DEFINITIONS OF ENTRANCE UNITS

INTRODUCTORY STATEMENT

This bulletin is published for the information of school officers, high school teachers, and others who desire information regarding the character and extent of the work which should constitute the units that are accepted for admission to the Ohio State University. The definitions of units and the descriptive matter in connection therewith are (with exceptions noted below) republished from the 1910 report of the Commission on Accredited Schools and Colleges of the North Central Association of Colleges and Secondary Schools, and have been adopted by the faculty of the Ohio State University with slight corrections or changes which are here incorporated. The definitions in Chemistry and Manual Training differ in form, rather than in substance or extent, from similar definitions of the North Central Association. The University also defines units in Agriculture, Commercial Geography, Physiology, and Freehand Drawing, subjects not yet defined by the North Central Association.

As a charter member of the North Central Association of Colleges and Secondary Schools, the educational organization which seeks by the voluntary action of its constituent members to promote and make effective the best educational policies in the fourteen North Central States, the Ohio State University commends the definitions here printed to the careful consideration of school officers. The definitions represent the judgment of the best institutions, both higher and secondary, in these states and are substantially the same also as those adopted by the Association of Colleges and Preparatory Schools of the New England States, and the Association of Colleges and Secondary Schools of the Middle States and Maryland. These definitions are published for the purpose of being helpful and suggestive rather than with the object of restricting the work of secondary teachers in any undesirable manner.

No attempt is made in this bulletin to indicate the entrance requirements to the various colleges or courses of the University. Such information is contained in a Bulletin of Entrance Information, which will be mailed on request. Requests for this or other

bulletins of information should be addressed to W. E. Mann, University Editor, Columbus, Ohio.

THE UNIT.

The amount of class-room work which is recognized by the University as constituting a unit of entrance work is indicated by the following definition, which coincides with that adopted by the North Central Association: A unit is a course of study covering a school year, which shall include in the aggregate not less than one hundred and twenty sixty-minute hours of class-room work, two hours of manual training or laboratory work being equivalent to one hour of class-room work. The character of the work which should occupy this time unit is indicated in the following pages under the various subject headings.

ENGLISH (Four units)

Preparation in English has two main objects: (1) command of correct and clear English, spoken and written; (2) ability to read with accuracy, intelligence, and appreciation.

The first object requires instruction in grammar and composition. English grammar should ordinarily be reviewed in the secondary school; and correct spelling and grammatical accuracy should be rigorously exacted in connection with all written work during the four years. The principles of English composition governing punctuation, the use of words, paragraphs, and the different kinds of whole composition, including letter-writing, should be thoroughly mastered; and practice in composition, oral as well as written, should extend throughout the secondary school period. Written exercises may well comprise narration, description, and easy exposition and argument based upon simple outlines. It is advisable that subjects for this work be taken from the student's personal experience, general knowledge, and studies other than English, as well as from his reading in literature. Finally, special instruction in language and composition should be accompanied by concerted effort of teachers in all branches to cultivate in the student the habit of using good English in his recitations and various exercises, whether oral or written.

The second object is sought by means of two lists of books, headed respectively READING and STUDY, from which may be framed a progressive course in literature covering four years. In connection with both lists, the student should be trained in reading aloud and be encouraged to commit to memory some of the more

notable passages both in verse and in prose. As an aid to literary appreciation, he is further advised to acquaint himself with the most important facts in the lives of the authors whose works he reads and with their place in literary history.

a. READING—The aim of this course is to foster in the student the habit of intelligent reading and to develop a taste for good literature, by giving him a first-hand knowledge of some of its best specimens. He should read the books carefully, but his attention should not be so fixed upon details that he fails to appreciate the main purpose and charm of what he reads.

I. BOOKS PRESCRIBED FOR READING

For 1912 nine books, selected as prescribed below from the following list:

Group I (two to be selected).

Shakespeare's As You Like It, Henry V, Julius Cæsar, The Merchant of Venice, Twelfth Night.

Group II (one to be selected).

Bacon's Essays; Bunyan's The Pilgrim's Progress, Part I; The Sir Roger de Coverley Papers in The Spectator; Franklin's Autobiography.

Group III (one to be selected).

Chaucer's Prologue; Spenser's Færie Queene Book I; Pope's The Rape of the Lock; Goldsmith's The Deserted Village; Palgrave's Golden Treasury (First Series), Books II and III, with especial attention to Dryden, Collins, Gray, Cowper, and Burns.

Group IV (two to be selected).

Goldsmith's The Vicar of Wakefield; Scott's Ivanhoe, Quentin Durward; Hawthorne's The House of the Seven Gables; Thackeray's Henry Esmond; Mrs. Gaskell's Cranford; Dickens' A Tale of Two Cities; George Eliot's Silas Marner; Blackmore's Lorna Doone.

Group V (one to be selected).

Irving's Sketch Book; Lamb's Essays of Elia; De Quincey's Joan of Arc and The English Mail Coach; Carlyle's The Hero as Poet, The Hero as Man of Letters, The Hero as King; Emerson's Essays (Selected); Ruskin's Sesame and Lilies.

Group VI (two to be selected).

Coleridge's The Ancient Mariner; Scott's Lady of the Lake; Byron's Mazeppa and The Prisoner of Chillon; Palgrave's Golden Treasury (First Series), Book IV, with special attention to Wordsworth, Keats, and Shelley; Macaulay's Lays of Ancient Rome; Poe's Poems; Lowell's The Vision of Sir Launfal; Arnold's

Sohrab and Rustum; Longfellow's The Courtship of Miles Standish; Tennyson's Princess; Browning's Cavalier Tunes, The Lost Leader, How They Brought the Good News from Ghent to Aix, Evelyn Hope, Home Thoughts from Abroad, Home Thoughts from the Sea, Incident of the French Camp, The Boy and the Angel, One Word More, Hervé Riel, Pheidippides.

For 1913, 1914 and 1915:

With a view to large freedom of choice, the books provided for reading are arranged in the following groups, from which at least ten units* are to be selected, two from each group:

I. The Old Testament, comprising at least the chief narrative episodes in Genesis, Exodus, Joshua, Judges, Samuel, Kings, and Daniel, together with the books of Ruth and Esther; the Odyssey, with the omission, if desired, of Books I, II, III, IV, V, XV, XVI, XVII; the Iliad, with the omission, if desired, of Books XI, XIII, XIV, XV, XVII, XXI; Vergil's Aeneid. The Odyssey, Iliad, and Aeneid should be read in English translations of recognized literary excellence.

For any unit of this group a unit from any other group may be substituted.

II. Shakespeare's Merchant of Venice, Midsummer Night's Dream; As You Like It, Twelfth Night, Henry the Fifth, Julius Cæsar.

III. Defoe's Robinson Crusoe, Part I; Goldsmith's Vicar of Wakefield; either Scott's Ivanhoe or Scott's Quentin Durward; Hawthorne's House of the Seven Gables; either Dickens' David Copperfield, or Dickens' Tale of Two Cities; Thackeray's Henry Esmond; Mrs. Gaskell's Cranford; George Eliot's Silas Marner; Stevenson's Treasure Island.

IV. Bunyan's Pilgrim's Progress, Part I; The Sir Roger de Coverley Papers in The Spectator; Franklin's Autobiography (condensed); Irving's Sketch Book; Macaulay's Essays on Lord Clive and Warren Hastings; Thackeray's English Humorists; Selections from Lincoln, including at least the two Inaugurals, the Speeches in Independence Hall and at Gettysburg, the Last Public Address, and Letter to Horace Greeley, along with a brief memoir or estimate; Parkman's Oregon Trail; either Thoreau's Walden or Huxley's Autobiography and selections from Lay Sermons, including the addresses on Improving Natural Knowledge, A Liberal Education, and A Piece of Chalk; Stevenson's Inland Voyage and Travels With a Donkey.

V. Palgrave's Golden Treasury (First Series), Books II and

*Each unit is set off by semicolons.

III, with especial attention to Dryden, Collins, Gray, Cowper, and Burns; Gray's Elegy in a Country Churchyard and Goldsmith's Deserted Village; Coleridge's Ancient Mariner and Lowell's Vision of Sir Launfal; Scott's Lady of the Lake; Byron's Childe Harold, Canto IV, and Prisoner of Chillon; Palgrave's Golden Treasury (First Series), Book IV, with special attention to Wordsworth, Keats, and Shelley; Poe's Raven, Longfellow's Courtship of Miles Standish, and Whittier's Snow-Bound; Macaulay's Lays of Ancient Rome and Arnold's Sohrab and Rustum; Tennyson's Princess; Browning's Cavalier Tunes, The Lost Leader, How They Brought the Good News from Ghent to Aix, Home Thoughts from Abroad, Home Thoughts from the Sea, Incident of the French Camp, Hervé Riel, Pheidippides, My Last Duchess, Up at a Villa—Down in the City.

b. STUDY — This part of the requirement is intended as a natural and logical continuation of the student's earlier reading, with greater stress laid upon form and style, the exact meaning of words and phrases, and the understanding of allusions. For this close reading are provided a play, a group of poems, an oration, and an essay, as follows:

II. BOOKS PRESCRIBED FOR STUDY.

For 1912: Shakespeare's Macbeth; Milton's Comus, L'Allegro, and Il Penseroso or Tennyson's Gareth and Lynette, Launcelot and Elaine, and The Passing of Arthur; Burke's Speech on Conciliation with America, or Washington's Farewell Address and Webster's First Bunker Hill Oration; Macaulay's Life of Johnson, or Carlyle's Essay on Burns.

For 1913, 1914 and 1915:

Shakespeare's Macbeth; Milton's L'Allegro, Il Penseroso, and Comus or Tennyson's Gareth and Lynette, Launcelot and Elaine, and The Passing of Arthur; either Burke's Speech on Conciliation with America, or both Washington's Farewell Address, and Webster's First Bunker Hill Oration; either Macaulay's Life of Johnson, or Carlyle's Essay on Burns.

[Text-books: Scott and Denney's Elementary Composition and Composition-Literature, or equivalents.]

HISTORY (four units)

1. ANCIENT HISTORY, with special reference to Greek and Roman history and including also a short introductory study of the more ancient nations and the chief events of the early middle ages,

down to the death of Charlemagne (814). [Botsford's Ancient History for Beginners, or West's Ancient World, or Wolfson's Essentials in Ancient History, or an equivalent.]

2. MEDIAEVAL AND MODERN EUROPEAN HISTORY, from the death of Charlemagne to the present time. [Adams' European History or Harding's Essentials in Mediæval and Modern History, Myers' Mediæval and Modern History, or an equivalent.]

3. ENGLISH HISTORY. [Higginson and Channing's English History for Americans, or Walker's Essentials in English History, or Cheyney's Short History of England, or an equivalent.]

4. AMERICAN HISTORY, or AMERICAN HISTORY AND CIVIL GOVERNMENT. [McLaughlin's History of the American Nation, or Montgomery's Student American History, or an equivalent; Ashley's American Government, or an equivalent.]

The periods that are here indicated as constituting the four units were recommended by the Committee of Seven of the American Historical Association in their report to the Association in 1899. The full report is published under the title "The Study of History in Schools." It contains suggestions as to various methods of treating these periods, and gives further information likely to be of service to the teacher. A short course of one year in general history of the world has been in a great measure abandoned by the schools, because it does not give the opportunity for the more concrete study and for the training in historical thinking that can be obtained from the more intensive work. The plan of continuing ancient history to the time of Charlemagne or the establishment of the Holy Roman Empire has much to commend it, and is now adopted in many schools. Excellent books have been prepared which will enable the teachers to cover the field, as a whole, satisfactorily. By continuing the study of ancient history down into the early middle ages, a reasonable adjustment of time between the earlier and later periods is secured; and from the purely historical as well as the pedagogical point of view, there is much to be said in favor of connecting Roman history with the latter times; the pupil is not left in the confusion of the fallen or the decadent empire. In connection with a year's work in American history much instruction can be given in civil government; a course dwelling on the development of American political ideals and the actual workings of institutions necesarily gives information concretely of the present governmental forms and methods.

No definite statement need be made concerning the mode of teaching or the apparatus that should be used. But it may be said that the mere learning of a text will not give the preparation that

the colleges desire. Happily the time is gone when teachers are inclined to confine their classes to the memorizing of a single text. Some colleges in their entrance examination expect the candidate to present notebooks showing the amount and character of the work done in the schools. It is desirable that notebooks or cards should be kept as a record of the work done. They may contain copious extracts from primary and secondary authorities, references to important material, sketch maps made by the pupils as illustrations of their studies, and informal notes on reading that has been done in connection with the course. Such work is necessary if the historical courses are to give their best educational results. Effort should be made to cultivate the power of handling facts and of drawing proper inductions from data, to develop the faculty of discrimination, to teach the pupils the use of books and how to extract substance from the printed page. The acquisition of information alone cannot be the chief aim of any school work; knowledge of how to acquire information and, above all, some skill in putting forth what one knows must always be of more than secondary importance; history, therefore, should be taught as a disciplinary and educational subject.

The teacher of history in the secondary school should have completed a four year college course or the equivalent. He should have completed courses in history aggregating *at least* twelve hours for one year, including one "intensive" or "research" course. In the selection of these courses, at least three fields of history represented in the secondary school units should be chosen. It is also strongly recommended that the teacher should have pursued elementary courses in economics and political science.

The school library or an accessible public library should be equipped with at least the following numbers of well-selected books on the different units: Ancient History, 25 volumes; Mediæval and Modern History, each 25 volumes; English History, 50 volumes, and United States History, 75 volumes.

In addition to a good text-book, the pupil should have read in connection with each unit of History, as a minimum, the following amounts of carefully selected collateral material, of which at least one-fourth should be source material: Ancient History, 200 pp.; Mediæval and Modern European History, each 150 pp.;; English History, 300 pp.; American History, 350 pp. (It is understood that Civics is additional.) Especial care should be exercised by the teacher in testing the reports on outside reading, to see that the best results are obtained. The pupil should show ability also in map analysis and the completion of outline maps.

The history class-room should contain standard maps and the pupils should have access to good historical atlases. Photographs of historic scenes ought also to constitute a part of the school equipment for the use of the teacher of history.

MATHEMATICS (three and one-half units)

a. Three chief aims should be set for instruction in mathematics in the secondary school.

1. To inspire and facilitate the acquisition of knowledge in an important field of human thought, mathematics is necessary to the comprehension and mastery of nature.

2. To develop the ability to apply this knowledge to practical and theoretical investigations.

3. To develop and strengthen the ability to perceive exact relations and to make inferences correctly; the teacher's constant aim should be to train the pupil to *think* and to formulate clearly the results of his thinking.

b. We may reasonably expect of students completing a high school course and presenting themselves for admission to college:

1. A fair degree of accuracy and rapidity in calculations, and a fair knowledge of the applications of numbers to the solution of the common problems of life.

2. A fair degree of skill in making algebraic transformations.

3. The ability to use the equation as an instrument in the solution of problems.

4. The ability to interpret algebraic results.

5. A fair comprehension of what constitutes a proof in mathematics.

6. A good knowledge of the facts of elementary algebra, and plane and solid geometry.

c. We recognize the fact that the students of the last high school year, because of their greater maturity, have much more ability to grasp the abstract thinking of mathematics than do students of the first year. The material offered in the courses and the methods of instruction should be determined with this in view. At first the simpler and more concrete ideas of the subject should be dealt with. In later stages, more complicated mechanical work and formal theory should be introduced gradually.

d. The units, by title, shall be:

1. Algebra, first course, 1 unit.
2. Plane Geometry, 1 unit.

3a. Algebra, ½ unit.

3b. Solid Geometry, ½ unit.

4. Plane Trigonometry, ½ unit.

It is becoming more and more evident that a change in the arrangement of the subject matter involved in the units named above is desirable. Many schools are offering courses in mathematics which cover in effect the equivalent of the courses named, but with the subjects somewhat intermingled. This Committee will have more to say on this subject in a later report.

Under any arrangement, arithmetic, algebra, geometry and trigonometry should be regarded and treated as different phases of one and the same great subject, mathematics. The geometrical, the arithmetical, algebraic and physical phases of mathematics should be presented, as far as possible, from the beginning to the end of the secondary course. Much can be done in this direction by employing geometrical methods in algebra and by using algebraic processes in geometry. Numerous examples taken from physics and problems illustrated graphically and taken from any source whatever may be advantageously employed.

e. The algebra required for entrance to college should include the following topics (no significance to be attached to the order given here):

1. The fundamental laws of algebra.
2. The general view of algebraic number.
3. The four fundamental operations as applied to integral fractional and irrational expressions.
4. Factoring.
5. Binomial theorem for positive integral exponents.
6. Solution of equations in one variable—including simple quadratic, fractional, and irrational equations.
7. Solution of systems of equations in two variables; including linear system, linear-quadratic system and a few of the quadratic systems that occur more frequently in practice.
8. Ratio and proportion.
9. The statement and solution of problems.

It is recommended that this unit and a half be divided into two portions, an elementary course: Algebra 1, to be given in the first year of high school, and a more advanced course to be given after the course in plane geometry in the third or fourth year.

The following suggestions are made as to the character of these courses:

Algebra I should deal with the simpler portions of the topics

named, with the exception of the greater portion of 7, which should be treated in Algebra 3a.

Omit complicated forms of parentheses, fractions, irrationals, types of factoring and equations. The aim should be a training in algebra as a method of thinking rather than as an exercise in the manipulation of complicated expressions. Ideas and methods should grow out of the pupil's knowledge of arithmetic and the relations of common experience. The traditional order of topics is not to be commended. Emphasis should be placed on the equation as a means of solving problems, other topics contributing assistance as the need arises. The equation should be used at the very beginning, as it is of paramount importance throughout the course.

The second course, 3a, should be a more systematical and scholarly consideration of the ground already covered and an extension of ideas to more complicated expressions. The pupil is now more mature and is better able to do abstract thinking. This is the time to acquaint him with the nature of algebraic reasoning and to arouse within him some appreciation of algebra as a science. By the time he has finished this course, he should have acquired that facility in the use of algebraic expressions which is so essential to further study of mathematics. A mastery of the fundamentals of theory and practice must be insisted upon.

In plane geometry it is suggested that a clearer conception of geometrical reasoning and a firmer grasp upon geometrical facts can be acquired by a thorough consideration of a small number of theorems than by a hurried glance at a larger number. It is therefore recommended that the more important theorems be emphasized and that the less important be omitted or passed over without proof. It is suggested that teachers be free to assume the truth of some of the most evident theorems at first. Proof may be given later if desired. The original demonstration of theorems is of the utmost importance. The use of exercises involving algebraic and numerical applications is to be encouraged. The habit of giving accurate definitions, the perception of what constitutes a demonstration of truth, confidence in one's own power of correct reasoning and the ability to discover geometrical relations are of more importance than the ability to recall the demonstration of a large number of theorems. It would be well to omit the theory of limits and incommensurables from this course.

Solid Geometry, 3b, should comprise the usual topics given in texts. Here, too, there should be a centering of attention upon the

more important theorems. More emphasis should be placed on mensuration.

It may be desirable in some schools to re-arrange the material of courses 2 and 3b so that course 2 should include the elements of both plane and solid geometry, leaving to course 3b the more difficult phases of the subject.

Plane Trigonometry, 4, should include the definitions and relations of the six trigonometrical functions as ratios, the theory of logarithms and use of tables, the proof of important formulae and considerable practice in trigonometric transformations; the solution of right and oblique triangles.

LATIN (four units)

In Latin the commission adopts the first two units as defined by the American Philological Association, and the third and fourth units as defined by the College Entrance Examination Board.

1. LATIN LESSONS, accompanied from an early stage by the reading of very simple selections. Easy reading; twenty to thirty pages of consecutive text.

In all written exercises the long vowels should be marked, and in all oral exercises pains should be taken to make the pronunciation conform to the quantities.

The student should be trained from the beginning to grasp the meaning of the Latin before translating, and then to render into idiomatic English; and should be taught to read Latin aloud with intelligent expression.

2. SELECTIONS FROM CAESAR'S GALLIC WAR equivalent in amount to four books; selections from other prose writers, such as Nepos, may be taken as a substitute for an amount up to, but not exceeding, two books.

The equivalent of at least one period a week in prose composition based on Cæsar.

Reading aloud and translating, together with training in correct methods of apprehending the author's meaning, both prepared and unprepared passages being used as material. The memorizing of selected passages.

3, 4. CICERO. Any six orations from the following list, but preferably the first six mentioned:

The four orations against Catiline, Archias, the Manilian Law, Marcellus, Roscius, Milo, Sestius, Ligarius, the fourteenth Philippic.

VERGIL. The first six books of the Aeneid.

The equivalent of at least one period a week in prose composition based on Cicero.

NOTE — In place of a part of Cicero an equivalent of Sallust's Catiline, and in place of a part of Vergil an equivalent of Ovid will be accepted.

GREEK (three units)

In Greek the definitions of the three units of the Philological Association are adopted.

1. INTRODUCTORY LESSONS: Xenophon's Anabasis (20 to 30 pages). Practice in reading at sight and in writing Greek. Systematic study of grammar begun.

2. XENOPHON'S ANABASIS (continued), either alone or with other Attic prose (75 to 120 pages). Practice in reading at sight, systematic study of grammar, thorough grammatical review, and practice in writing Greek, both based on study of Books I and II of the Anabasis.

3. HOMER (2,500 to 4,000 lines): e. g., Iliad I-III (omitting II, 494-end), and VI-VIII. Attic prose (33 to 40 pages), with practice in writing Greek, grammar, practice reading at sight.

GERMAN (four units)

1. During the first year the work should comprise: (a) Careful and persistent drill upon connected pronunciation; (b) The memorizing and frequent repetition of easy colloquial sentences; (c) Drill upon the rudiments of grammar, viz., upon word order, the inflection of the articles, of such nouns as belong to the language of everyday life, of adjectives, pronouns, weak verbs, and the more *usual* strong verbs; also upon the use of the more common prepositions, the simpler uses of the modal auxiliaries, and the elementary rules of syntax; (d) Abundant easy exercises designed not only to fix in mind the forms and principles of grammar, but also to cultivate readiness in the reproduction of natural forms of expression; (e) The reading of from 50 to 100 pages of graduated texts from a reader or other text, with constant practice in translating into German easy variations upon sentences selected from the reading lesson (the teacher giving the English). Besides parts of readers available for first year's class-work, good selections may be made from Müller und Wenckebach's Glück Auf; Kern's (Grimm's) German Stories Retold; Guerber's Märchen and Erzählungen; Seligmann's Altes and Neues.

It will be found, however, that the work as outlined above,

can be done successfully only when the students of the class are either fairly mature (say, in the eleventh or twelfth grade), or have had some previous language training. It is only to such that the full reading requirements can profitably be made to apply as a part of the first year's work. The chief consideration in thoroughness and accuracy, is to put the student upon firm and sure ground, and never to give up what has already been gained.

2. During the second year the work should comprise: (a) The reading of from 150 to 200 pages of suitable texts in the form of easy stories and plays; (b) Accompanying practice, as before, in the translation into German and easy variations upon the matter read; (c) Continued drill upon the essentials of the grammar, directed to the ends of enabling the pupil, first to use his knowledge with facility in the formation of sentences and secondly, to state his knowledge correctly in the technical language of grammar.

Reading material suitable for the elementary course, other than that already mentioned, can be selected from the following list: Andersen's Märchen and Bilderbuch ohne Bilder; Weidermann's Biblische Gerschichten; Arnold's Fritz auf Ferien; Baumbach's Die Nonna and Der Schwiegersohn; Gerstaecker's Germelshausen; Heyse's L'Arrabbiata, Das Mädchen von Treppi, Die Blinden; Storm's Immensee and Geschichten aus der Tonne, in St. Jürgen; Auerbach's Brigitta; Keller's Legenden; Fulda's Under vier Augen; Wildenbruch's Der Letzte, or, Das edle Blut; Frommel's Eingeschneit; Seidel's Aus Goldnen Tagen; Zschokke's Der zerbrochene Krug; Blüthgen's Das Peterle von Nürnberg; Bacon's Im Vaterland; Mosher's Wilkommen in Deutschland; Lambert's Autägliches.

The net results of the first two years of a high school German course should be: (a) A correct and ready pronunciation; (b) A ready, exact, and fairly complete working knowledge of grammar, especially on the formal (inflectional) side; (c) At least some ability to speak and understand the foreign spoken language; (d) A better understanding of the grammatical structure of the English language; (e) The reading of some 200-250 pages of suitable texts and the mastery of the fundamental facts of the language involved and illustrated in them; (f) The acquisition of a fair working vocabulary, involving the full mastery of some 80 per cent of the words occurring in the texts read and worked over; (g) Ready familiarity with ordinary or common idiomatic phrases or other expressions, such as, es tut mir leid, Sie haben recht, nehmen Sie sich in acht, wo hat er das her? etc. (h) The ability to understand and translate (with the help of a vocabulary

for uncommon terms) from German into English texts of similar degree of difficulty as the one worked over in class.

In words of one of the high school manuals, "The ideals of enabling the student eventually to read German literature in German without translating should be ever before the teacher. . . . . Modern German literature is so rich in novelistic, dramatic, historical, and lyrical productions of a high order that, even for the more elementary classes, good literary selections may be found well suited to the age and preparation of high school students. If this principle be strictly observed, the German instruction will gain enormously in dignity and interest, and will greatly extend the range of knowledge and the culture of the student."

3. The work of the third year should comprise: (a) A thorough and systematic review of the fundamental facts of grammar in connection with suitable practice in composition. A text-book, such as Harris', Wesselhoeft's or Pope's German Composition, should be used for this purpose. Neither the teacher nor the pupil should trust himself to the process of merely "incidental" grammar and composition exercises. At least two recitation periods per week should be devoted to this purpose. (b) The reading of some 300-400 pages of moderately difficult prose. A selection may be made from the following texts: Ebner-Eschenbach's Die Freiherren von Gemperlein; Freytag's Die Journalisten or Bilder aus der deutschen Vergangenheit—for example, Karl der Grosse, Aus den Kreuzzügen, Dokter Luther, Aus den Jahrhundert des grossen Kriegs, Aus dem Staat Friedrich's des Grossen; Gertstaecker's Irrfahrten; Meyer's Der Schusz von der Kanzel; Goethe's Hermann and Dorothea; Hoffman's Historische Erzählungen; Lessing's Minna von Barnhelm; Meyer's Gustav Adolf's Page; Moser's Der Bibliothekar; Riehl's Novellen—for example, Burg Neideck, Der Fluch der Schönheit, Der stumme Ratsherr, Das Spielmannskind; Rosegger's Waldheimat; Schiller's Wilhelm Tell, Die Jungfrau von Orleans, Das Lied von der Glocke; Sudermann's Frau Sorge; selections from the poems of Uhland, Heine, Schiller, Goethe, etc.

4. The work of the fourth year should comprise the reading of about five hundred pages of good literature in prose and poetry, reference readings upon the lives and work of the great writers studied, the writing in German of numerous short themes upon assigned subjects, independent translation of English into German. Favored texts seem to be: Goethe's Sessenheim, Dichtung und Wahrheit, Egmont, Iphigenie; Schiller's Maria Stuart; Lessing's

Minna von Barnhelm; Kleist's Michael Kohlhaas, Prinz von Homburg; Fulda's Der Talisman, Das Verlorene Paradies; Grillparzer's Der Traum ein Leben, Sappho; Ludwig's Zwischen Himmel und Erde; Hebbel's Agnes Bernauer; Scheffel's Ekkehard; Hauff's Lichtenstein.

The nature and scope of the fourth year's work may well be left to the direction of the authorities issuing the several high school manuals, and to those in immediate charge of these advanced courses. It is possible that even here many teachers will feel the necessity of insisting upon the more formal aspects of the problem, others may feel that the advancement and maturity of the class will warrant a sympathetic and systematic study of literature proper.

FRENCH (four units)

The definitions of the four units in French are those recommended by the Committee of Twelve of the Modern Language Association of America.

1. During the first year the work should comprise: (a) Careful drill in pronounciation; (b) the rudiments of grammar, including the inflection of the regular and the more common irregular verbs, the plural of nouns, the inflection of adjectives, participles, and pronouns; the use of personal pronouns, common adverbs, prepositions, and conjunctions; the order of words in the sentence, and the elementary rules of syntax; (c) abundant easy exercises, designed not only to fix in the memory the forms and principles of grammar, but also to cultivate readiness in the reproduction of natural forms of expression; (d) the reading of from 100 to 175 duodecimo pages of graduated texts, with constant practice in translating into French easy variations of the sentences read (the teacher giving the English), and in reproducing from memory sentences previously read; (e) writing French from dictation.

2. During the second year the work should comprise: (a) the reading of from 250 to 400 pages of easy modern prose in the form of stories, plays, or historical or biographical sketches; (b) constant practice, as in the previous year, in translating into French easy variations upon the texts read; (c) frequent abstracts, sometimes oral and sometimes written, of portions of the text already read; (d) writing French from dictation; (e) continued drill upon the rudiments of grammar, with constant application in the construction of sentences; (f) mastery of the forms and use of pronouns, pronominal adjectives, of all but the rare irregular verb forms, and of the simpler uses of the conditional and subjunctive.

Suitable texts for the second year are: About's Le Roi des montagnes, Bruno's Le Tour de la France, Daudet's easier short tales, La Bedolliére's La Mére Michel et son chat, Erckmann-Chatrian's stories, Foa's Contes biographiques and Le Petit Robinson de Paris, Foncin's Le Pays de France, Labiche and Martin's La Poudre aux yeux and Le Voyage de M. Perrichon, Legouvé and Labiche's La Cigale chez les fourmis, Malot's Sans famille, Mairet's La Tâche du petit Pierre, Merimée's Colomba, extracts from Michelet, Sarcery's Le Siége de Paris, Verne's stories.

3. The work of the third year should comprise the reading of from 400 to 600 pages of French of ordinary difficulty, a portion to be in the dramatic form; constant practice in giving French paraphrases, abstracts or reproductions from memory of selected portions of the matter read; the study of a grammar of moderate completeness; writing from dictation.

Suitable texts are: About's stories, Augier and Sandeau's Le Gendre M. Poirier, Béranger's poems, Corneille's Le Cid and Horace, Coppée's poems, Daudet's La Belle-Nivernaise, La Bréte's Mon oncle et mon curé, Madame de Sévigné's letters, Hugo's Hernani and La Chute, Labiche's plays, Loti's Pêcheur d'Islande, Mignet's historical writings, Moliére's L'Avare and Le Bourgeois Gentilhomme, Racine's Athalie, Andromaque, and Esther, George Sand's plays and stories, Sandeau's Mademoiselle de la Seigliére, Scribe's plays' Thierry's Récits des temps mérovingiens, Thiers' L'Expédition de Bonaparte en Egypte, Vigny's La Canne de jonc, Voltaire's historical writings.

4. The work of the fourth year should comprise the reading or from 600 to 1,000 pages of standard French, classical and modern, only difficult passages being explained in the class; the writing of numerous short themes in French; the study of syntax.

Suitable reading matter will be: Beaumarchais's Barbier de Séville; Corneille's dramas; the elder Dumas's prose writings; the younger Dumas's La Question d'argent; Hugo's Ruy Blas, lyrics and prose writings; La Fontaine's fables; Lamartine's Graziella; Marivaux's plays; Moliére's plays; Musset's plays and poems; Pellissier's Mouvement littéraire au XIXe siécle; Renan's Souvenirs d'enfance et de jeunesse; Rousseau's writings; Sainte-Beuve's essays; Taine's Origines de la France contemporaine; Voltaire's writings; selections from Zola, Maupassant, and Balzac.

SPANISH (four units)

In Spanish the commission adopts the definitions of the two units of the College Entrance Examination Board, which are in

close harmony with the definitions of French of the Modern Language Association.

1. During the first year the work should comprise: (a) Careful drill in pronunciation; (b) the rudiments of grammar, including the conjugation of the regular and the more common irregular verbs, the inflection of nouns, adjectives and pronouns, and the elementary rules of syntax; (c) exercises containing illustrations of the principles of grammar; (d) the reading and accurate rendering into good English of from 100 to 175 duodecimo pages of graduated texts, with translation into Spanish of easy variations of the sentences read; (e) writing Spanish from dictation.

2. During the second year the work should comprise: (a) the reading of from 250 to 400 pages of modern prose from different authors; (b) practice in translating Spanish into English, and English variations of the text into Spanish; (c) continued study of the elements of grammar and syntax; (d) mastery of all but the rare irregular verb forms and of the simpler uses of the modes and tenses; (e) writing Spanish from dictation; (f) memorizing of easy short poems.

Suitable texts for the second year are: Valera's El Pajaro verde; Alarcon's El Final de Norma; Valde's José; Galdos's Marianela; Parde Isla's version of Gil Blas; Carrion and Aza's Zaragueta.

3. In addition to the above, applicants must have had a third year of instruction, and should be able to read at sight ordinary Spanish prose or simple poetry, to translate into Spanish a connected passage of English based on the text read, and to answer questions involving an adequate knowledge of syntax.

4. In addition, applicants must have had a fourth year of instruction, and should be able to read at sight, with the help of a vocabulary of special or technical expressions, difficult Spanish, whether prose or poetry; to write in Spanish a short essay on some simple subject connected with the works read; to put into Spanish a passage of easy English prose, and to carry on a simple conversation in Spanish.

PHYSICS (one unit)

1. The unit in physics consists of at least one hundred and eighty periods of forty-five minutes each (equal to 135 hours) of assigned work. Two periods of laboratory work count as one of assigned work.

2. The work consists of three closely related parts, namely,

class work, lecture-demonstration work, and laboratory work. At least one-fourth of the time shall be devoted to laboratory work.

3. It is very essential that double periods be arranged for the laboratory work.

4. The class work includes the study of at least one standard text.

5. In the laboratory each student shall perform at least thirty individual experiments, and keep a careful note-book record of them. Twenty of these experiments must be quantitative; each of these must illustrate an important physical principle which is one of the starred topics in the syllabus of required topics, and no two must illustrate the same principle.

6. In the class work the student must be drilled to an understanding of the use of the general principles which make up the required syllabus. He must be able to apply these principles intelligently to the solution of simple, practical, concrete problems.

7. Examinations will be framed to test the students understanding of and ability to use the general principles in the required syllabus, as indicated in 6.

8. The teacher is not expected to follow the order of topics in the syllabus unless he wishes to do so.

SYLLABUS OF REQUIRED TOPICS.

The list of required topics is not intended to include all the material for the year's work. It is purposely made short, in order that each teacher may be free to supplement it in a way that fits his individual environment. It does include those topics which all agree are essential to a first course in physics, and which are capable of comprehension, at least to the extent specified in number 6 of the definition of the unit, by boys and girls of high school age.

(*1) Weight, center of gravity; (*2) Density; (*3) Parallelogram of forces; (4) Atmospheric pressure; barometer; (*5) Boyle's law; (6) Pressure due to gravity in liquids with a free surface; varying depth, density, and shape of vessel; (*7) Buoyancy; Archimedes' principle; (*8) Pascal's law; hydraulic press; (9) Work as force times distance, and its measurement in foot-pounds and gram-centimeters; (10) Energy measured by work; (*11) Law of machines; work obtained not greater than work put in; efficiency; (*12) Inclined plane; (*13) Pulleys, wheel and axle; (*14) Measurement of moments by the product of force times arm; levers; (15) Thermometers: Fahrenheit and Centigrade scales; (16) Heat quantity and its measurement in gram calories;

(*17) Specific heat; (*18) Evaporation; heat of vaporization of water; (*19) Dew point; clouds and rain; (*20) Fusion and solid; ification; heat of fusion; (21) Heat transference by conduction and convection; (22) Heat transference by radiation; (23) Qualitative description of the transfer of energy by waves; (24) Wave length and period of waves; (25) Sound originates as a vibrating body and is transmitted by waves in air; (*26) Pitch and period of sound; (*27) Relation between the wave length of a tone and the length of a string or organ pipe; (*28) Resonance; (29) Beats; (30) Rectilinear propagation of light; pin-hole camera; (*31) Reflection and its laws; image in a plane mirror; (*32) Refraction, and its use in lenses; the eye, the camera; (*33) Prisms and dispersion; (34) Velocity of light; (35) Magnetic attractions and repulsions; (*36) Field of force about a magnet; (37) The earth a magnet; compass; (38) Electricity by friction; (39) Conductors and insulators; (*40) Simple galvanic cell; (*41) Electrolysis; definition of the ampere; (*42) Heating effects; resistance; definition of the ohm; (*43) Ohm's law; definition of the volt; (*44) Magnetic field about a current electromagnet; (*45) Electromagnetic induction; (*46) Simple alternating current dynamo of one loop; (*47) Electromagnetic induction by breaking a circuit; primary and secondary; (48) Conservation of energy.

[A text-book should be used as a basis for the class-room work. Millikan and Gale, Carhart and Chute ("Elements"), Mann and Twiss, Hall and Bergen, Adams, are suitable texts. Many problems should be assigned for solution. Ordinarily, a separate laboratory manual (Millikan and Gale or Cheston, Dean, and Timmerman, or equivalent) should be used.]

CHEMISTRY (one unit)

Text-books: McPherson and Henderson's Elementary Study of Chemistry, together with the Exercises in Chemistry arranged to accompany the same, or the equivalent. The course should consist of at least three recitations and four hours of laboratory work weekly throughout the year.

It is of the greatest importance that the student should thoroughly grasp the general elementary principles of the science rather than spend time in simply acquiring detailed information in regard to substances. Great care should be taken to see that the student has a clear conception of a theory and of the part theories play in the progress of science, and that in a discussion of any subject he clearly differentiates between fact and theory. The solution of

problems pertaining to the subjects under discussion should be encouraged.

In the laboratory it is of fundamental importance that the student should acquire accuracy and neatness and that he should always work with a well defined object in view. Under no conditions should a student be permitted to proceed with an experiment until he clearly understands the object of the experiment. Moreover, any apparatus which is constructed for the carrying out of an experiment should be rigidly examined by the teacher and only after his approval should the student be allowed to proceed.

PHYSICAL GEOGRAPHY* (one unit)

The following outline includes only the most essential facts and principles of physical geography, which must be studied in the class room, laboratory, and field:

THE EARTH AS A GLOBE.

Shape of Earth: How proved; probable causes of.

Size: How measured.

Rotation: How proved; day and night; longitude and time; latitude.

Revolution: How proved; rate; path; direction.

Seasons and their causes.

Magnetism: Compass; variation in.

Map projection explained.

THE LAND.

Distribution: Graphic representation of topography.

Changes in land areas and in land forms: Effects of (1) elevation and depression, of (2) deposition of sediments, of (3) shore erosion.

Plains: Plains distinguished from the plateaus and mountains. Kinds of plains: Classification based on genesis, on topography, on fertility, etc. Development of plains of different forms. Distribution of the great plains of the earth. The coastal plain of the Atlantic and Gulf coasts. The plains of the eastern interior. The plains of the western interior. Effect of climate and rock structure on topography of plains. Alluvial plains: Their formation and importance. Relation of life to different forms of plains.

*For the present the combination of any two of the following as one unit will be accepted by the University: Physical Geography, Zoology, Botany, and Physiology.

Plateaus: Relations to plains and to mountains. Stages in the history of a plateau; young plateaus, dissected plateaus, old plateaus, broken plateaus. Effect of climate, rock structure, etc., on topography of plateaus. Locations of the great plateaus. Life conditions on plateaus.

Mountains: Classes,—block mountains; folded mountains; domed mountains; massive mountains; mountains of circumdenudation. History of mountains. Effects of climate, rock structure, etc., on mountain topography. Life conditions on mountains.

Volcanoes: Distribution. Phenomena of eruptions. History of a volcanic mountain. Influence of volcanoes on topography and life.

Rivers: Life history of a river from birth to old age. The work of rivers. The topography of surfaces shaped by river erosion at different stages of valley development. Revived rivers. Drowned rivers and valleys. The great drainage basins of the United States.

Lakes: The distribution of lakes, particularly in North America. The changes which they are undergoing. Their relations to rivers. Their effect on climate. Their relations to life in general. Salt lakes; their history. The origins of lake basins.

Glaciers: The nature of glacier ice. The distribution of glaciers. The conditions necessary for glaciers. Types of glaciers. The work of glaciers. Glaciated areas compared and contrasted with areas which have not been affected by ice; especially the glaciated and non-glaciated areas of North America.

THE ATMOSPHERE

Composition and offices of atmosphere. Instruments used in study of atmosphere.

Temperature: Source of atmospheric heat, and variations of atmospheric temperatures. Isothermal charts of world, and of the United States, especially the January, July and annual charts, with special study of (1) isotherms of northern and southern hemispheres, (2) location of heat equator, (3) cold pole, (4) crowded isotherms, etc.

Pressure: Measurement of pressure. Determination of altitudes by atmospheric pressure. Relation to temperature. Study of isobars on United States weather maps. Distribution of pressure in general, in mid-winter, (January), and in mid-summer (July). Relation of pressure (isobars) and temperature (isotherms).

Circulation of Atmosphere: Winds; their causes; their classes; and their effects.

Moisture: Sources. Conditions for precipitation. Forms of precipitation; rain and snow; dew and frost; distribution of rain and snow; principles governing. Relation of precipitation to life.

Storms: Cyclones of temperate and tropical latitudes. Paths and characteristics of storms of United States. Relation of storms to general weather conditions. Weather at different seasons; study and construction of weather maps. Relation of weather to climate. Relation of climate, weather, etc., to life and to human industries.

THE OCEAN

Form, divisions and general characteristics of the oceans, and of ocean basins. Depth, density and temperature of ocean waters. Characteristics of ocean floor; topography, material, etc. The life of the oceans.

Movements of ocean waters: Waves; cause and effect. Currents; causes and their proofs; important currents; effects of currents on climate, life, etc. Tides, character of motion; causes of tides; variation of tides, and their causes; bores; effect of tides on navigation, harbors, etc.

Work of ocean: Erosion and deposition. Shore lines; the leading types, and their distribution. Influence of harbors and coast lines, now and in the past.

Summary. The outline given can but enumerate the larger topics to be covered, and in a way suggest the point of view desired. Each topic should be treated so as to show its causal relations to other topics. So far as possible, the effects of earth features on life (especially human life) conditions should be emphasized.

Throughout the work an effort should be made to develop the student's ability to use the data presented. The acquisition of the facts presented in the text-books is in itself of relatively little value. The student should be taught to apply, out-of-doors and in the laboratory, the principles developed in the class room. When he can do this, and when he can utilize and combine the data presented in the books in new ways and to new ends, one of the chief aims of the study will have been accomplished.

The candidate's preparation should include:

a. The study of one of the leading secondary text-books in physical geography, for the sake of essential principles, and of well-selected facts illustrating those principles.

b. Individual laboratory work should occupy from one-fourth to one-half of the time of the student in the class room. Field trips should take the place of some of the laboratory work in autumn and spring. The results of laboratory work should be carefully recorded in writing, and in many cases should be made the basis of class-room discussion. Similarly the field work should be made the basis of written reports or of subsequent class-room discussion, or both. In general the laboratory and the field should be made to afford illustrations of as many principles and phenomena as possible.

[Text-books recommended: Salisbury (Briefer Course), Dryer, Gilbert and Bingham, Tarr, Davis, Hopkins.]

ZOOLOGY* (one unit)

A high school course in Zoology should have for its objects: (1) To acquaint the student with the common animals of his own neighborhood, with the various environments of these animals, with the structural adaptations which the animals show to their environment and with their habits and economic importance. (2) To afford training in critical methods of making and recording observations both by drawing and by writing, both in the laboratory and in the field. (3) To teach enough of the interpretation of the observed facts that the student may understand the current methods of interpretation from the morphological, physiological, and ecological standpoints. In other words, with the study of the structures there should go an interpretation of their use (physiology, ecology) and of their past history (evolution). An elementary training in both experimental and comparative methods should be sought, and the peculiar value of such training as a means of intellectual development should not be overlooked. Ability on the part of the student to observe and think independently is especially desired.

For a course extending through the year, with four periods per week, it is recommended that the laboratory and field work consist of the study of at least ten type forms, to be selected from the following list:

(1) An insect. (2) The crayfish. (3) An earthworm, leech, or fresh water oligochaete. (4) An amoeba or other protozoan. (5) Hydra or a hydroid. (6) A mussel or snail. (7) A fish. (8) A frog, or turtle. (9) A bird. (10) A mammal.

The animal to be taken as the type under each head may be selected by the teacher and will vary with the locality. It will

usually be most convenient to begin with insects in the fall and to take up birds before the spring migration, and mammals later in the spring. The order in which the other forms are taken up may vary according to convenience. In the above list the crayfish and the earthworm have been placed after the insect in order to bring like forms together. Those who find difficulty in beginning with a form as small as the grasshopper may prefer to spend the first two weeks on the crayfish, but any considerable delay in taking up insects in the fall should be avoided. The other forms are arranged in the usually accepted logical order which is preferred by most teachers. If, for practical reasons, it is deemed best to depart from this order, it will be found that the idea of evolution may be taught with quite as much force material within the individual groups as by an adherence to the so-called logical order of the groups themselves.

If time permits, the teacher may profitably add to the list of types an echinoderm and a sponge, to each of which one or two classes and laboratory periods may be devoted. The student's conception of the animal kingdom is thus greatly broadened.

A suitable laboratory and field equipment is assumed. Its precise character will vary with circumstances. In general the better the equipment the better the work that may be done. While it is true that a course in zoology may be given without the use of the compound microscope, in the opinion of your committee a much better course may be given by its moderate use.

As far as possible, the work on each type should be begun by collecting by the students, chiefly of the type form, but incidentally of as many as possible of other forms belonging to the same group. Some of the animals collected should be kept living, and the subsequent study should, where practicable, be made on living material. The work on each type should include:

1. Structure. The structural work should consist chiefly of external morphology, and the structures should be considered as adaptations. It is not intended to eliminate individual dissection, but it is thought that the amount of individual dissection may be much lessened and that internal structures may be studied in part by means of anatomical preparations made by the teacher and by means of models and charts. In connection with each system of organs the special physiology of the system should be taught and should be illustrated by experiments. Physiology should not be taught merely as an inference from structure. The physiological instruction may be profitably concentrated on two types, one in-

vertebrate and one vertebrate, preferably the insect and the frog. By this plan physiological work on other types may be minimized.

2. Behavior and Habits. These should be considered in connection with the study of its structure, and where practicable the behavior should be studied first and the structures necessary to the behavior considered afterward. It is believed that more interest will be aroused by finding out first what the animal does and then studying the structures which it uses; but it will often be found necessary to reverse this order.

3. Study of Related Forms. It is not meant that the course should be limited to the study of the type forms, but rather that, in each group, the type form should be the basis upon which to build an acquaintance with the commoner related forms in the local fauna. The scientific names and the classification of these forms need not be taught, but rather sight recognition of many forms and their common names, with a reference of each to the group represented by the laboratory type. Although it is not intended that taxonomy should be taught, nevertheless individual students who show an aptitude for it should be provided with literature and should receive every encouragement from the teacher to carry on voluntary work in collecting and classifying animals.

4. Ecology. Animal ecology includes not only a study of the habits of animals referred to, but also a study of the relations of animals to their environment. This branch of zoology, which must be in part carried on in the field, attempts to determine how animals maintain themselves in their environment and why animals in a given environment give place to others when the physical and other characteristics of the environment are altered. Few teachers are prepared to include this subject in their teaching, but attention should be called to the importance of the subject as a constituent part of a high school course in zoology, and teachers should prepare themselves to do work of this sort. The amount of such work that may be done in elementary classes is indicated in the specific illustration which follows.

The plan recommended for laboratory and field work may be best made clear by a specific illustration. Thus, the work on insects may be begun with the grasshopper with a collecting trip, in which each individual student is required to bring into the laboratory as many kinds of grasshoppers as he can obtain, and together with these a certain number of insects belonging to other groups. Each student should then preserve most of the insects in his collection, and after sorting them, put them aside for future

use. In this connection instruction may be given in methods of pinning and preserving insects, and encouragement may be given the pupil to make his own collection. Many of the grasshoppers collected should be kept alive and their study now be undertaken. In this study function and structure should, as far as possible, be considered in connection with one another. Thus, the student may observe the ways of walking, hopping, and flying, and in connection with these may study on preserved material the structure of the legs and wings. At the same time he may be instructed in the class room and by the aid of models, preparations, and diagrams concerning muscles and the movements produced by them. Similarly, he may study the use of the mouth parts in feeding and may then observe the structure of the mouth parts in greater detail. From this he may proceed to a study of the structure of the digestive organs either from his own dissections or from preparations and charts. The teacher may then give them elementary instruction concerning the process of digestion. Again, observations may be made on the breathing movements, to be followed by an anatomical study of the spiracles and tracheæ and an exposition of the nature of respiration. Thus, in all cases, so far as practicable, close correlation should be made between the work on the function and that on the structure of the various parts of the body.

The work in which the student can actually see the working of the part observed will of course have to be followed by a study of the parts whose function is not so obvious, but the same principle of correlating structure and function may be followed throughout. It is advisable that the work in which the teacher supplies most of the physiological instruction should follow that in which the pupil is able to make his own observations.

The class should next make a comparative study of the different grasshoppers collected, so as to be able to distinguish the different species in the second field excursion. When a good conception has been gained of the general structure of the body and of the chief functions of its parts, and when a sight recognition of the local species of grasshoppers is assured, attention may be directed to the life of grasshoppers in the field and to the adaptations shown by the various species to their conditions of existence (ecology). To give an illustration of the nature of the ecological work that may be undertaken advantageously in the high school, we may cite the following observations which may easily be made upon the grasshoppers which occur in nearly every neighborhood. The kind of situation should be noted in which each species occurs. The students should observe the relation between these habitats

and the species found in them; the instinct of the roadside grasshopper to alight in barren spots of ground and of various species of green coloration to alight on grass stems and to keep on the side opposite the observer; the instinct of other species when alighting in the grass to drop down and remain quiet next the ground. These and many other features of behavior which show a marked adaptation to particular kinds of environment can easily be observed and interpreted. If the teacher directs the attention of the students to such phenomena and by carefully planned questions leads them to make and to record observations of their own, work cannot fail to prove of interest and value. Such work, if properly planned, can be controlled as well as tasks performed in the laboratory.

When the field work on the grasshopper has been completed, the class should take up the insects on the first field excursion and should become familiar with the principal groups of insects. At this point attention may be directed to the economic value of certain species. Here, again, opportunity will be afforded to stimulate individual work and the making of collections.

The same plan of work may be followed in considerable detail with the mollusca. In the case of other groups the field work may need to be considerably modified. Thus, birds and mammals may not be collected, but both may be studied in the field. Protozoa and hydra may be collected, but are not, of course, suitable for field study. In the case of each type the plan outlined should be followed in so far as the nature of the material permits. It is believed that in the laboratory the plan is feasible in nearly every case.

Both laboratory and field work is best carried on by means of written or printed directions prepared by the teacher. Just before each field excursion the teacher should visit the locality selected for the field work, in order to be assured that the desired material is available and that the observations outlined are feasible.

The class room instruction should co-ordinate and extend the work done in the laboratory and further interpret it. It is believed that the further work carried on in the class room may be best done by means of topics to be studied in connection with those laboratory types which best illustrate them. Thus, in connection with insects protective coloring and mimicry, as well as the general subject of metamorphosis, may be enforced and illustrated. In connection with the frog, development should be studied in the laboratory and general notions of development added to those of metamorphosis. In connection with mollusca, variation and the

ideas of species may be enforced. Instinct and intelligence may properly be considered in connection with several of the types. Toward the end of the course time should be left for a connected presentation of the doctrine of evolution and of natural selection.

The importance of proper field and laboratory notes and drawings should be emphasized. Notes, both in field and laboratory, should be made while the work is in progress, not afterward. They should be criticised by the teacher with reference to their pertinence and completeness and should be permanently preserved. Such notes may be made the basis of more careful reports, which should be criticised with a reference to the arrangement of their contents, the character of their conclusions and their English. It is suggested that teachers of English will often be found willing to cooperate in the correction of such reports. Drawing is of no less importance than note taking. Drawings should be made chiefly in the laboratory and always from the specimen. It should be the object of the teacher to see that the drawings are accurate and that their details have meaning. Meaningless or ambiguous lines or masses of shade have no more place in a scientific drawing than meaningless words in a sentence.

Attention should also be called to the importance of local school museums. These should contain primarily representatives of the local fauna attractively displayed. Students may be referred to specimens in such a museum as they are referred to books and may use the museum as they would a library. The Michigan Academy of Sciences maintains a bureau, the purpose of which is to secure for teachers and others the identification of specimens collected by them and their exchange for other specimens. Information concerning the bureau may be had from the Secretary of the Academy, Mr. George Shäfer, Agricultural College, Michigan.

The following recommendations are also made:

1. That the course be put in the second high school year, rather than in the first, and that it be preceded by a course in physiography. Such an arrangement should greatly help in the teaching of field ecology.

2. Each week's work should consist of two class exercises and at least two laboratory exercises. Each laboratory exercise should consist of at least two school periods, and these should, if possible, be the last two periods of the afternoon. By this arrangement it will be possible to use the greater part of the afternoon for field excursion.

3. Where but half a year's work is offered in zoology, the teacher should select the groups to be studied. Since the groups do not require equal periods of time, the number to be studied in a half year's course will depend on the selection. It should not be less than five.

4. Where but a half year's work is offered in zoology, and where at the same time human physiology is taught, the zoology should be followed at once by the physiology, or the two subjects should be combined into a single course. It is believed that time will be saved by this arrangement and that interest will be added to both subjects.

[Texts: Jordan, Kellogg, and Heath's Animal Studies; Kellogg's Elementary Zoology; Davenport's Introduction; or equivalents.]

BOTANY* (one unit)

It has been the intent of the committee to prepare a statement that is sufficiently elastic to give adequate recognition to all good courses in high school botany, rather than to present a set line of procedure that must be followed by all. The work that is done should meet the needs of the pupils regardless of whether any work is to be done in any higher institution. Emphasis is placed upon the quality and quantity of the work done and upon the preparation of the teacher, rather than upon the particular things that are to be done. To this end the report considers the following:

I. The purpose and content of the course and the time to be given to it.

II. Suggested plan of the course.

III. The preparation that should be had by the teacher of botany.

The committee wishes to express its appreciation of the work done by the Committee on Education of the Botanical Society of America. This committee, previously working as the committee of the Society of Plant Morphology and Physiology, of the College Entrance Examination Board, and later of the Botanical Society of America, has published four reports, the latest in the School Review for November, 1908. These reports have been most potent in giving purpose and organization to the teaching of botany in secondary schools. The unit statement here present-

*For the present the combination of any two of the following as one unit will be accepted by the University: Physical Geography, Zoology, Botany, and Physiology.

ed is in agreement in many respects with the last report of the above mentioned committee, but differs from it in flexibility, recognition of the practical aspects of plant life, in definition of the preparation of the teacher, and in some other points. It is hoped that some time there may be a single statement of the unit issued by the two committees.

I. The purpose and content of the course, and the time that should be given to it.

1. The ends to be sought through an elementary study of plant life include training in the scientific method of thinking particularly as relates to plant life, information and a more intelligent and a more active interest in natural phenomena in general, an elementary knowledge of fundamentals of plant life and a better understanding of those features and activities of plants that relate to every day affairs.

2. In determining the content, order and treatment of topics in any individual course, the needs and opportunities of the teacher and class should be dominant. To this end this statement includes the general features of the course, the teacher being left at liberty to adopt such details as best meet the needs of any particular class of pupils. The quality and quantity of work done by the pupil, evidence of his ability to do accurate and reliable work, and adequate preparation by the teacher, rather than the specific content of the course are emphasized.

3. There is presented a general plan of the "synthetic course," which the majority of the committee believes to be the best type, though it is not intended to restrict teachers to this type. This course embodies the elements of morphology of the great groups including the "lower forms" as well as the seed plants, of physiology with experiments upon plant activities, of ecology with emphasis upon class and individual field trips, including some acquaintance with local plants, of the relation of plants to their habitat and to man, of food and timber supply, parasitism, disease, decay, soil replenishment, etc. It is recommended, however, that plants be studied in an elementary way leading into any or all of the above aspects, rather than that the differentiated divisions of the subject be taken up at one time.

An elementary consideration of the relations of plants to man as shown in plant and animal diseases, hygiene, agriculture, horticulture, erosion, decay, foods, fibres, etc., should be presented as an organic part of the study of botany. The inclusion of these practical matters as an organic part of the course rather than as a number of sections upon the applied aspects of plants, gives appre-

ciable meaning and fuller significance to the study. An adequate consideration of such separate applied sciences as agriculture, forestry, bacteriology, and horticulture should follow the general study of plants and animals.

4. The time requirement of the course should be the equivalent of 180 periods of at least forty minutes each; there should be two doubled periods per week for laboratory or field work, each of these doubled periods counting as one period in making up the total 180 periods.

II. Suggested Plan of the Course. This is a plan for a synthetic course. It suggests more material than any one year's work can present. Some of the topics will receive more emphasis at the hands of teachers who prefer to treat briefly or omit other topics, the ones selected for full or brief treatment varying with different teachers. In order of treatment consideration may first be made of the structure and function of seed plants, or of the characteristics of the great group of plants.

1. In beginning the course with a study of seed plants, the first work may deal with *any* of the following topics, the one selected for the beginning serving to lead directly to others of the group:

The structures of a typical seed plant—roots, stem, leaves, flowers and seeds—and the kinds of work done by these parts.

How the plant lives—elementary physiological experiments, absorption, root pressure, conduction, transpiration, photosynthesis, relation of functions to the structures by means of which they are performed.

The work of leaves.

The storage of food, its relation to the plant; its relation to man and other animals.

Seeds and seedlings; seed distribution; the establishment of new plants.

Acquaintance with some of the plants of the locality.

2. In addition to the topics just named, due to seasonal advantage, preferences of the teacher or needs of the pupils, the following will at times be found best in this connection, while in other cases it will be found best to take up these topics after the consideration of the great groups:

Relation of plants to light, soil, water, atmosphere, gravity, contact, seasons.

Growth and reproduction.

Responses to different regions.

Artificial control and methods of improving agricultural and horticultural plants.

Forests, their uses, distribution, dangers and preservation.

3. The Great Groups. In the following outline, what plants are and what they are doing in the locality are to be kept prominent, although these matters cannot be studied apart from plant structures.

It is recommended that detailed anatomical work be reduced to the minimum, and that gross structures and life habits be given correspondingly larger attention. By means of demonstrations many of the details may be made of more value than would be true if pupils were to try to study out these details by means of the compound microscope. When compound microscopes are available some of the structures may be determined by the pupils, but often it is better to use demonstration microscopes. A full study of gross structures will give a good basis for understanding demonstrations through microscopes, and pictures of the important details.

a. Algae. General appearance and distribution; local types studied with reference to their places of living, their nutritive and reproductive structures and habits, conditions controlling their growth and reproduction. Two or three blue-green forms as Nostoc and Oscillatoria, and such green forms as Pleurococcus, Cladophore, Spirogyra, Vaucheria and the Desmids. The gradations in complexity in nutritive and reproductive structures should be understood but no attempt at establishing a detailed evolutionary series should be made. The characteristics of these forms should be studied out-of-doors and in the aquarium. Their distribution and abundance in the locality, and their relation to water supplies should receive attention.

General appearance and regional distribution of the red and brown algae, but no detailed work with them is recommended. Gross characteristics of diatoms in fresh water should be noted.

b. Fungi. Some of the following common forms as types of dependent plants—toadstools and mushrooms, mildews, water mould, wheat rust, corn smut, cedar apples, etc.

Parasitic method of living and its helpful and harmful economic significance; regulation and elimination of injurious fungi.

Yeasts and fermentation.

Bacteria studied chiefly with reference to life habits and effects. Relation of the bacteria to decay, to soils, to leguminous plants, to rotation of crops, and to sanitation. Bacteria as instruments of disease. Sterilization as shown in a study of milk.

Purity of milk and water supply. Relation of knowledge of bacteria to public hygiene.

c. Lichens. A type used to illustrate the interrelation of algae and fungi. Distribution of the lichens of the locality and their influence upon their supporting structures.

d. Liverworts. Life habits, distribution and life cycle.

e. Mosses. Life habits, distribution and life cycle.

f. Ferns. Life cycle of a true fern, stem and leaf in relation to chlorophyll work; perennial nature; distribution; acquaintance with a few local types.

General characteristics of the horsetails and club mosses.

g. Gymnosperms. Pine or spruce as a type; habit of tree, perennial nature, twigs and stems of different ages, age of tree, leaves and the evergreen habit, nature of the timber and its uses; two kinds of cones and the processes, time and structures involved in seed formation, nature of the seed, seed distribution, seedlings and the establishment of the new tree.

Names of other kinds of gymnosperms.

Gymnosperms as source of much of the world's lumber supply, chief regions of gymnosperm forests, preservation and extension of gymnosperm forests.

h. Angiosperms.

Life cycle as compared with the gymnosperms.

Types of stem, root, leaf and flower structure, with consideration of the special work, habits and uses of each of these.

Nutritive and reproductive processes arranged so as to extend whatever work was done with seed plants at the beginning of the course. Work suggested at the outset that was not done in that connection may be included here.

Pollination and seed formation, number of seeds, seed distribution, seedlings, vitality of seeds, struggle for existence.

Structures and habits of plants of different regions.

Acquaintance with plants of the leading families in the local region.

Angiospermous forests (possibly delay the consideration of gymnospermous forests until this point), the local timber supply either from local forests or from others, enemies of the forests, elementary forestry problems, United States, state and local private work in forestry.

Relation of plants to soil, water, light, temperature, gravity and other environmental factors. Productive and unproductive soils and climates in relation to agricultural plants.

Diseases of plants and their significance. Artificial improvement of plants through cultivation, pruning, grafting, selection and breeding.

III. The Qualifications of the Teacher of Botany.

It is believed that the teacher of botany in the high school should have a minimum preparation in botany equivalent to two years of college work. This work should include the general morphology of the lower and higher groups, elementary plant physiology and ecology; zoology, physiography and a course in general bacteriology are desirable. The teacher should also have some knowledge of the purpose of botany in high school education and of current and desirable practice in teaching botany.

Since the teacher of botany usually teaches other sciences each demanding somewhat similar quantity of preparation, obviously to maintain this standard more general and more extensive preparation needs to be urged. This standard of preparation is deemed highly desirable in order to give botany its proper place in secondary education, but it may not always be practicable. It is the standard that should be met by those who are now preparing to teach the subject.

PHYSIOLOGY* (One-half unit)

Text-books: Colton's Briefer Course, or an equivalent. No credit will be accorded in this subject for work done below the ninth year.

AGRICULTURE, COMMERCIAL GEOGRAPHY, FREEHAND DRAWING, MANUAL TRAINING, DOMESTIC SCIENCE.

The total credit allowed by the University for the above subjects will not exceed two units. The credit will be granted by the Entrance Board after investigating each claim.

AGRICULTURE (One-half or one unit)

One-half unit — One-half year given to the study of soils and plants and their relation to each other. There shall be sufficient experimental work to accompany the subjects discussed.

One Unit—One full year shall be given to study of soils, plans, insects, and farm animals. There shall be sufficient experimental and demonstration work to be equivalent to one full year's

*Accepted by the University for the present only when offered in combination with one of the following: Physical Geography, Zoology, and Botany, as one unit.

laboratory work. Text-books should be of such a standard as Jackson and Dougherty's Agriculture through the Laboratory, or Bailey's First Principles of Agriculture.

COMMERCIAL GEOGRAPHY (One-half unit)

One-half year devoted to the study of the physical and human factors influencing commercial exchange. The work should be preceded by a good course in General History and Physical Geography.

FREEHAND DRAWING (One-half or one unit)

The minimum time to be given for one unit should be the equivalent of 240 hours of sixty minutes. Preferably two double periods per week.

For one-half unit credit the work should be principally representative drawing, and for one unit at least one-half the time should be given to this work.

Mediums used: Pencil, charcoal, water color, crayons. The work should cover studies from objects, plant forms, pose drawing, landscape, and composition, illustrating proportion, perspective, values, texture and surface modeling, and may include also decorative design—conventionalized plant forms, units, borders, corners, arrangement of straight lines and of straight and curved lines, stencils, geometric designs, historic ornament.

MANUAL TRAINING (Not to exceed two units)

The minimum time given for one-half unit in Manual Training should not be less than the equivalent of 120 hours of sixty minutes each. This Manual Training should be preceded or accompanied by Mechanical Drawing.

Bench Work. One-half unit. Care and use of the tools for measuring, squaring, sawing, planing, gauging, boring, chiseling, clamping, and finishing. Use of woods, nails, screws, glue. Use of oils, stains, filling, shellac, and varnish. Elementary constructions involving different forms of joints used in framing, cabinet work, and pattern making. Designing.

Wood Turning. One-half unit. Care and use of lathe and tools. Turning of different woods. Centering, roughing, straight and taper turning, convex turning, concave and compound curve turning, beading, face plate turning, face and plug chuck work.

Pattern work. One-half unit. Drafts, shrinkage, and finish

allowances. Parted patterns, dowels, fillets, fasteners, core prints and core boxes, built-up patterns, ribbed patterns.

Cabinet Work. One-half unit. Furniture involving the common methods of construction and including panels, drawers, hinges, staining and fuming, filling and finishing. Each student should design his work and make complete drawings for it.

Machine Tool Work. One-half unit. Work on the engine lathe, drill press, planer and shaper, involving such elementary principles as centering, stright and taper turning on external and internal surfaces, screw cutting, chuck and face plate work, filing and polishing, drilling, planing, and shaping.

Forging. One-half unit. Management of forge, fire and tools. Practice involving the processes of drawing out, bending, twisting, upsetting, splitting, punching, forming, fullering, swaging, welding, case-hardening, annealing, hardening and tempering.

HOUSEHOLD ARTS AND SCIENCE (Not to exceed two units)

1. PLAIN SEWING (One unit)

Every exercise in sewing should illustrate an important principle or process, or a simple combination of such principles and processes. Hand sewing and sewing machine work must be equally insisted upon.

a. The various stitches and their special uses.

b. Hand sewing, fundamental processes.

c. The use and care of sewing machines and their attachments.

d. The nature and special uses of cotton, linen, and woolen goods.

e. The use of patterns; cutting out.

f. Taking measurements; making of simple garments.

2. SEWING AND MILLINERY (One unit)

a. Making of shirt waists, wash dresses, and similar garments.

b. Millinery. Study of material for hats; making, altering, and covering hat frames. The planning, making, and trimming of seasonable hats of appropriate materials.

Throughout the course economy and good taste in dress.

COOKING (Two units)

1. Food classified and tested for food principles.

A study of the effect of heat upon foods alone and in combination; experiments with leavening agents, and their uses shown in