. Free.

A cardboard quart milk bottle showing the proportions of the substances of which milk is composed, and the total caloric value.

Fabrics

Flax Manufacture. Barbour Products Co., 96 Franklin St., New York City. Free. \$ 3.00 + transport.

Cabinet showing full process of flax manufacture with actual specimens.

Silk Culture Cabinet. Corticelli Silk Mills, Florence, Mass. \$2.00 to schools.

Box of 2 cocoons and silk culture chart, free. Same specimens mounted on cards, 56c.

Silk Specimen Exhibits. H. K. H. Silk Co., 120 East 16th St., New York City. No. 1, \$2.50. No. 2, \$1.00.

Each set contains all the life stages of the moth as well as the steps in the manufacture of silk thread. Each is accompanied by a booklet of explanations.

Silk Worm Eggs. T. A. Kelleher, P. O. Box 82, Washington, D. C. 300 for 25c.

Will grow into real silk worms. Useful for biology classes.

Steps in the Manufacture of Esmond Blankets. Esmond Mills, Esmond, R. I. Free.

A neat little case with specimens showing six steps in the process.

Miscellaneous

Collection of Specimens. U. S. National Museum, Washington, D. C. Free.

At times, upon written request of the principal, special collections can be supplied to schools. Write for particulars, asking about a specific collection, such as fossils, fishes, etc.

Rack of Wood Samples. National Lumber Manufacturers' Association, Transportation Bldg., Washington, D. C. \$10.00, f.o.b. Chicago.

Contains 32 smoothly dressed samples, $\frac{3}{4}$ "x2 $\frac{1}{4}$ "x5", of native American hard and soft woods, with celluloid labels bearing common and scientific names.

Samples of Hardwoods. Hardwood Manufacturers' Institute, Memphis, Tenn. \$5.00.

Box of about 45 pieces of hardwood, each labelled with name and special qualities of the wood.

Drug Samples. Victor Lewitus, College of Pharmacy, 113 West 68th St., New York City. Send postage.

Samples of plant parts—berries, bark, roots, etc.—used as drugs, such as digitalis, gum arabic, etc., will be sent for postage. Send addressed envelope for list.

Sponge Samples. Schroeder and Tremayne, Inc., 500 North Commercial St., St. Louis, Mo. Free.

Also leaflet, "Men Who Fight Sharks." This company desires to coöperate with schools. Write for particulars.

Animal Track Series. U. S. Rubber Co., 1790 Broadway, New York City.

Footprints of many different animals, made directly from the paws of animals, pressed into soft clay. Individual prints of smaller animals, 35c; of the elk, bear cub, wolf, etc., 50c each; and of the buffalo, 75c. Three cases also obtainable.

Case No. 1 contains 11 prints of pack rat, gopher, prairie dog, raccoon, coyote, squirrel, wild cat, mountain sheep, wolf, \$5.00.

Case No. 2—ground squirrel, red squirrel, opossum, skunk, porcupine, mink, bear cub, 10 prints in all, \$5.00.

Case No. 3—woodchuck, kit fox, red fox, badger, otter, white tail deer, black tail deer, antelope, goat, badger, elk, beaver, 15 prints in all, \$6.40.

The Herediscope. American Instrument Co., 1220 D St., N. W., Washington, D. C.

Bulletin No. 1105 describes this instrument board with which to teach genetics.

B. CHEMISTRY

General

Ready Reference Rule. Henry Heil Chemical Co., St. Louis, Mo. 30c each. \$3.00 per dozen. \$20.00 per hundred.

Comparison of Metric and English rules. Also of F. and C. temperature scales and a list of the principal elements with atomic weights and valences. 6" long.

Demonstrating Slide Rule.

See comment under heading "Miscellaneous" in PHYSICS Section (p. 16).

Aluminum

Aluminum Cooking Utensil Co., New Kensington, Pa. Free.

An envelope containing samples of aluminum plate. Other materials also available.

Evolution of a "Mirro" Aluminum Clothes Sprinkler. Aluminum Goods Manufacturing Co., Manitowoc, Wisc. Free.

Interesting exhibit tracing evolution from bauxite, through refining processes to the drawing, trimming, shaving, and polishing of the sprinkler. Size, 16"x24". Exhibit accompanied by eight-page booklet entitled, "From Clay to Cooking Utensil."

American Bauxite Co., Pittsburgh, Pa. Free.

Samples of bauxite ore, aluminum powder, and aluminum ingot.

Corundum. Norton Co., Worcester, Mass. Free.

A well-made case, containing grinding wheels and other products made of corundum.

Calcium

American Lime and Stone Co., Bellefonte, Pa. Free.

Samples of "Bell Mine" limestone and pebble lime.

The Permutit Co., 440 Fourth Ave., New York City. Free.

This company will send a demonstrating tube by means of which the instructor can demonstrate on the lecture table softened water from any hard water.

U. S. Gypsum Co., 300 West Adams St., Chicago, Ill. Free.

Samples of Gyplap, Thermofill, Rocklath, and other gypsum products.

Carbon

Manufacture of a Lead Pencil. Eberhard Faber, 37 Greenpoint Ave., Brooklyn, N. Y. 50c.

Set showing manufacture of pencil and eraser. Is mounted with actual samples of the crude and finished materials. Size, approximately, 17"x22".

✓ **Manufacture of Fountain Pen.** L. E. Waterman Co., 191 Broadway, New York City. Free.

Process of the manufacture of Waterman pens. Shows in particular samples of rubber at the various stages of manufacture.

Ace Combs of Hard Rubber. American Hard Rubber Co., 11 Mercer St., New York City. Free to schools.

Set of 10 samples showing the stages in the manufacture from crude rubber to comb.

Firestone Tire and Rubber Co., Advertising Dept., Akron, Ohio. Free.

Samples of raw materials and various products.

From Raw Material to Finished Product. Goodrich Rubber Co., Akron, Ohio. Free.

Six samples and several pictures of the processes of rubber manufacture.

Educational Exhibit. Hood Rubber Products Co., Watertown, Mass. 60c to schools.

This exhibit shows samples of crude rubber and the various ingredients necessary to refine and manufacture it into rubber boots and shoes.

Experimental Material. Educational Dept., U. S. Rubber Co., Box 12, Station G, New York City. \$1.00.

All requisite materials and full instructions for an experiment to demonstrate the extraction of rubber from latex, and also a simple vulcanizing experiment. A wooden mill will be lent by the company free of charge. A small box of samples of crude rubber will be supplied for 25c.

Rubber Display. Goodyear Tire and Rubber Co., Akron, Ohio. No. 1, \$5.00; No. 2, \$25.00.

Send for leaflet picturing and describing these sets, which consist of specimens of raw materials and finished products.

Standard Carbon Brush Exhibit. Stackpole Co., St. Marys, Pa. Free.

Various types and sizes of standard carbon motor brushes, mounted on an exhibit board. Also will send catalogs as reference books.

Chromium

International Nickel Co., 67 Wall St., New York City. Free.

Set of samples illustrating the various stages of production of Monel metal and pure nickel. Valuable material.

Fuels and Flames

Paraffin Paint Co., San Francisco, Cal. Free.

Set of samples of products.

The Quaker State Oil Refining Co., Oil City, Pa. Free.

Set of 8 bottles showing different types of Quaker State oil.

School Samples. Sinclair Refining Co., 45 Nassau St., New York City. Free.