From answers to question 8 it was ascertained that the following elements, of those listed, are omitted from courses given in the number of schools indicated.

Antimony	17	Gold	16
Arsenic	13	Iodine	3
Barium	10	Manganese	7
Bismuth	22	Nickel	12
Boron	18	Phosphorus	2
Bromine	4	Radium	49
Cadmium	32	Silicon	11
Chromium	16	Strontium	27
Cobalt	13	Tin	5
Fluorine	10		

In answer to question 9 it was found that the following theories, laws and principles are omitted by the number of schools indicated.

Law of constant proportions—3, combining weights—2, Boyle's law—2, kinetic molecular hypothesis—26, Avogadro's law—3, Gay-Lussac's law—5, catalytic agent—3, allotropism—16, osmotic pressure—21, freezing and boiling point effects—7, gram molecular volume law—21, Du-Long and Petit's law—51, periodic arrangement of elements—15, Moseley numbers—99, electron theory—19, structure of atom—27, ionization—2, Faraday's law—25, equilibrium—8, thermal equation—45, colloids—45.

Question 15 is answered in Tables IV., *A*, *B* and *C*.

TABLE IV

(*a*) *Number of Lectures per Week per Instructor*

Number of Lectures	Number of Schools	Number of Lectures	Number of Schools	Number of Lectures	Number of Schools
1	25	4	3	6	2
2	9	5	2	7	2
3	7			8	2

(*b*) *Number of Recitations per Week per Instructor*

Number of Recitations	Number of Schools	Number of Recitations	Number of Schools	Number of Recitations	Number of Schools
1	17	7	2	16	1
2	24	8	6	18	1
3	24	9	2	20	1
4	16	12	6	21	1
5	6	14	3	25	1
6	3	15	3	26	1

With reference to question 18 it is gratifying to note that most of the science teachers in high schools are graduates of reputable colleges and universities. The writer has a list showing the number from each institution. This list is available for any one who may be interested. It would seem unnecessary to include the institutions here, because of the large amount of space required for the purpose. Seventy-four institutions are included in the list already compiled.

(*c*) *Number of Hours of Laboratory per Week per Instructor*

Number of Lab. Hours	Number of Schools	Number of Lab. Hours	Number of Schools	Number of Lab. Hours	Number of Schools
1	11	6	6	12	5
2	22	7	1	14	1
3	21	8	7	15	3
4	11	10	6	16	3
5	7			17	1

It is evident from the variety of answers already received that standardization is necessary. For this purpose the state should have a permanent committee, as long as the United States Commissioner of Education is not empowered to establish standards and enforce them. The latter procedure is naturally more desirable, as it would enable all colleges and universities to plan their courses as continuation courses instead of repeating much of the material which students in some high schools have already covered.

The writer wishes to acknowledge valuable assistance rendered by Miss Marcella Schwer.

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TWENTY-FIVE IMPORTANT TOPICS IN THE HISTORY OF SECONDARY MATHEMATICS

The rapid increase in the number of the historical notes in our recent text-books on elementary and secondary mathematics raises the question, What should be the dominating motive in the selection of such notes? The history of mathematics is so enormous that it is clearly impossible to present a considerable part of it in such notes, but it would be possible to select for them some of the central elements of this history, which might become

nucleuses for the student's further development along this line.

To emphasize the fact that some of the present historical notes are useless from this standpoint we may mention that many of our elementary geometries state that according to tradition Pythagoras was so jubilant over his discovery of the Pythagorean theorem that he sacrificed 100 oxen to the gods on the occasion. It is difficult to see why authors of text-books waste space on such a statement. It is probably not true that such a sacrifice was made by Pythagoras, and if it were true, it could only lessen our respect for him. Just imagine meeting now a man in the act of sacrificing 100 oxen because he had made a mathematical discovery. Would you not conclude that he ought to be in an asylum for the insane?

By the time the average student reaches college he may easily have read twenty-five historical notes in his various mathematical text-books. It is therefore of interest to list twenty-five topics which have been epoch making in the development of pure mathematics and are nucleuses of an extensive history. It can scarcely be expected that all would agree entirely on what twenty-five points should be regarded as most important in the history of secondary mathematics but one may perhaps assume general agreement as regards the fact that each of the subjects of the following list is worthy of consideration in connection with this question. The order of these subjects is supposed to be chronological with respect to the beginnings of their history. (1) Numeration and notation; (2) Value of π; (3) Irrational quantities and irrational numbers; (4) Science of elementary geometry; (5) Science of elementary algebra; (6) Translations of treatises into a different language; (7) Science of trigonometry, or arithmetical geometry; (8) Algebraic solution of the general cubic and of the general biquadratic equation; (9) Use of logarithms for numerical calculations; (10) Science of analytic geometry, or algebraic geometry; (11) Science of differential and integral calculus; (12) Scientific societies supporting publications; (13) Special mathematical periodicals; (14) Ecole polytechnique; (15) Science of arithmetic, or the theory of numbers; (16) Reality of complex numbers; (17) founding of descriptive and projective geometry; (18) Theory of functions; (19) Non-euclidean geometry; (20) Theory of groups; (21) Johns Hopkins University; (22) Theory of aggregates; (23) International mathematical congresses; (24) Large modern mathematical encyclopedias; (25) International commission on the teaching of mathematics.

The above list of twenty-five important topics in the history of secondary mathematics does not include any of the subjects of applied mathematics, which have furnished strong motives for the development of pure mathematics. From the earliest times astronomy and surveying have furnished such motives especially for the development of spherical and plane trigonometry respectively. Among the subjects which furnished strong motives for some of the later developments in pure mathematics we may mention celestial mechanics, hydromechanics, and the theory of heat.

Some may be surprised to find in the above list of important topics the names of two institutions, but a little reflection will tend to make it clear that these institutions have been the centers of unusually strong mathematical influences. The early courses offered at these institutions are of great historical interest. It is true that the influence of the latter might be regarded to have been national rather than international, but the national activity which it fostered has been sufficiently extensive to merit general recognition.

It is, however, not our purpose to justify the particular selection of topics noted above. If this list will tend to direct the attention of teachers and authors to the really serious and fundamental questions of mathematical history, the purpose of its compilation will be fulfilled. Just as the material of the body of a text-book is selected with a view to furnishing matter of permanent usefulness rather than to arouse ephemeral interest, so it seems that the material for the historical notes

should be selected primarily with a view to furnishing enjoyment by growth of knowledge about the history of our subject.

The topics of this list may also be suitable subjects for consideration at meetings of mathematical clubs. In fact, it is especially important that the subjects selected for such metings should be fertile, since those who take active part in them include to a large extent the mathematicians of the future, and these mathematicians can not afford to be as ignorant of the history of their subject as are those of the passing generation.

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SCIENTIFIC EVENTS

THE CLEVELAND MEETING OF THE AMERICAN CHEMICAL SOCIETY

The annual September meeting of the American Chemical Society will be held at the Hotel Statler, Cleveland, Ohio, September 10 to 13, 1918, inclusive. There is every prospect of a large and successful meeting. The chemists of the country are showing a very decided desire to get together in these war times for conference at a time when it is so difficult to keep in touch with the progress of chemistry through our literature. A meeting of this kind offers special inducements to members of our society to keep themselves abreast of the time. Wonderful chemical advancement has taken place in America during the last year. Many chemists, both from the government service and from the industries, will be present.

Registration will begin at 3 P.M., September 9, at the Statler Hotel. Information regarding other hotels may be obtained from the chairman of the committee on hotels.

The general preliminary program is as follows:

Monday, September 9

4 P.M.—Council meeting at the University Club, Euclid Avenue and East 38th Street. Dinner there for the Council as guests of the Cleveland Section.

Tuesday, September 10

10 A.M.—General meeting. "The American Chemist's Place in Warfare," by Charles L. Parsons, Chairman of the Committee on War Service for Chemists.

Other general papers to be announced.

2 P.M.—General Symposium on the Chemistry of Dyestuffs. R. Norris Shreve, Chairman. Numerous interesting papers and addresses are being prepared. These will take up the whole of the afternoon of Tuesday and may continue on Wednesday morning in the Industrial Division.

Evening.—Banquet, Hotel Statler, followed by a smoker at the same place.

Wednesday, September 11

Morning.—Divisional meetings—Hotel Statler.

Afternoon.—Choice of excursions.

(*a*) Sanitary trip, including sewage disposal experiments, water filtration, garbage disposal.

(*b*) Steel industries, blast furnaces, by-product coke, steel—bessemer and open hearth.

(*c*) Industrial tour of Cleveland, including manufacturing centers.

(*d*) Trip to Oberlin.

Evening.—President's address, followed by informal reception.

Thursday, September 12

Divisional meetings all day.

Late Afternoon.—Outing to one of the country clubs, followed by reception at the Cleveland Museum of Art.

Friday, September 13

Choice of excursions.

(*a*) By special cars to Akron—Goodrich Rubber Co. (limited to 200), Knight Chemical Stoneware plant, and possibly pottery works.

(*b*) Auto trip to Wadsworth, near Akron—Ohio Match Co., Ohio Salt Works, and Ohio Brass Co. (limited to 50).

The usual meetings, including the annual election of officers, will be held by all the Divisions, and by the Rubber Chemistry Section, with the following special program: