

**CHEMICAL ATLAS: OR, THE
CHEMISTRY OF FAMILIAR
OBJECTS: EXHIBITION THE
GENERAL PRINCIPLES OF THE
SCIENCE**

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Chemical Atlas: Or, The Chemistry of Familiar Objects: exhibition the general principles of the science by Edward L. Youmans

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EDWARD L. YOUMANS

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OPINIONS OF DISTINGUISHED CHEMISTS AND EDUCATORS.

THE following expressions of opinion concerning the plan of illustrating Chemistry adopted in the present volume, are from the most eminent teachers and scientific men in the country. It will be seen that the testimonials refer to the Author's "Chemical Chart;" but as the "Atlas" is a reproduction and improvement of that mode of exhibiting chemical facts and phenomena, the commendations apply to this work with much greater force.

OF THE PLAN OF ILLUSTRATION.

From BENJAMIN SILLIMAN, LL. D., *Professor of Chemistry in Yale College.*

I have hastily examined Mr. Youmans' new Chemical Diagrams, or Chart of chemical combinations by the union of the elements in atomic proportions. The design appears to be an excellent one. It conveys to learners the idea of chemical combinations by connecting the elements by right lines with the compounds which they produce. Colored squares, differently colored in the different cases, are employed to represent the elements, and proportion in area indicates their relative combining weight.

From W. F. HOPKINS, *Professor of Natural and Experimental Philosophy in the U. S. Naval Academy, Annapolis, Md.*

Having given to the Chemical Chart of Mr. E. I. Youmans such an examination as my small leisure permitted, I cheerfully state my conviction that its plan is admirably adapted to assist the teacher in communicating, and the learner in receiving, correct notions of the laws of chemical combination.

I commend it to the patronage of schools and academies where chemistry is taught, and shall immediately introduce it into the institution with which I am connected.

From Dr. JOHN W. DEAFER, *Professor of Chemistry in the University of New York.*

Mr. Youmans' Chart seems to me well adapted to communicate to beginners a knowledge of the definite combinations of chemical substances, and as preliminary to the use of symbols, to aid them very much in recollecting the examples it contains. It deserves to be introduced into the schools.

From JAMES B. ROGERS, *Professor of Chemistry in the University of Pennsylvania.*

We cordially subscribe to the opinion of Professor Draper concerning the value to beginners of Mr. Youmans' Chemical Chart.

JOHN TORREY,
Professor of Chemistry in the College of Physicians and Surgeons, New York.

WILLIAM H. ELLET,
Late Professor of Chemistry in Columbia College, S. C.

From JAMES R. CHILTON, M. D., *Chemist.*

I have examined the Chemical Chart of Mr. E. I. Youmans, and am much pleased to say that it is a valuable means of readily imparting a correct knowledge of the nature of chemical combinations. A variety of compounds are dissected so as to show at a glance their ultimate atomic constitution, in such a way as to impress it more forcibly upon the mind than could be effected by any other method with which I am acquainted. To those who are studying to obtain a knowledge of elementary and agricultural chemistry, as well as to all learners of chemical science, Mr. Youmans' Chart will render easily understood what might otherwise appear very difficult.

From Dr. THOMAS ANTRELL, *Professor of Chemistry in the Vermont Medical College.*

Experience in teaching theoretical and practical chemistry for many years, has convinced me of the great benefit derivable from exhibiting the chemical elements in a material form to the eye, and I therefore take great pleasure in bearing testimony to the utility and value of Mr. Youmans' Chart. It represents the principal elements, binary compounds and salts, those minerals

which interest chiefly the geologist and agriculturist, together with the most important organic bodies. It is got up in a style which renders it a neat appendage to the lecture-room, and wherever chemistry is taught in schools and public institutions, it will be found an invaluable assistant to both teacher and pupil.

From PROF. GRAY, *Author of Text-Books on Natural Philosophy and Chemistry.*

Mr. Youmans' Chart presents to the eye a clearer view of the manner in which the atoms of chemical compounds are united, than could be gained by the most laborious description.

It would be especially useful to institutions not furnished with chemical apparatus.

From ROBERT HAER, M. D., *Emeritus Prof. of Chemistry in the University of Penn., and Associate of the Smithsonian Institute.*

I concur in thinking favorably of Mr. Youmans' Chemical Chart. The design is excellent, and as far as I have had time to examine the execution, I entertain the impression that it is well done.

From ALEXANDER PETER, LL. D., *Philadelphia.*

The conception embodied in Mr. Youmans' Chemical Chart strikes me as a very happy and useful one, and the execution is evidently the fruit of much care and skill. I should think its introduction into schools, in connection with the study of the first principles of chemistry, was much to be desired.

From the Hon. HERSCHEL MANN, *President of Antioch College.*

I have been highly delighted by inspecting a Chart shown to me by Mr. E. I. Youmans, of New York, the object of which is to represent the ratios in which chemical atoms are combined to form compound bodies. The different atoms are represented by square diagrams of different colors; and then the compounds exhibit the exact number, or numbers, of the respective atoms that unite to form them, each atom retaining its original color. Thus the eye of the learner aids his memory; and as the eye, in regard to all objects having form and color, can learn a hundred things by inspection, while the ear is learning one by description; so, when material objects, too minute to be seen, or too intricately combined to be distinguished, can be represented by form and color, the same great advantage is obtained. The power of the learner is multiplied, simply by an exhibition of the object, or its representative, to a superior sense.

I think Mr. Youmans is entitled to great credit for the preparation of his Chart, because its use will not only facilitate acquisition, but, what is of far greater importance, will increase the exactness and precision of the student's elementary ideas.

From GEORGE R. EBERSON, Esq., *Boston.*

I have had the satisfaction of examining the Chemical Chart prepared by Mr. Youmans, and very gladly give my testimony to its value. The author avails himself of color to represent proportion, and of magnitude to indicate quantities; and by a judicious selection and skilful use of those representatives, he makes remarkably clear to the eye, and very easily remembered, the most important principles and laws of the sciences, and renders intelligible many of the changes in chemical substances which are of most frequent occurrence and of the greatest interest. I would strongly recommend the use of the Chart to all teachers of chemistry.

From SAM'L S. RANBALL, *Superintendent of Schools of the City of New York, and Editor of District School Journal of Education.*
I have examined Youmans' new Chart of Chemistry, designed to present to the eye of the student of this science the fundamental principles of chemistry, and the ratios in which the various elemental atoms are combined in the formation of compound bodies; and cheerfully recommend it to the attention and patronage of teachers, trustees, and directors of public schools, as well adapted to promote a knowledge of the beautiful science for the illustration of which it is designed.

From JOSEPH McKENZIE, *Deputy Superintendent of Common Schools in New York City.*

I have been greatly pleased with an examination of a Chart of elementary chemistry, by Mr. Youmans. It seems to me that it so simplifies the subject, that pupils in the best classes in our common schools may acquire from a few lessons, with its aid, more knowledge of the laws and principles of this science than

from months of study without such means of illustration. I know of no other chart like this; and as by its means chemistry may now be taught with the same facility as geography or astronomy, I would earnestly commend it to the attention of school committees, teachers, and learners.

In the above view of the utility of Mr. Youmans' Chemical Chart, I fully coincide.

S. L. HOLMES,
Superintendent of Schools, Brooklyn, L. I.

From the Boston Common School Journal.

We consider this Chart a great simplification of a somewhat confused subject; and we welcome it as another successful attempt, not only to simplify truth, but to fix it in the mind by the assistance of the eye. If we were called to teach the elements of chemistry in a school-room, we should be very unwilling to lose the valuable assistance of this ingenious chart.

OF THE CLASS-BOOK OF CHEMISTRY.

From PROF. WA. H. BAZELON, *Principal of Clinton St. Academy.*
I have introduced Mr. Youmans' Chart and Class-Book into the institution under my charge and am very happy to say, after subjecting them to a practical test, that they are better calculated to excite the interest and fix the attention of pupils, than any other works upon the subject which I have seen.

The eminently practical character of the Class-Book, treating of the familiar applications of the science, is in my opinion its chief excellence, and gives it a value far superior to any other work now before the public.

From PROF. SYME.

MR. YOUMANS: DEAR SIR,—I have carefully examined your Class-Book on Chemistry, and, in my opinion, it is better adapted for use in schools and academies than any other work on the subject that has fallen under my observation.

The science of chemistry is highly interesting; and it would be difficult to exaggerate the advantages which would result to the community were it systematically taught in our schools. There is no situation in life in which a knowledge of the nature and properties of the elements of matter, and the laws and powers which affect their mutual actions and combinations may not prove of the greatest practical utility. The application of chemical agents in the various departments of art has been exceedingly serviceable; and every attempt to popularize the study should be encouraged.

Hoping that your efforts to diffuse the knowledge of chemistry will be duly appreciated by the friends of education,

I remain, Dear Sir,
Yours truly,

DAVID SYME, A. M.,
Formerly Principal of the Mathematical Department and Lecturer on Natural Philosophy, Chemistry, and Physiology, in Columbia College, and now Principal of P. S. No. 7.

I cheerfully concur in the above recommendation of Mr. Syme.
G. H. STEBBINS, P. S. No. 12.

We entirely concur in the foregoing recommendation.

F. D. CLARKE, Prin. of P. S. No. 3.
S. C. BARNES, Prin. of P. S. No. 4.
CHAS. MCGREGOR, Prin. of P. S. No. 2.
W. C. ROGERS, Prin. of P. S. No. 9.
LYMAN E. WHITE, Prin. of P. S. No. 1.
JNO. T. CONKLING, Prin. of P. S. No. 5.
DEA W. FITCH, Prin. of P. S. No. 6.
CHAS. H. OLIVER, Prin. of P. S. No. 11.
JOSIAH REEVE, Prin. of P. S. No. 8.
A. B. CLARKE, Prin. of P. S. No. 13.

From PROF. J. MULLER, *Principal of Young Ladies' School, New York.*

I have read a considerable portion of Youmans' Class-Book of Chemistry. I think the author has presented his subject in a

more attractive aspect than it has been presented in any of the manuals in common use. His terse, lively style, and his continual reference to the important practical applications of chemistry, are well calculated to interest the learner.

We have a large number of school-books for the purpose of giving elementary instruction in chemistry—possessing various kinds and various degrees of merit; but of all which I have examined, I should prefer the Class-Book of Chemistry, as the most perspicuous in style and in method, and as containing the happiest selection of what is most interesting, and most practically valuable in the vast field of chemical science.

From the N. Y. Commercial Advertiser.

Either for schools or for general reading, we know of no elementary work on chemistry which in every respect pleases us so much as this.

From the N. Y. Tribune.

We have rarely met with an elementary scientific treatise which in clearness, brevity, and freedom from extraneous matter, surpasses the present volume.

From the Albany.

A remarkably interesting and thoroughly popular work on chemistry, recommended to the general reader by the clearness of its style and its freedom from technicalities.

From the National Intelligencer.

Besides the fulness with which this work treats of the chemistry of agriculture and the arts, we regard it as chiefly valuable for the clear account it gives of the action of chemical agents upon the greatly varied functions of life. It is very elementary and practical; and whether for the use of schools or of private libraries, it is an appropriate, because an instructive and entertaining book.

From the Scientific American.

Such a book, in the present state of chemical science, was demanded; but to present the subject in such a clear, comprehensive manner, in a work of the size before us, is more than we expected. The author has happily succeeded in clothing his ideas in plain language—true eloquence—as to render the subject both interesting and easily comprehended. The number of men who can write on science, and write clearly, is small; but our author is among that number.

From the Farmer and Mechanic.

A Class-Book of Chemistry for the use of beginners and young students, which should be divested as much as possible of its tedious technicalities and dry repulsiveness, so often attending their first efforts in this important study, has long been a desideratum. To supply this need, the present volume is fully adequate. It is designed as a popular introduction to the study of this beautiful science, and presents it in such a manner as to win the attention and engage the interest.

TO

SAMUEL M. ELLIOTT, M. D.,

TO WHOSE PROFESSIONAL ABILITY

THE AUTHOR IS INDEBTED

FOR THE ENJOYMENT OF VISION

AND THE POWER OF EFFECTIVE LABOR,

THE PRESENT WORK

IS GRATEFULLY AND AFFECTIONATELY

Subscribed.

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TO TEACHERS AND STUDENTS.

EVERY experienced teacher understands the necessity of making the acquisition of the elementary and foundation principles upon which a science rests, the first business of study. If these are thoroughly mastered, subsequent progress is easy and certain. The system of illustrating Chemistry, which will be found in the following pages, is designed to aid in effecting this object. Those portions of the science which it is important should be well learned, and which are also considered usually as most irksome and difficult, are here presented in such a manner as to be quickly perceived and long retained in the memory. Of course very much that belongs to chemical science does not fall within the scope of this method of illustration; but the great laws of combination which constitute its basis, the composition of compound substances, and many chemical changes and transformations, may be so clearly and correctly exhibited in pictures to the eye, as greatly to facilitate acquisition, and thus afford the student a large economy of time and labor.

The Atlas is intended to accompany the author's Class-Book; but it may be employed with equal convenience and advantage in connection with any of the school text-books. It is to be used in exactly the same manner as a geographical atlas. As the pupil proceeds with the work in hand, whatever it may be, reference should be made to the diagrams as often as the subject may require. For example; when combining proportions, salts, combustion, or compound-radicals are reached, the plates which illustrate these subjects will be resorted to for assistance by those who possess the work. The text contains not only full explanations of the diagrams, but it consists of a series of essays or chapters upon the subjects illustrated. It will be observed that the reading matter is not a repetition of what is contained in the class-books. Where the same topics are treated, the statements are here more full, for they present the subject in a new aspect; while much of the contents of the Atlas is new information, which may be profitably superadded to that found in the books. For the convenience of those who may desire to use them, questions have been subjoined at the close of the volume, which will be found to refer to the numbered paragraphs. It is recommended that, as pupils advance to the various subjects in their text-books, they study carefully those portions of the Atlas which treat of the same points. Teachers will also find, that after going through with other books they may make effective use of the Atlas, in the way of review; thus fixing clearly in the mind the general principles of the science.

INTRODUCTION.

THE Atlas of Chemistry is offered as an extension of the principle embodied in the Author's large Chemical Chart. That chart was published four years ago, and has met with a degree of favor from all classes of instructors rarely accorded to a novel method of illustration, especially in the department of science. It has passed through several editions, and the testimonials of its serviceableness and value as an aid in teaching elementary chemistry, which have appeared from all quarters, afford a gratifying assurance that the work was not done in vain. The atlas form has been adopted at the solicitation of numerous persons—teachers and others—who have expressed a desire to possess the work in a more portable and convenient shape. Though the scale of the diagrams has been so reduced as to bring them within much narrower limits, yet their application has been greatly extended, so as to embrace a larger class of subjects, and include those views of the science which have been recently established, and are of most general interest.

Of the value and importance of some such plan of illustrating Chemistry there can be no longer a doubt. Indeed, the surprise almost universally expressed is, that something of the kind was not devised and adopted long ago. The superiority of the eye over all other senses, as a means of education, is undeniable. The beginning of the intellectual progress of the human race consisted in the invention of letters and words as visible symbols of sound and thought; and to teach those symbols remains still the starting point of education. So also with music: it rose to the dignity of a regular art only when musical notes were invented, by which it became possible to express harmonies of sound to the eye. The symbolism in both cases is perfectly arbitrary; nevertheless, when once acquired, it becomes an instrument of wonderful intellectual power. But if the mind is capable of being thus greatly aided by ocular signs, when there is no natural relation between them and the objects they represent, how much more must its power be multiplied when the symbols it employs assume the pictorial character, and become in a manner actual imitations of the things to be considered.

It is especially in natural science, where definite and exact ideas of properties and relations are to be communicated to the mind, that the employment of visible diagrams is most useful. Whenever the object to be contemplated cannot itself be seen, and consists of such fixed elements or qualities as are capable of being represented or delineated to the eye, pictorial illustrations become indispensable. In Mathematics, we diagramize geometrical conceptions. In order to grasp and hold the elements and conditions of calculation with sufficient steadiness for the mind's eye to contemplate them, they must be displayed before the physical eye. In Astronomy, where the scheme of arrangement is too complicated and extensive to admit of direct observation, pictures of