

Oral versus Written Instruction in the
Teaching of Outdoor Botany

by

L. H. Dentel

A. B. Central College
Huntington, Indiana
1915

Submitted to the Department of
Education and the Faculty of the
Graduate School of the University
of Kansas in partial fulfillment
of the requirements for the
degree of Master of Science in
Education.

Approved by

J. W. Twenter
Instructor in Charge

Raymond A. Schwepker
Head of Department

April 28, 1931

ACKNOWLEDGEMENTS

The writer wishes to express his sincere appreciation particularly to J. W. Twente, Professor of Education, and Dean Raymond Schwegler of the University of Kansas. The attitude of the former has fostered self reliance and initiative in this experimental study and has been at the same time kindly suggestive. The latter, whose expressed faith in the ability of the writer to successfully complete a seemingly impossible schedule, has indeed been a source of inspiration. To both of these advisers I am indeed most grateful.

L. H. D.

TABLE OF CONTENTS

CHAPTER I	INTRODUCTION
CHAPTER II	SPECIFIC SCOPE OF THE STUDY DEFINED
CHAPTER III	PRESENT STATUS OF THE PROBLEM
CHAPTER IV	METHOD OF INVESTIGATION
CHAPTER V	PRESENTATION AND INTERPRETATION OF DATA
CHAPTER VI	SUMMARY AND CONCLUSIONS
	BIBLIOGRAPHY
	APPENDIX

Index To Figures And Tables

Figure	Page
1. Comparison of Group A and Group B as to gain in information in Section I (first 40 plants)----	15
2. Comparison of Group A and Group B as to gain in information in Section II (second 54 plants)--	16
3. Graph showing distribution of 80 scores made in Section I and Section II by Group A (Oral)----	17
4. Graph showing distribution of scores made in Section I and Section II by Group B (Written)----	18
5. Comparison of Group A and Group B as to identification of plants-----	19

Table

1. Scores in sequence made by Group A and Group B made in Section I, Section II, and Identification	20
2. Chart showing results of study-----	21
3. Table showing all data used in this study-----	22

CHAPTER I

INTRODUCTION

In this age of science it is very natural and logical to find that methods of teaching have been subjected to careful study in an attempt to find the best methods of presentation. Practically all of the conventional subjects taught have been used as fields of experimentation and in the biological and physical sciences, especially, a considerable number of carefully controlled studies have been made. It is unwise to hope that any large number of sweeping generalizations, if any, can be safely made from any one study or group of studies. What we may feel more justified in expecting is that general drifts or tendencies may be detected and that these may be of some value in determining classroom procedure.

This thesis deals with a study carried on with the hope that some such general tendency might be noted in the teaching of a certain phase of botanical science.

The writer would like to confess at the outset his complete humility and lack of dogmatism in the face of the problem at hand. A wholesome acknowledgement of the many uncontrollable factors affecting the outcome of a study such as this one would seem to discourage us from too definite and sweeping conclusions. Try as we may to isolate in our school environment the factor which is the subject of any such study, a thousand influences playing upon the lives of our students out of school hours and even during school, such as disrupted homes or physical

condition, may set us to wondering as to the validity of our conclusions. As an illustration, a certain girl in the first half of this study made a very creditable showing. In the second half she made almost no progress. It was learned that a disrupted home at this time was undoubtedly responsible. She was accordingly discarded and not used in the pairings. But what about the others who we did use and who might have been influenced by some such conditions? The per cent of pupils from broken homes in our school is dishearteningly large.

The assumption that these uncontrollable influences will be equal in both groups and hence can be disregarded seems to the writer to be quite unjustified and unscientific. We are left with no alternative however, but to proceed upon this assumption.

It is not, however, the purpose of the writer to claim that these studies are without value. What is being advocated here is the recognition of the enormous complexity and variability of the human individual as a subject for scientific study and accordingly a wholesome caution in the drawing of our conclusions.

CHAPTER II

SPECIFIC SCOPE OF STUDY DEFINED

The present problem dealt with in this thesis is the comparative efficiency of oral and written instruction in the teaching of Outdoor Botany. Do students in this case learn more through the eye or through the ear? This question has been the subject of many discussions both inside and outside of pedagogical circles. Will evidence as to the relative value of these methods of approach to the study of science point us to surer ways of leading our boys and girls to a more intimate acquaintance of nature about them?

It is not the claim of the writer that conclusions from this study can be regarded as entirely valid in the presentation of all phases of botany, much less in the teaching of all sciences. Strictly speaking we can only say with reasonable safety that under the same conditions affecting this experiment similar results should be obtained in the teaching of the same material.

It is hoped however that there may be some carry over by inference at least as to the significance of these findings in this limited field in noting general tendencies that may apply to the methods of teaching other sciences as well.

The writer wishes to state here the reasons that have prompted him to undertake this particular study. First, as to the choice of materials. It has long been his firm conviction that in the teaching of Botany we have over

stressed the technical side of plant study ignoring, too much, phases which can be intimately usable and practical not only to specialists and teachers but to every student in his everyday life during the rest of his life. This conviction has been supported by a sort of surreptitious questionnaire carried on during the last five years in which the writer has secured by adroit questioning the unbiased opinion of citizens of all walks of life, except in the teaching profession, as to what they thought would be of the most value to their children in a Botany course. Without fail the answer has been emphatic and instant to teach their boys and girls to know the plants which they see about them every day both as to identification and factual material and to let technicalities merely supplement this knowledge. Largely on the basis of these opinions, in the Fall of 1928 a project was carried out under the writer's direction by which about 150 of his Botany students brought in from roadsides and woods some 1100 native and cultivated trees, shrubs, and vines, representing about 80 species. These were set out on the campus and athletic field joining Central Junior and Senior High School, Kansas City, Missouri, through the kind and hearty cooperation of the City School Gardener, Mr. C. L. Quear and his assistant, Mr. Rose. With a considerable number of other plants provided by the Board of Education, the campus was transformed from a rather barren one with 22 species to one with something

over 120 species. Its increasing beauty with the passing years should be a distinct educational asset. The main purpose of the writer however, was not so much beautification, desirable as it is, as to create the opportunity to teach Outdoor Botany in a really organized fashion, 1st, as to Landscaping, 2nd, as to Identification, 3rd, as to Factual Materials, 4th, (and perhaps the most essential) Nature Appreciation.

The above, then, is the "stage setting" for this study and were the plants used as outlined in following pages.

The query arose in the writer's mind as to whether the Oral or Written method would be better in teaching this Outdoor Botany. Both had very obvious advantages and disadvantages. Which would yield the best results in the main? It was to attempt to answer this question that this experiment was carried out.

The writer wishes to point out here that the only measurements that this study purports to show is gain in information of three kinds, 1st, Identification, 2nd, Factual Material, 3rd, Principles and generalizations. Problem solving or nature appreciation were not included in the scope of this study.

CHAPTER III

PRESENT STATUS OF THE PROBLEM

The writer has been unable to find any other study made in the exact field which he chose for his experiment, namely the teaching of Outdoor Botany, nor indeed in any comparable field of any science. Some studies have been made, however, as to the comparison of Oral and written instruction in other fields, and dealing with conventional subject matter. Perhaps a brief review of these conclusions might be of value. Hunter* found in favor of Oral instruction in the teaching of conventional subject matter in Biology. He states that his results should be considered as no more than suggestive. Coopridge found also in favor of Oral instruction in laboratory exercises in Biology. In both of these cases an entirely different type of subject matter was studied and in an entirely different setting, than the present study.

The controversy which has raged for a decade over individual instruction versus demonstration involves some points in common with this experiment. A study of the next chapter will show that the Oral Method might be regarded as a sort of demonstration and the written as individual instruction. In the light of this observation it might be advisable to review briefly the conclusions of some of these studies. Kiebler and Woody found in Physics laboratory work that demonstration was superior as a whole, though in some experiments the individual

method proved better. Cunningham, with ten pairings of Sophomores taking Botany, found lecture demonstration as superior in regard to economy of time but that individual laboratory work is better retained. Anibal found in chemistry that lecture demonstration and individual laboratory were equally effective as a whole, though Lecture Demonstration was found better for brighter pupils and yielded better results for immediate retention. Walter concluded that in physics, Demonstration was superior to the individual laboratory method in gaining knowledge of the experiment performed. Weideman concludes from an analysis of all studies in this field up to March 1930 that "acquisition of information as an immediate result favors demonstration" but that "the accumulated evidence is insufficient to warrant final conclusions".

*All references in this study are found in the Bibliography Page 26

CHAPTER IV

METHOD OF INVESTIGATION

The term "Outdoor Botany" shall refer in this experiment, to the study of 94 species of trees, shrubs, and vines on the campus of Central Senior High School, Kansas City, Missouri. It was conducted during the regular class periods of fifty-two minutes, in the Fall of 1930.

Four classes of Juniors and Seniors, each class averaging about thirty-five pupils, were divided into two groups. Group "A", composed during the first half of the experiment, of two classes, Hours 1 and 3, was given the Oral Method of Instruction, in which various facts and principles were explained in the manner of an informal lecture while the pupils and instructor were grouped about, and examining, the plant under consideration.

Group "B" was composed during the first half of the experiment of two classes, Hours 2 and 5, following a procedure identical to that of Group "A", except that they were given mimeographed copies of instruction that explained the same facts and principles which were given orally to Group "A".

Both groups were permitted to ask questions of the instructor but in Group "B" they were not answered if explained in the written instructions. The instructor accompanied Group "B" to answer questions and to encourage the progress of the work.

After Section I (the first 40 plants) had been studied

the groups were reversed as to method, Hours 1 and 3 changing to the Written Instructions and Hours 2 and 5 to the Oral Instructions. It was thought that this procedure of varying the method would facilitate learning in both groups and that the results would be more significant in that it would show the reactions of each group to both methods. At the time of this shift of method, the test, covering the first 40 plants, was given to both groups in order to obtain gain in information due to that particular method in those materials studied.

To avoid confusion of terms it was decided that the term "Group A" shall in this study refer always to those pupils being taught by the Oral Method while the term "Group B" shall refer to those being taught by the written Method. Section I shall in every case refer to the first half of the materials studied (40 plants) while Section II shall refer to the last half of the materials studied (54 plants). (See illustrating diagram, Page 21). It will be noted that Group A (Oral) was composed of Hours 1 and 3 in Section I of the experiment but in Section II was composed of Hours 2 and 5. In like manner Group B (Written) was reversed in the two sections.

To secure comparable groups for purposes of comparing the relative merit of Oral and written instruction in this field, 40 pairings were made between Groups A and B on two bases: 1st, the grade percentile ranking of the pupils in comparison with over 1,000 scores made in the

Terman group test by pupils of the same grade; 2nd, the pupils score on an objective preinformational test given at the beginning of the experiment. Care was exercised to secure comprehensiveness in this test. It was divided into two parts, each part covering half of the materials studied. This test served both as the initial and final test. To determine the relative superiority, if any, of either method, the gain in number of correct answers of Group A using Oral Instruction was compared with the gain of Group B using Written Instruction.

In comparing the gain in information of both Groups A and B in Section II (the last 54 plants studied) only the gain due directly to the method of instruction was considered. In order to isolate this gain, the initial test covering Section II was given again after Section I was completed. The difference in correct answers made in the second giving of this test and the correct answers made in the third or final giving was the criterion for comparison of the two methods of Instruction in Section II. This technique eliminated gain in information relative to Section II acquired while studying Section I. Naturally this gain was considerable. In order to avoid the danger of paralyzing and sterilizing the course, other class work was being conducted at the same time that the four classes were studying Section I. It included text book work, stereoptican slides, lectures and other materials on landscaping and the making of a leaf collection of 100 specimens. In these activities some considerable

number of facts relative to Section II were bound to be learned by the brighter pupils. It was hoped however, that the technique outlined above would eliminate this disturbing factor.

It was a real concern of the writer that the initial test, should get a fairly accurate picture of the botanical information which these pupils possessed. It has often been a serious question whether tests given without a reward attached will get valid results. To meet this condition, a number of points were offered as a reward for correct answers, these points being added in to the pupils grade during the first five week period. They were scaled down so that each pupil who made any showing at all could earn some of these "extra points." All grades in these classes were evaluated on a mathematical or point basis so the inclusion of these extra points earned in the initial test was a simple matter. The writer believes that this reward stimulated the pupils to their best efforts.

In addition to gain in information pupils were also tested as to plant identification. Time was found, however, only to test this in Section I of the experiment. The technique used was as follows: the day following the giving of the initial preinformational test the pupils were taken out on the campus and given an initial identification test, under carefully controlled supervision. During the study of the first 40 plants (Section I) Group A

was learning to identify them aided by Oral Instruction while Group B was aided by written Instruction. Upon completion of Section I this same identification test over the same plants was given. The gain in knowledge of correct names was the criterion in determining whether Oral or Written Instruction was better in learning to identify plants.

CHAPTER V

PRESENTATION AND INTERPRETATION OF DATA

The data obtained by the methods set forth in the preceding chapter are presented, along with interpretations thereof, in the following tables and figures.

Figure No. 1 shows the comparison of Group A and Group B in gain in information in Section I. The graphs indicate a closely normal distribution with that of Group B showing a slight but distinct grouping in the higher quartiles. The results may be summarized as follows:

Score intervals	10-15	16-25	26-50	51-60	61-65
Group A frequencies	1	5	28	5	1
Group B frequencies	1	5	27	6	1

It may be interesting to note that these distributions happen to follow an alignment very similar to the 5%, 20%, 50%, 20%, 5% scheme of grading.

Figure No. 2 shows the comparison of Group A and Group B in gain in information in Section II. These graphs very plainly show a decided advantage in favor of the written method, the results being more consistently good in that method, as evidence by the clustering the scores around a reasonable level of achievement. The scores from oral instruction fall markedly toward the lower quartiles, though a few did better than any in Group B. The results may be summarized as follows:

Score Intervals	0-5	6-15	16-35	36-45	46-50
-----------------	-----	------	-------	-------	-------

Group A frequencies	4	12	18	4	2
Group B frequencies	0	9	26	5	0

Figures No. 3 and 4 will show by comparison distinctly in favor of the Written method. These graphs are particularly significant inasmuch as they picture the total results of all pupils throughout the entire study as to gain in information and also because they give a comparison of the two methods (Oral and Written) when each pupil has used both of these methods. The scores may be summarized as follows:

Score Intervals	0-5	6-20	21-45	46-60	61-65
Group A frequencies	4	21	43	11	1
Group B frequencies	0	19	49	11	1

The above data would indicate no superiority of either method for those pupils making the higher scores. Apparently these people are able to adapt themselves to either method with success. But for those pupils who would fail or make low scores the written method is found by the above data to be superior.

Figure No. 5 shows a comparison of Group A and Group B as to identification of plants. The graph for Group B is noticeably strong in the upper quartiles. The scores may be grouped as follows:

Score Intervals	15-20	21-30	31-45	46-55	56-60
Group A frequencies	2	9	23	6	0
Group B frequencies	2	9	19	9	1

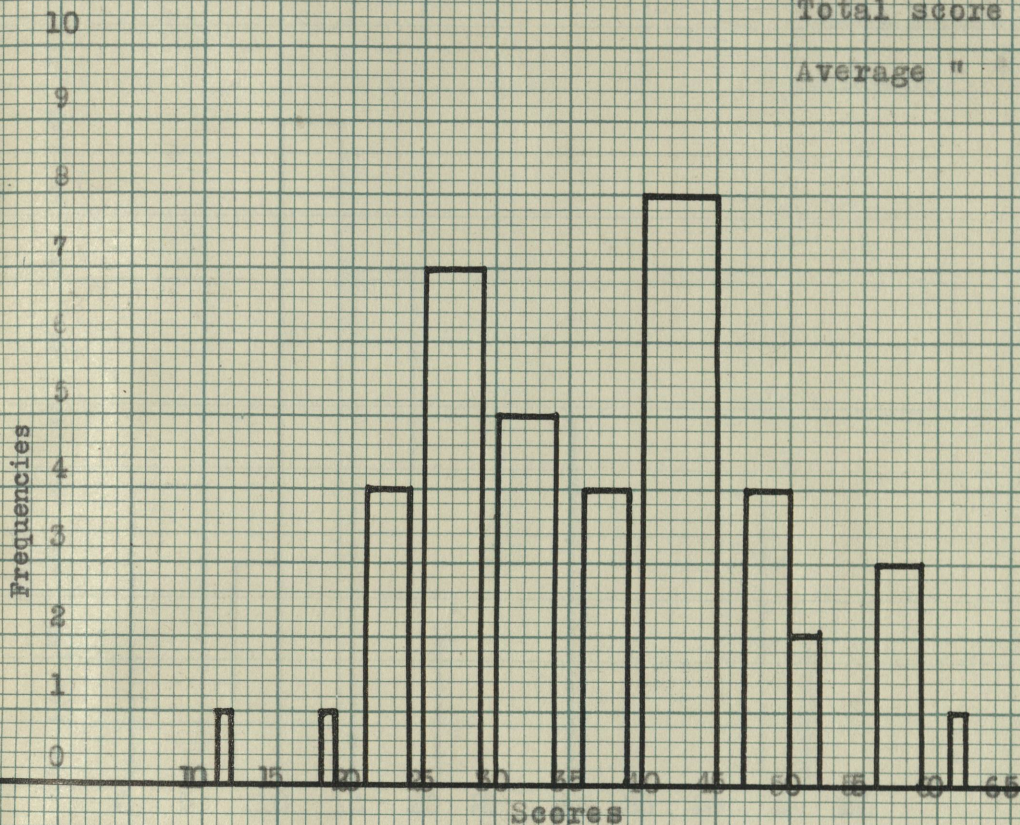
FIGURE NO. 1

Comparison of Group A and Group B in Section I

Group A (Oral)

Total score gain 1511

Average " " 37.77



Group B (Written)

Total score gain 1551

Average " " 38.77

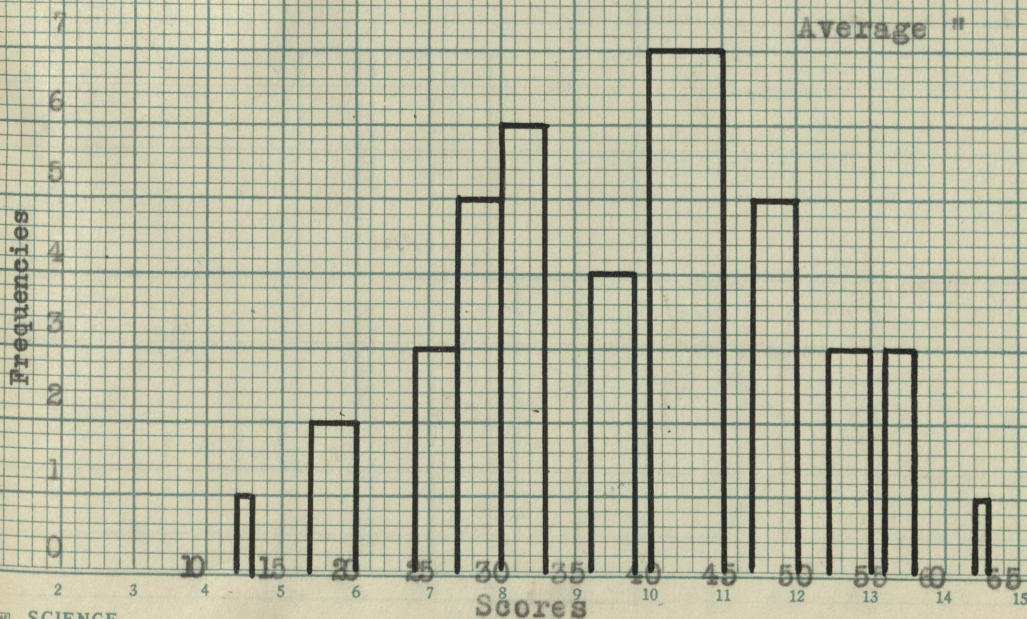


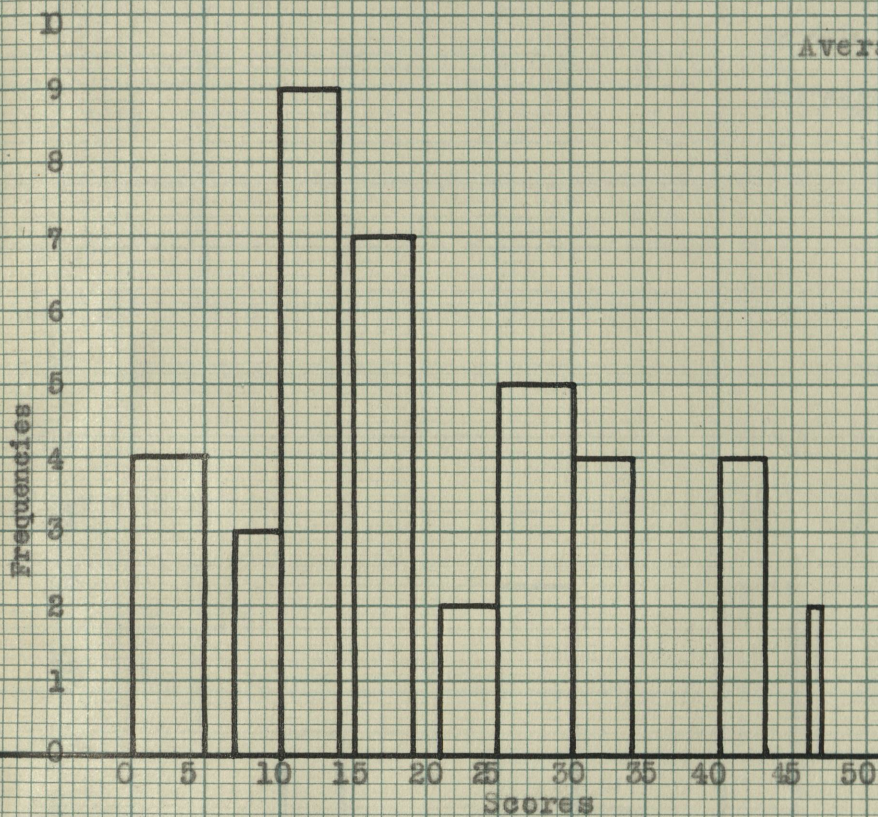
FIGURE NO. 2

Comparison of Group A and Group B in Section II

Group A (Oral)

Total score gain 847

Average " " 21.18



Group B (Written)

Total score gain 973

Average " " 24.32

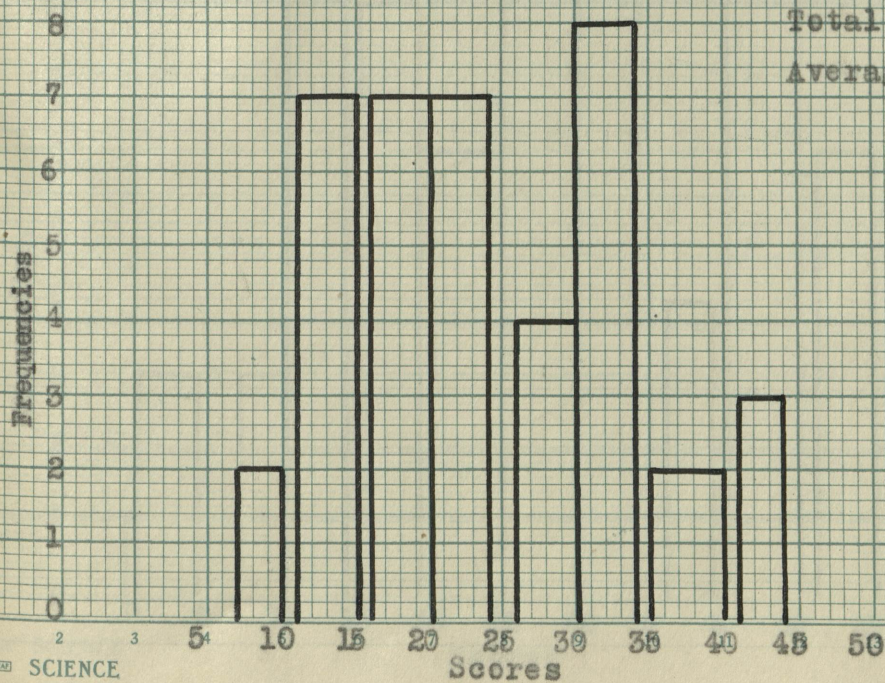


FIGURE NO. 3

Group A (Oral)

80 scores

Section I and II

Total score gain 2358

Average " " 29.47

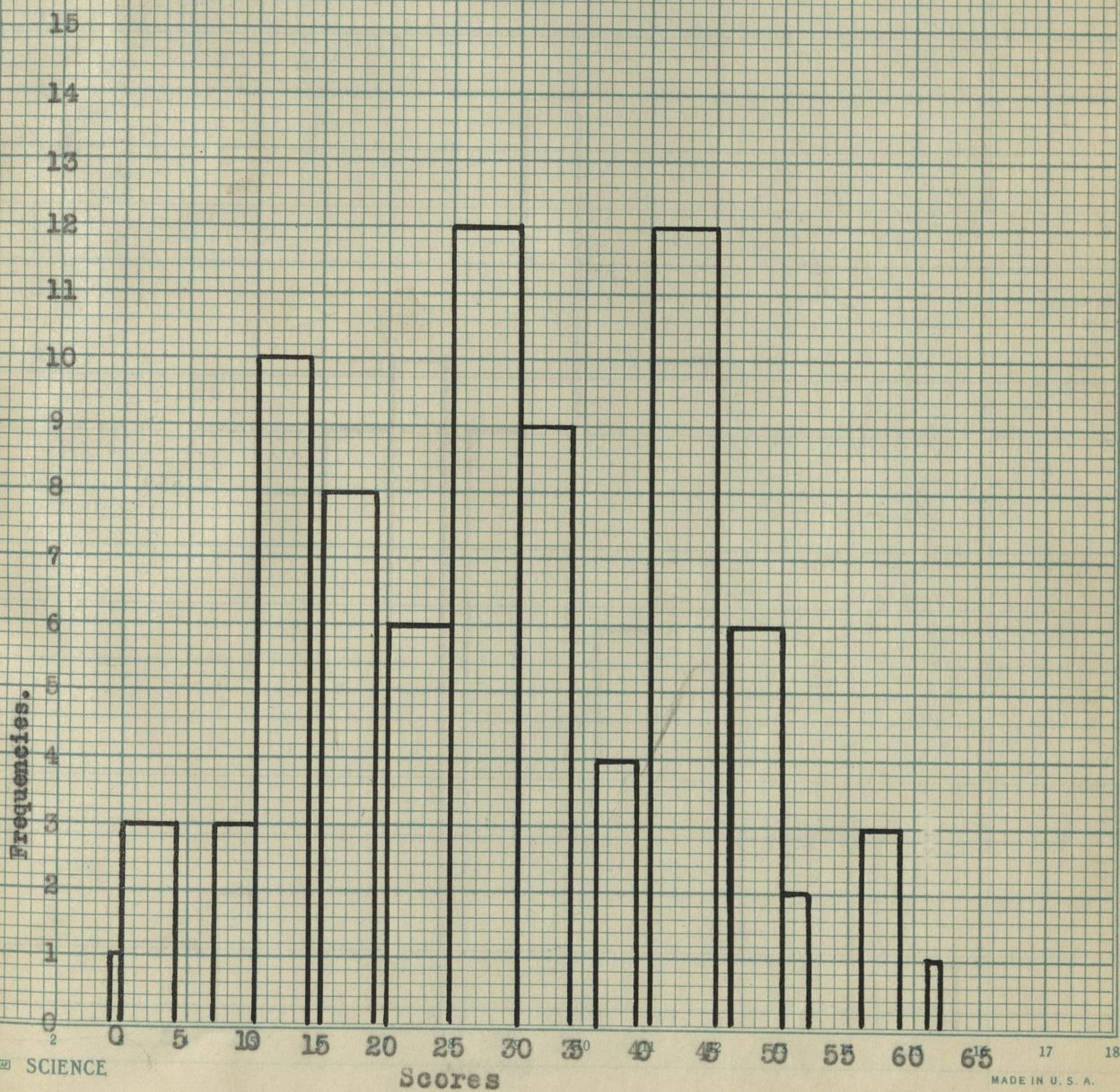


FIGURE NO. 4

Group B (written)

80 scores

Section I and II

Total score gain 2524

Average " " 31.55

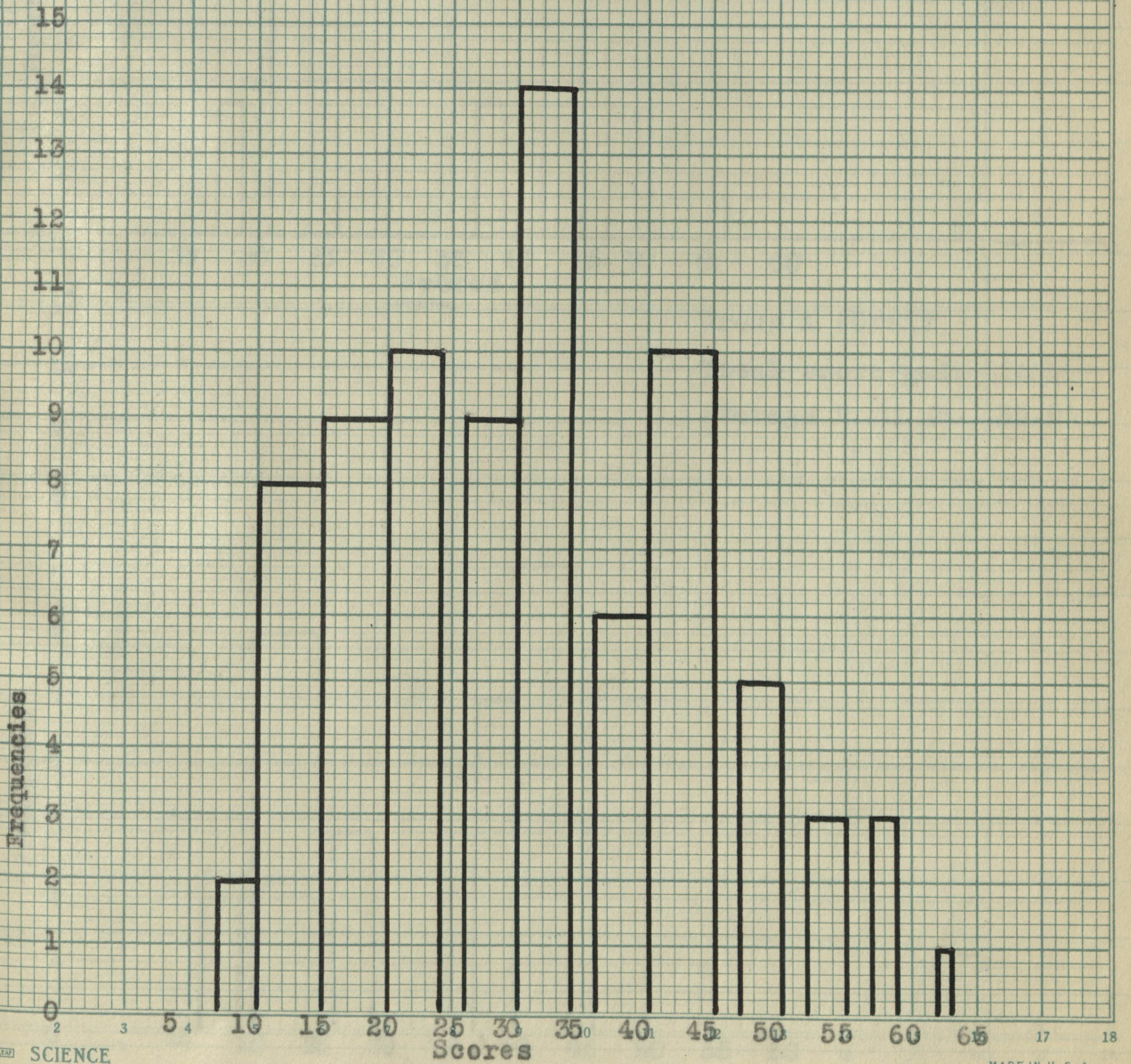


FIGURE NO. 5
Comparison of Group A and Group B as to Identification
of Plants

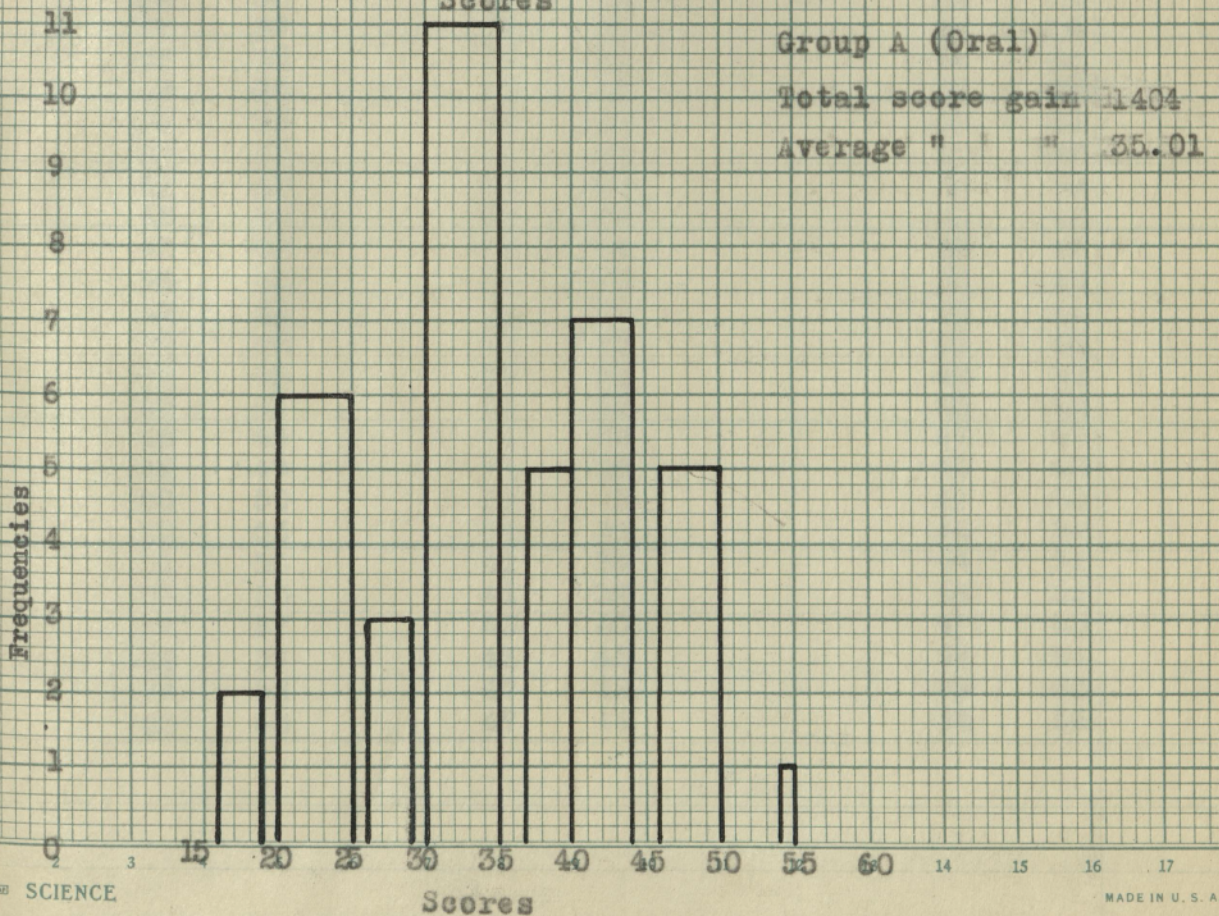
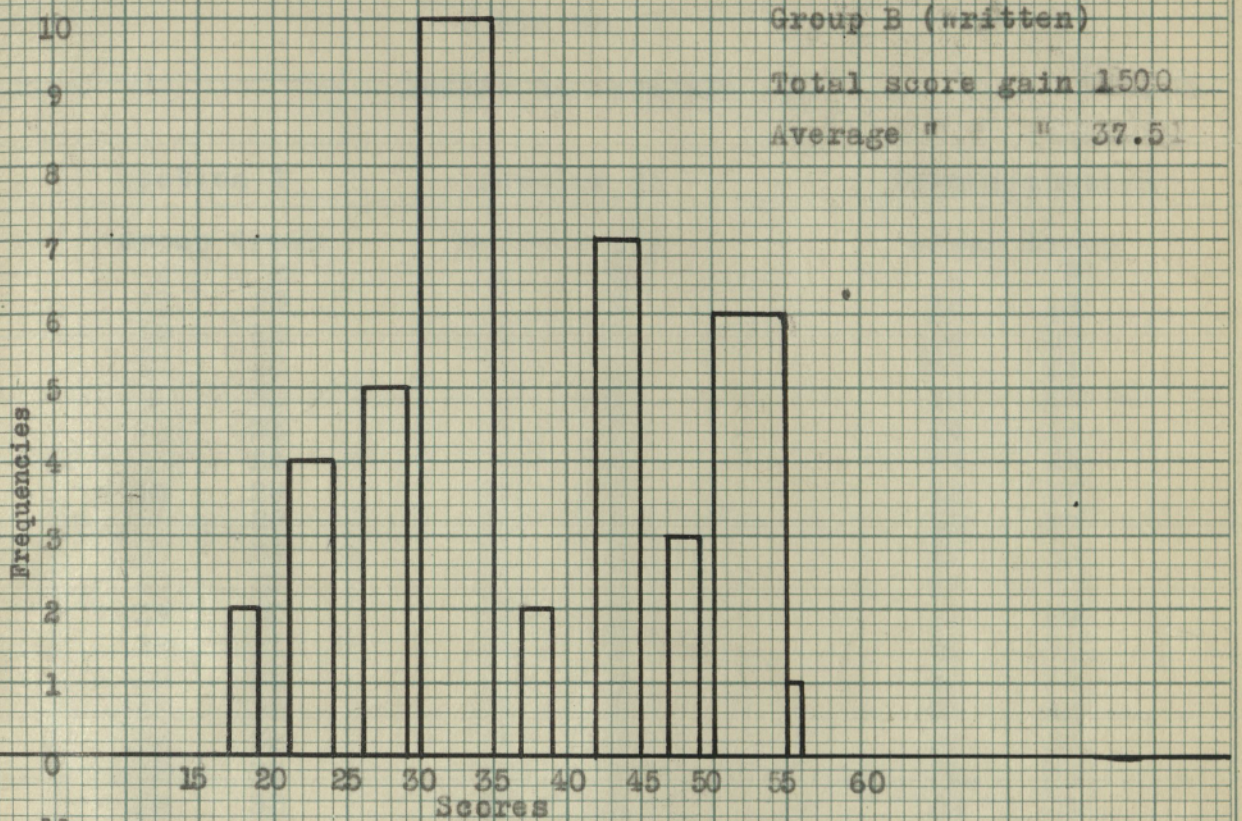


Table No. 1
Scores in Sequence

Section I		Section II		Identification	
Group A	Group B	Group A	Group B	Group A	Group B
12	13	0	8	16	18
19	18	1	10	19	19
22	20	4	11	21	21
22	21	4	12	23	23
23	22	8	13	24	23
24	24	8	14	24	24
26	28	10	14	25	27
26	28	11	14	25	27
27	29	11	15	27	28
27	30	12	16	29	29
27	30	12	16	29	29
28	31	13	17	31	31
29	32	13	17	31	32
31	32	13	18	32	32
32	32	13	19	32	33
33	33	14	20	32	34
34	33	16	21	32	34
34	37	18	21	34	35
37	39	18	22	34	35
38	39	18	23	35	35
38	39	19	23	35	35
39	41	19	23	35	37
41	42	19	24	36	38
42	42	21	27	38	42
43	43	25	29	38	43
44	43	26	29	38	43
44	44	26	30	40	44
44	45	27	31	41	44
44	48	29	31	42	45
45	48	30	32	43	45
48	49	31	33	43	47
49	49	31	33	43	48
50	50	31	33	43	48
50	53	34	34	44	51
51	55	41	34	44	51
52	55	41	37	46	52
57	57	43	40	47	53
58	57	43	42	47	54
59	58	47	42	49	55
62	63	47	44	55	56

Table No. 2
CHART SHOWING RESULTS OF STUDY

Section I (first 40 plants)

Group A (Oral) Hours 1 and 3	Group B (Written) Hours 2 and 5
Total Information score gain 1511 " Identification " " 1404	Total Information score gain 1551 " Identification " " 1500

Above data shows Group B (Written) leading by 40 score gains in Section I of study, in information. In identification Group B also leads by 96 score gains.

Section II (Second 54 plants)

Group A (Oral) Hours 2 and 5	Group B (Written) Hours 1 and 3
Total Information score gain 847	Total Information score gain 973

Above data shows Group B (Written) leading by 126 score gains in Section II

Judgment of students as to relative merits of the two methods expressed by vote after full discussion. For written, 98, for Oral, 57.

Table No. 3

SHOWING PAIRINGS AND GAINS

Hours 1 and 3

Group A in

Section I Group

B in Section II

	Term Test	Initial Test	Score Gain Sec. 1	Score Gain Sec. 2	Identify
Andrews	29	50	22	19	43
Burns	25	59	38	30	46
Conrick	39	54	57	22	49
Epstein	23	53	12	21	42
Flournoy	36	60	26	16	35
Huff	69	43	49	15	40
Ladden	49	48	28	17	27
Anderson	49	67	26	18	23
Courtney	95	62	52	33	47
Caywood	96	43	62	37	41
Foley	66	63	45	23	38
Harris	61	63	37	31	36
Holloway	78	67	68	34	46
Jones	43	37	22	12	25
Stubbs	57	51	27	11	32
Meyer, E.	40	66	32	20	32
Siebenthaler	43	59	39	31	31
Enright	40	61	27	17	19
Huggins	22	49	34	23	32
Klutznick	24	56	44	14	32
Lyons	86	45	59	44	34
Biederman	94	84	50	42	47
Zarisky	11	22	41	10	21
Oserman	41	46	44	16	29
Meyer, L.	78	53	38	29	55
Neve	60	46	33	14	35
McGaughey	34	55	50	42	43
Woodrome	11	73	34	40	24
Marlatt	41	55	29	29	31
Joyce	30	48	48	33	38
Marsch	38	55	27	15	24
Neffendorff	29	32	44	8	38
Campbell	52	67	19	32	29
Orendorf	28	48	24	13	16
Wasserman	42	36	44	34	44
Frederick	48	53	51	24	35
Kraft	27	51	42	23	43
Cooper	60	35	31	33	34
Chinnery	80	41	43	27	43
Anchutz	25	42	23	21	25

Hours 2 and 3

Group B in

Section I Group

A in Section II

	Term Test	Initial Test	Score Gain Sec. 1	Score Gain Sec. 2	Identify
Lindsey	23	55	22	19	32
McCracken	24	63	39	43	45
Streeter	39	56	48	11	48
Ferstle	23	55	20	18	29
Bland	35	60	30	29	53
Temple	64	44	44	11	21
Smith, C.	47	47	53	31	51
Tamoglia	49	65	42	18	56
Clements	90	57	33	31	44
Branson	91	44	31	21	23
Sanders	66	56	42	13	42
Crutcher	57	61	21	25	28
Coleman	80	68	28	26	43
Von Wolff	43	46	43	47	35
Krause	59	50	41	43	37
Davis, M.	41	66	48	8	24
Hawkins	43	59	32	8	52
Hunt	42	57	29	12	55
Lupton	20	51	28	26	29
Erwin	30	57	39	41	19
Coble	90	48	50	4	27
Rhoades	95	87	49	16	23
Speck	13	30	12	13	34
Jones	40	45	58	47	44
Porter	76	52	24	31	38
Wheeler	60	38	57	19	31
Bingzeli	35	49	63	19	48
Matters	17	69	32	18	33
Spector	43	50	49	4	43
Sturgeon	36	50	30	19	34
McCulloch	31	60	37	14	27
Moore	36	33	55	13	45
Smith	59	60	39	34	35
Wimmer	17	39	43	27	32
Bassin	40	28	45	13	35
Kile	46	59	33	10	47
Bowman	22	57	32	12	35
Duncan	66	35	57	41	51
Elias	87	33	53	30	54
Frances	26	42	18	0	18

CONCLUSIONS

1. In the light of the foregoing data one would seem justified in drawing the conclusion that for the type of work represented in this study the superiority of either the oral or written method of instruction is slight.

2. That margin of superiority found in this study is, though small, consistently in favor of the written method. This is, no doubt, partially accounted for by a difficulty inherent in this type of work when presented orally. It is obviously difficult to group 34 to 38 pupils about one shrub or vine so that all may hear and see to an advantage. When this is considered it is surprising that the oral method yielded as good results as were found. In smaller classes it is reasonable to presume that the oral method would yield results in its favor.

3. In the light of these findings we are justified in vigorously urging that Outdoor Botany be included more often in our Botany courses. The greatest difficulty, strange as it may seem, is usually the lack of familiarity of the instructor with plant identification, and practical information about them. If the written instruction is as good or better than oral, the above mentioned handicap is to be a very considerable extent, overcome.

4. In the study of plant identification, a comfort-

able margin of 6% is found in favor of the written method and is again due, we believe, to the better opportunity the student has of examining the specimen and associating it with the facts and principles explained about it in his written instructions.

5. It is well to keep in mind that data often may be a measure of teacher as well as pupil efficiency. In this study we cannot escape the observation that the results showing slightly in favor of the written method might indicate that that method was better organized and better presented by this particular instructor than was his oral method.

6. While neither the oral or written method yielded graphs that are skewed badly to either end of the curve it will be seen that the scores resulting from the written method more closely follow a normal distribution. This might be interpreted as meaning that this method yields more uniform results.

7. Again we point out that when we have two variables in a direct relationship, namely in this case, pupil and teacher, we cannot be too dogmatic as to which one or indeed whether both of these variables the resulting data should explain. Here the writer wishes to call attention again to the many factors, most of which are absolutely beyond control, which will surely affect both of these variables. As was previously mentioned, those

affecting pupil achievement are physical condition, existing state of home environment, love affairs and other factors that influence from time to time the desire to learn. The teacher, too, is not immune to factors that affect his efficiency and thus influence the results of a study of this kind. Health, particularly throat condition as affecting the voice, could work against oral superiority and favor the written method.

8. After the experiment was completed, it was explained to the pupils that a comparative study of methods of learning had been the purpose of using both oral and written instruction. Before that time, care was taken to guard this fact. At the close of the experiment a discussion of the relative merits of each method was engaged in by each class. This discussion was very interesting, many pupils taking part and ardently championing the side they favored. A vote was then taken. It is interesting to note that the judgment of the pupils agreed with the results of the study, as later worked out. The vote stood 98 for Written and 37 for Oral.

BIBLIOGRAPHY

1. George William Hunter. An Attempt to Determine the Relative Values of Visual and Oral Instruction in Demonstration and Experimental work on Biology. School Science and Mathematics. January, 1922. Vol. 22 pp 22-29
2. J. L. Coopridge. Oral versus Written Instruction and Demonstration versus Individual work in High School Science. Masters Thesis reported in School Science and Mathematics. December, 1922. Vol. 22 pp 838-844
3. E. W. Kiebler and Clifford Woody. The Individual Laboratory versus the Demonstrating Method of Teaching. Physics Journal of Educational Research. January, 1923. Vol. 7 pp 50-58
4. Harry A. Cunningham. Laboratory Methods in Natural Science Teaching. School Science and Mathematics. October and November, 1924. Vol. 24 pp 709-715 and 848-851
5. Fred G. Anibal. The Comparative Effectiveness of the Lecture Demonstration and the Individual Laboratory Method. Journal of Educational Research. May, 1926. Vol. 13 pp 355-365
6. C. H. Walter. A Comparative Study of the Teacher Demonstration and the Individual Laboratory Method in Physics. School of Education. University of Chicago. 1926

7. C. C. Weideman. An Evaluation of Individual and Lecture Demonstration Laboratory Methods for High School Science. Junior Senior High School Clearing House. April, 1930 pp 463-470
8. Valeda G. Norris and George W. Hunter. Methodology in Biology. School Science and Mathematics. December 1928, pp 1987-1994

THE FOLLOWING TESTS AND INSTRUCTIONS AS USED BY
THE STUDENTS WERE ON MIMEOGRAPHED PAGES, 8 $\frac{1}{2}$ BY
15 INCHES. IT WILL BE NOTED THAT THUS EACH TEST
COULD BE ENTIRELY STATED ON TWO MIMEOGRAPHED
PAGES.

Section I

DIRECTIONS FOR OUTDOOR STUDY

The purpose of these instructions is to help you to become acquainted with the trees, shrubs, and vines growing upon our campus, so that you may know them where ever you meet them. It is not our purpose to memorize large numbers of technical facts about them, but to direct your attention to characteristics of growth and form that will help you to remember them and to use them about your own home.

Most students have found a certain amount of personal enjoyment in being able to know the plants when they see them. The world means more to us if we become familiar with things around us. Each bird, star, or tree that we add to our list makes life just that much richer and fuller. Bear in mind that it is our own personal attitude that determines largely how much we will profit by studies of this kind and how much progress we will make.

In using these instructions, examine carefully each plant, feel the texture of the leaf, especially noting its structure and the shape of its margin. (T. K. 151). Since the leaf is the most noticeable part of the plant and is usually the easiest method of identification, we will refer to it most often.

Study the plants in order as they are listed here, as far as possible. In order that you may work to ad-

vantage avoid crowding around one specimen. It is suggested that you spend about 5 minutes of careful study on each one. In fixing the plant in mind try to remember some particular thing that is very noticeable. Your attention will be directed to such items in these instructions.

With some plants, however, you will find it best to remember them as you do a person, that is, by the general appearance rather than by one feature. Remember that leaves, even on the same plant, will show some variation in form, although there will be a general similarity. Therefore be sure to pick an average or typical leaf for observation.

It is unfortunate that there is considerable confusion as to the common names of some plants, many being known by various names that have become attached to them from local use or from other causes. One oak tree has over 40 common names used in different parts of the United States. This is an exception however, and the names given in these instructions will be the ones which you will most frequently meet.

This illustrates the value of the scientific name, which is universally accepted for each species and does not change as it is usually derived from the Latin. It often tells something about the plant such as color, form, or native habitat. A tree like the oak referred to, may have 40 common names but only one scientific name. In

order to acquaint you with their use, it is to be part of your work to learn the scientific names which are given in these instructions.

It will be advisable to study carefully these instructions and also all references, as an examination will be given covering this work when it is completed. The references will be stated under the following abbreviations.

"Trees in Kansas" as T. K. and Bergen and Caldwell as "text".

1. Sugar Maple (*Acer saccharum*) Also called the Hard Maple. We will start with a tree with which many of you are familiar, as it is the one most commonly planted along our boulevards. You may remember it first, by the dense, broad, rounded form of the crown or foliage. Second, by its rather smooth iron-gray bark and third, by its leaves, which are not cut in so deeply on the margins as its brother the silver maple. Here is a good place to remember a rule that will help you to identify many trees that you see. The only trees that you meet often that have opposite leaves are maples and ashes. If the leaves are opposite and simple you will know it is a maple. If opposite and compound it is some species of ash. There are only two exceptions which are easily remembered. First, the native catalpas have opposite (or whorled) leaves, but you will know them by their large heart-shaped simple leaves. Second, the buckeye and horse

chestnut also have opposite leaves, but they are palmately compound (T. K. page 151). Note that the branches of the sugar maple also follow the opposite arrangement.

What accounts for this? (Text Par. 53). What use is made of the sap of this tree? What amount is produced by the average tree (Text Par. 74)?

2. *Desmodium*, High Bush Clover. (*Lespedeza formosa*). Is one of the most beautiful of ornamental shrubs at this time of the year. It has many small purple flowers which are similar to the pea blossom, in fact they are closely related. It is really not a shrub, but an herbaceous plant, that is, one that dies down to the ground each winter. The roots live, however, and come up with renewed vigor the following spring. The leaves have the interesting characteristic of tending to fold up at night and point edgewise to the sun in the day time. What is the advantage of the latter position (Text Par. 58)?

3. Lombardy Poplar (*Populus nigra italica*) Here is a tree unlike any other as to form. Its tall, slender outline reminds one of a cathedral spire when seen silhouetted against the sky. There is some mystery as to its origin. It is named after a province in Italy, and is supposed to have come from Western Asia. It is grown entirely from cuttings in this country as it produces no pistillate flowers (Text Par. 96) and therefore has no seeds. It grows very rapidly and is hard but unfortunately is short-lived, (about 15 years). Is also very

susceptible, as all poplars are, to boring insects. The leaves of the Lombardy are smaller and more heart-shaped than the other poplars.

Let us use this tree to illustrate an interesting principle in landscaping. Horizontal lines in a building should be set off by planting trees and shrubs with vertical lines as much as possible and visa versa. Notice in this case how the slender vertical lines of these Lombardies relieve the square box-like appearance of the annex. This will be much more obvious in a few years when they are taller. Look across at the Junior High and see how the same principle is illustrated in the row of Lombardy poplars over there. Do you see how shrubbery with low, rounded outlines would add to the flat appearance of the Junior High building? On the other hand, such shrubs relieve a top-heavy or "spindley" appearance of a building which is very tall and slender.

4. Tartarian Honeysuckle (*Lonicera tartarica*) Is a member of a hardy group, natives of Asia and represent 20 or 30 species. They are noted for the sweet fragrance of their blossoms and are also desirable as the leaves stay green later than most other plants. What effect would a southern climate have in this respect (Text Par. 62)? Note the leathery leaves and scaly bark.

5. Cut-leaf Staghorn Sumach (*Rhus typhina laciniata*). The sumach is a member of a tropical family which has 400 species, 100 in North America. Every one is familiar

with the gorgeous colors of orange, yellow and red which add so much beauty to the landscape in autumn. The compound leaves remind one of some ferns. These plants secrete a milky juice which in some species is poisonous. This is not the common staghorn sumach, though often confused with it, due to the velvety appearance of the stems which resemble the antler of a deer "in velvet," after the leaves have fallen.

6. Morrow Bush Honeysuckle (*Lonicera morrowi*). A very desirable variety. Note the leaves are leathery in texture as *Lonicera tartarica*, but much narrower. It has small creamy flowers which appear in the spring and red berries in the fall as you have perhaps observed. This honeysuckle, is used where a bush form is desired, as in screening some unattractive part of the landscape. You will notice as you study the various species that in shrubs the leaves are usually opposite, in trees they are nearly always alternate. Look back to No. 1 of these instructions for trees which are exceptions.

7. Eastern Arborvitae (*Thuja orientalis*) and Western Arborvitae (*Thuja occidentalis*). Here are three evergreens planted in a triangle. Some of them are Eastern Arborvitae and some Western. You will find it difficult to distinguish between them except by the following experiment. Let one student for each group of 3 or 4 pinch off near the ground a portion of the foliage not over 1/4 inch long. (It will be necessary in order not to ruin the tree that each student follow this instruction carefully.)

Now crush this small piece between the finger tips and smell. If the odor is of a strong turpentine character then the tree is the Western *Arborvitae*. The one which is much milder and somewhat sweeter is the Eastern *Arborvitae*. These trees are much used for ornamental planting, especially at entrances of homes and in corners. Do they look as if they were one of the largest of all tree species (Text Page 313)?

8. Common Lilac (*Syringa vulgaris*). This shrub most of us know. It is a native of Asia, which indicates its hardy qualities. It was brought to America at the same time the Whites settled here. There are about 40 species and many sub-species with blue, red, and white variations of blossoms. One of the most desirable shrubs and one of the few with no single terminal bud. What effect does that have upon its form (Text Par. 84)? *Vulgaris* refers to the original meaning of the word "vulgar," which was "common".

9. Sand Vine. This vine which you see climbing over the lilac is a common wild one. You will meet it frequently on the campus. It is in the milkweed family as is proven by the milky juice released by pinching one of the pods. Notice carefully how it has twined about the stems of the lilac to get to the light. Follow it down some distance. This twining is due to the more rapid growth of the outer cells and the slower growth of the inner cells. Does it always twine in the same direction (Text Page 61)?

Move now to the west entrance at the sidewalk.

Let us observe here another fundamental principle in landscaping. You note that the planting at the entrance to the school building is practically identical on both sides, both as to shrubs used and the size and shape of the beds. Does that impress you as giving a balanced effect? Would it look unbalanced or one-sided if there were no planting to the north or to the south of the entrance or if the planting were entirely different? Watch on the way home this afternoon for violations of this principle of landscaping.

10. Japanese Barberry (*Berberis thunbergii*) or Thunbergs Barberry. Is generally used for border planting as a protection to other plants. Note the thorns, which are modified leaves. The direct sunlight tends to turn the uppermost leaves in late summer to brilliant shades of red and orange. The scarlet berries make it desirable ornamentally and also as an attraction to birds.

11. Common Spirea (*Spirea van houttei*). This shrub has just recently been given the name Bridal wreath because of its being almost universally known in recent years by that name. *Spirea prunifolia*, which we will see later, is the real, original Bridal wreath. One of the rules in English is that usage helps determine correctness, hence the use of the term Bridal wreath in connection with *Spirea van houttei*. It is one of the most common and popular of all ornamental shrubs. It blooms early in the spring and

is covered with masses of small white blossoms. It is hardy and generally planted where massed effects are desired. Notice the characteristic shape of the leaves.

12. Russian Olive (*Eleagnus angustifolia*) This tree is easily remembered and recognized from a distance by the typical silvery appearance of the leaves, more noticeable when turned up by the wind. It is a native of western Asia. Notice the shiny, smooth bark which is a means of identification. The leaves are alternate, simple, entire, and have many silky hairs, which accounts for its silvery appearance, and which varies in different species of Russian Olive. This tree is unique in appearance due to the unusual texture of the leaves. The branches out toward the end look as if they were varnished. Notice the fruits which are really small olives. They develop from small, fragrant cream flowers in the spring.

13. Red-stemmed Dogwood (*Cornus alba sibirica*) The first part of this name obviously refers to the color of the twigs. The term dog-wood refers to the ancient practice of using the bark to make a wash with which to kill insects on dogs and other domesticated animals. Dogwoods are best remembered by the characteristic structure of the leaves, which have very prominent veins on the under side of the leaf and indented deeply on the upper surface. It is also characteristic that these veins tend to curve inward toward the tip of the leaf. Some species grow into small trees. Much of the beauty of these shrubs is due to

to their brightly colored berries, and the autumn tints of the foliage. The bright coloring of the twigs is also a desirable feature.

14. Snowball (*Viburnum opulus sterile*) Another very common hardy shrub which, as you see, has a very abundant (opulent) growth. These leaves look something like a Hard Maple and are rough and opposite. Is this arrangement typical of shrubs or trees? The term sterile refers to the fact that the flowers do not produce seeds. The twin brother to this plant is the High Bush Cranberry whose leaves look very much like the Snowball, but whose flowers produce beautiful red berries in the fall. This is a very good shrub to use where a dense, massed effect is desired.

15. Boston Ivy (*Ampelopsis tricuspidata*) "Tri" refers to the 3 "cusps" or lobes in the leaf. This ivy is very commonly used as a vine on chimneys or porches. Its disadvantage is that it tends to freeze back in the winter if it grows too high. This vine which almost covers Manual High School, climbs by special little disks or suckers. Push the leaves back and note these disks. See how firmly they are attached to the stone. They cling by a secretion which they give off and which glues them to the rock. Notice that the leaves have adjusted their position at the right angle so as to get the most light. The ability of the plant to solve the problems that confront it, by such ingenious methods as we see used by this Ivy should

help us to understand the fundamental truth that plants are living things often displaying unusual intelligence in their reaction. One scientist has said "All living matter thinks. Man is the only one who knows it." Whether or not this thought strikes you as reasonable think of each plant, as you study it, as a living organism, and try to recognize some reaction displayed, that illustrates this principle of constant adaptation to surroundings. To miss the recognition and appreciation of this "life" force as it manifests itself in the plants behavior, is to miss the deepest and most significant part of plant study.

16. Mahonia (*Mahonia aquifolia*) This plant you would place, judging by its appearance, in the Holly family, rather than in the Barberry where it really belongs. The spines in the margin of the leaves are characteristic and are a continuation of the veins. One ornamental feature of this shrub is the presence of delicate shade of russet and tan of the leaves in the fall. This, trait with the unusual spiny leaves makes the Mahonia quite unique.

17. American Elm or White Elm (*Ulmus americana*) One of the finest of all shade trees. It is hardy and it grows rapidly. Its beautiful shape is most often described as like a wine glass. Some elms attain the age of around 200 years. The wood is tough and hence is seldom broken by storms. The leaves are simple, alternate and have a characteristic double serration on the margin. (T. K. Page 151). They are also very rough on the upper surface, if

stroked from the tip backwards with the fingers, this roughness varying in different leaves.

18. P & G Hydrangea (*Hydrangea paniculata grandiflora*). These hydrangeas are quite hardy and grow nicely in the shade. They are especially desirable due to the tendency of the large clusters of flowers to hang on late into the winter and assume a beautiful purplish hue. Notice how well the leaves are placed so as to get the best light without interfering with the leaves below.

19. Austrian Pine (*Pinus nigra austriaca*) This pine is a member of a large family of trees called the conifers to which also belong the spruces, firs and hemlocks. Longfellow in his poem *Evangeline*, says "This is the forest primeval. The murmuring pines and the hemlocks." Longfellow knew his trees. You notice that he didn't say "murmuring maples and ashes." They are not primeval. Pines and hemlocks and all conifers existed on the earth long before the development of the broad-leaved trees such as the maple. Examine the needles carefully. Do they resemble twigs? Leaves are simply modified branches and in the pines are very obviously nothing but twigs which have assumed the green coloring in order to manufacture food. This is a species of Black Pine. *Nigra* means black. You will notice that the branches grow on the tree in definite layers centering about one point on the main trunk. The distance between these layers represents one years growth. This pine has long needles in clusters of 2 bound

together at its base by a transparent connective material.

20. Jersey Pine or Scrub Pine. (*Pinus virginiana*)

This pine is found very much in the East and like other pines, often grows on mountain slopes. You notice that the leaves are short and in clusters of 2. The years growth is again easily recognized by observing the distance between the whorls of branches. Notice on the buds at the end of the branch, the sugary resin which has been secreted there. Turpentine and rosin are obtained from trees of this and related species.

21. Yellow or Golden Willow (*Salix aurea*) This is

one of the most common of our many varieties of willow. It is named from the yellow color of the newer branches. The leaves are alternate, simple having characteristic, serrated margins. Willows grow most rapidly along a creek or where they get plenty of water. The flowers are dioecious (Text Page 107) One feature of some willows is the extreme brittleness of the branches, especially this one. This is an advantage to the tree when growing by a stream. These branches become detached by the wind or other means and float down the stream, lodge, take root and grow into another tree.

22. Persian Lilac (*Syringa persica*) Is quite similar to *Syringa vulgaris*, except that the leaves, as you observe, are narrower and more pointed. The flowers are also finer and in smaller clusters.

23. Indian Currant or Coral Berry. (*Symphoricarpos*

orbiculatus). Is found growing wild everywhere. It spreads by slender runner-like branches that creep along on the ground, sending roots into the soil at intervals. The Indians are said to have used the fruits as food. An easy way to remember this shrub is by the clusters of red fruits which you will find on the under side of the twigs and shaped much like a short vase. They turn a purplish red in the fall and winter, dropping off in the Spring.

24. Hackberry (*Celtis occidentalis*). This little specimen is one of the many brought here 2 years ago by the students in the Botany classes and it should rapidly grow up into a good sized tree. It is closely related to the Elms, the leaves being very similar. It should be remembered by the veins. Examine the under side of the leaf, and notice that at the base. There are 3 main veins branching out. The leaves are rough much as the elm, but not pointed. The hackberry is not considered to be a very desirable shade tree since it is quite susceptible to insects. The berries, however, are an attraction for birds. Watch for dense clusters of dwarfed twigs in the Hackberries you see. They are called witches brooms and are carried by insects or fungi. The bark of the mature tree, so different from any other that it can easily be identified, is light brown or silver gray and broken up into short, deep ridges, quite soft and corky.

25. White Ash (*Fraxinus americana*) Here is a chance to apply the rule we learned on page 1 of these instructions. You notice at once, the leaves are opposite, also

they are compound, therefore it must be an ash. If the leaves were simple what species would it be? There are about a dozen common varieties of ash trees, some of which we will study later. The fruits are long narrow wings which mature from inconspicuous flowers and in some species hang on during most of the winter.

26. White Pine (*Pinus strobus*). Is the most valuable for timber of all pine trees. The wood is very superior since it is light, easily cut and does not tend to warp as much as the Yellow Pine. Notice that the needle-like leaves are fine and are in clusters of 5, which is a sure method of identification. Pines have both staminate and pistillate flower upon the same tree, the latter developing into seed cones. You will find many fine specimens of this tree growing in various parks in the city.

27. Mock Orange (*Philadelphus coronarius*) It is also called the syringa, although this is an improper common name. As you know, the syringas are really the lilacs. Linnaeus the Swedish scientist, who was the "father of Botany" made the mistake of giving this plant the name of syringa, and at the same time giving the Lilac the scientific name, "syringa." The best method of identification of the leaf is to notice the tiny spines which are scattered along the margin at a distance of about 1/2 inch. Also the bark tends to look scaly as if it were about to come off in shreds much as the Honey-suckle bark. The younger twigs tend to have a brown or

reddish coloring. Notice the fruits which have developed from the beautiful creamy white flowers that appear in the spring. You can recognize in the fruits the following parts of the flowers: calyx, ovary, style, receptacle and withered stigma. (Text Page 20). Do the leaves have a typical shrub arrangement? The blossoms look much like those of the Orange.

28. Golden Arborvitae (*Thuja orientalis aurea*)

Aurea refers to the bright yellow color of the foliage, which gives it a characteristic and attractive appearance. The arborvitae have been developed into large numbers of varieties, specialized as to form and coloring. They are often used as they have been here in planting and seem to set off an entrance very nicely.

29. Green Ash (*Fraxinus lanceolata*). This tree, on Linwood Boulevard, according to your rule you quickly identify as an ash due to its opposite pinnately compound leaves. The leaflets are serrated and lance shaped (lanceolata). Next to the sugar maple it is planted perhaps the most commonly along the boulevards. It grows quite rapidly, having dark green foliage when the tree is healthy. A yellowish or light green appearance is always an indication that the tree is not doing well due to some harmful condition. A pleasing feature of this tree is the beautiful colors assumed by the leaves in the fall. It reminds one of the remark made by Mark Twain when asked what he thought to be the most beautiful sight that he

had ever seen in all the world. He instantly answered, "Missouri in the autumn." If you disagree with Mark Twain drive out to the first street north of the main entrance of Swope Park this fall and see the gorgeous colors on those double rows of green ashes.

30. Common Juniper (*Juniperus communis*) Sometimes called Cedar. The blue tings of the foliage is a unique feature of this evergreen. The leaves vary in texture, some being rather sharp and others of the same species being more lacy in appearance like the arborvitaes. The evergreens are especially susceptible to smoke and dust, especially to the smoke in the winter time, much more so than deciduous trees, such as the maple, which sheds its leaves and thus escapes absorbing the smoke and gases in the air in the winter. For that reason it is advisable to plant a minimum of evergreens where one lives in the city. They are also among the most expensive of trees and shrubs for planting.

31. Amur privet (*Ligustrum amurense*). The privets are close relatives to the lilacs, you will notice some similarity in the leaves. They are used mainly for hedges and can be pruned to almost any conceivable shape. The privet at the very top and to the left of the steps is the common privet.

32. Common Privet. Notice its light green, almost silvery-like appearance. It is usually difficult to distinguish between the different varieties of privets.

33. Creeping Juniper. (*Juniperus chinensis pfitzeriana*). Is one of the junipers which have been developed with the habit of sprawling out along the ground. The leaves have a tinge of blue. *Juniperus* refers to the general group of plants. *Chinensis* refers to its oriental origin and the term *pfitzeriana* is from the name of the man Pfitzer who originated the variety. Another variety of this same Juniper is one which has yellow tipped foliage. Its scientific name is the same except for the addition of "aurea", meaning yellow.

34. Pin Oak (*Quercus palustris*). The most desirable of all native oaks for ornamental planting. It is the most rapidly growing of all the oaks and is one of the few that can be transplanted with safety. It has beautiful dark green foliage when in a healthy condition and is quite free from insects. It is called the Pin Oak because of the spines found on the margins of the leaves when matured, and also due to the pyramidal shape of the tree. There are about 50 species of oaks growing commonly around Kansas City. Let us take occasion to examine the buds. At the base of each leaf will be found a tiny bud. This bud started to grow in the spring of 1930. It will continue to grow very slightly all fall and even some in the winter though but very little. In the spring from it will appear the leaves of 1931. In each leaf bud at the present time is a perfectly formed miniature leaf which needs only to grow to its full size. Notice that the younger bark is

green and hence carries on some photosynthesis. (Text Page 16)

35. Upright Forsythia or Goldenbell. (*Forsythia fortunei*). This is the shrub which produces the beautiful yellow flowers in the spring before the appearance of the leaves and often while the snow is still upon the ground. It can be remembered by the simple, opposite leaves with large serrations that reach almost to the base of the leaf, golden brown appearance of the twigs, also the clusters of buds at the base of the leaves, in the *Forsythias* are different than in any other shrub. "*Forsythia*" comes from the man Forsythe who originated the variety.

36. Dorothy Perkins Climbing Rose. The rose family is one of the largest of all plant families, including spireas, apples and haws. This climbing variety is only about two years old, which will give you an idea of the rapidity with which they climb. You remember that the Wild Rose (*Rosa setiger*) was chosen last year by a majority vote of the pupils of the United States, as the National Flower. Central votes also favored the Rose. Other close contenders were the Goldenrod and the Columbine, Burbank's favorite flower.

37. Rough leafed Rose. (*Rosa rugosa*) *Rugosa* refers to the very rough texture of the leaf. It is a monthly rose and very hardy and fragrant, the blossoms being much like the wild rose. There are literally hundreds of varieties of cultivated roses.

38. Chinese Wisteria (*Wisteria chinensis*) Is named from a doctor Wistar, who brought the variet. to this country. It has large clusters of beautiful purple flowers in the spring and sometimes fall, which are much like sweet pea blossoms, in fact this vine is in the Sweet Pea family along with some trees such as the Honey Locust and Red Bud. This vine spreads unusually fast, climbing in every direction by the rapidly twining stems which it sends out.

39. Lemoines Deutzia (*Deutzia Lemoinei*) Is not very commonly seen although it is a very desirable shrub, having very attractive white flowers in middle summer, which justify the name sometimes given it, "Bridal wreath." It grows rather upright to a height of about 3 feet. The leaf maybe remembered by the rudimentary teeth which are found along the margins and are characteristic of the Deutzia.

40. Yellow-stemmed Dogwood. (*Cornus aurea*) Has the characteristic varination of all the dogwoods. The veins are indented deeply on the upper surface and incurving inward to the tip. On the under surface they are very prominent and stand out like ribs.

Test Over Section I

Matching Test

In the parenthesis () before each descriptive phrase, put the number of the term which best describes, or illustrates it.

Two descriptive phrases will be left unused.

Terms	Descriptive phrases
1. Yellow Stemmed Dogwood	() Vine, climbing by rapidly twining stems
2. Pin Oak	() Tree with compound leaves, common along K. C. boulevards.
3. Privet	() Similar and related to the Elm
4. Evergreens	() Caused by lack of terminal buds.
5. Green Ash.	() Evergreen with short leaves in clusters of 2
6. Mock Orange	() Coniferous tree which is deciduous.
7. White Pine	() Tree named because of pyramidal shape of crown.
8. Rounded form	() Large clusters of flowers hang on late into winter
9. P & G Hydrangea	() Most expensive class of ornamental shrubbery
10. Photosynthesis	() Bark used as wash to kill insects on domestic animals.
11. Hackberry	() Used mainly for hedges. Can be pruned to any shape
12. Jersey Pine	() Tree with five needles in clusters of 5
13. Red Stemmed Dogwood	() Called Bridal wreath so long, the name is now accepted.
14. Common Spirea	() Manufacture of plant food

Test over Section I (con't)

by action of light.

15. Mahonia ☐ Shrub improperly called Syringa
16. Wisteria ☐ Shrub with twigs strikingly colored.
- ☐ Plant which is quite poisonous.
- ☐ Leaves have long prominent spines on margins.

Multiple Choice Test

Place in the parenthesis () before the statement the number which corresponds to the best answer.

- ☐ 1. As an illustration of a tree with many common names, one oak has: (1) fifteen; (2) thirty; (3) forty; (4) sixty.
- ☐ 2. Scientific names are generally derived from the: (1) Greek; (2) Latin; (3) French; (4) Modern Languages.
- ☐ 3. The tree with the most slender form is the: (1) American Elm; (2) Lombardy Poplar; (3) Yellow Willow; (4) Pussy Willow.
- ☐ 4. The tree most commonly planted along the K. C. boulevards is the: (1) Cottonwood; (2) Silver Maple; (3) Hackberry; (4) Hard Maple
- ☐ 5. Honeysuckles are native of: (1) America; (2) Asia; (3) Missouri; (4) Europe.
- ☐ 6. In North America the number of species of Sumach is: (1) one hundred; (2) fifty; (3) two hundred; (4) three hundred.

Test Over Section I (cont)

- () 7. Morrow's Bush Honeysuckle is best used in planting as: (1) a border plant; (2) where a slender shrub is desired; (3) to protect other plants; (4) to screen an unattractive part of the landscape
- () 8. The part of the plant which is usually the best means of identification is the: (1) Bark; (2) Leaf; (3) Internal structure; (4) Fruits
- () 9. The form of the Sugar Maple crown is: (1) slender; (2) pyramidal; (3) rounded; (4) wine glass shape.
- () 10. The Lombardy Poplar usually lives about: (1) fifteen; (2) seven; (3) forty; (4) thirty years.
- () 11. A good principle in landscaping is to choose shrubs and trees with lines or shape which in comparison to the buildings are: (1) opposite; (2) same; (3) slightly different; (4) unrelated.
- () 12. The Staghorn Sumach is so named because of the velvety appearance of the: (1) leaves; (2) stems; (3) air roots; (4) flowers.
- () 13. The silvery appearance of the leaves of Russian Olive is due to: (1) a waxy secretion; (2) fungous growth; (3) silky hairs; (4) deposit of mineral salts.
- () 14. The Forsythia leaf serrations are: (1) very fine; (2) usually missing; (3) composed of hairs; (4) large.
- () 15. Buds that open in the Spring of 1931 started to

Test over Section I (con't)

grow in: (1) late summer of 1929; (2) Fall of 1930; (3) Spring of 1930; (4) Midwinter of 1930.

If you think the statements below are true, put an "T" in front of them in the margin. If they are false put an "F". Do not guess. Do not spend much time on any one.

1. Dogwood leaves have deeply indented veins on the upper surface.
2. Forsythias bloom in the early Fall.
3. Deutzia Lemoinci is unfit for a hedge due to its spreading habit of growth.
4. Dark green foliage indicates that the tree is healthy.
5. There are no trees found in the Rose family.
6. The leaf of the Mock Orange has fine, widely separated teeth on its margin.
7. Evergreens are practically immune to smoky air due to their small leaves.
8. Wisteria blossoms resemble those of the sweet pea.
9. The Green Ash has lance shaped leaflets.
10. Charles Darwin was the "Father of Botany".
11. Arborvitae are very often planted at entrances to buildings.
12. The leaves of the Junipers are always sharp and pointed.
13. Green bark is always proof that moss is growing upon it.
14. Privets are closely related to the Lilacs.

Test over Section I (con't)

15. Turpentine and rosin are obtained from the Conifers.
16. Dogwoods are never classified as trees.
17. Snowball blossoms do not produce seeds.
18. The Austrian Pine has long needles in clusters of 2.
19. The wood of the American Elm is easily broken by storms.
20. Boston Ivy vines climb by twining.
21. The branches of the Yellow Willow are very brittle.
22. Leaves of shrubs are generally opposite on the branch.
23. Plants can hardly be thought of as "living things."
24. Herbaceous plants are those whose stems live during the winter.
25. Most trees that you see have alternate leaves.
26. Leaves on the same plant always have the same form.
27. A plant is never known by more than 2 or 3 common names.
28. Sumachs have simple leaves.
29. An average Hard Maple produces 30 to 50 quarts of sap annually.
30. Leaves of the Western Arborvitae when crushed have a strong turpentine.
31. Scientific names of plants are more reliable than common names.
32. Plants seldom show the ability to adapt themselves to surroundings.
33. The Common Lilac is a native of Asia.
34. Desmodium leaves point toward the sun in order to get more light.

35. The twining of the Sand Vine stem is due to the more rapid growth of the outer cells.
36. The Lombardy Poplar is usually grown from seeds.
37. Leaves of Honeysuckles are somewhat leathery in appearance.
38. The spines on the Mahonia leaf prove that it is in the Holly family.
39. Buildings that are tall and narrow should be landscaped with low, rounded shrubs and trees.
40. The Indian Currant may be known by its short, stubby branches.

Name Test

Place in each parenthesis () the number which you find in front of the corresponding common name, which is arranged in alphabetical order to save you time in finding it.

<u>Common names</u>	<u>Scientific names</u>
1. Amur Privet	() <i>Quercus palustris</i>
2. Boston Ivy	() <i>Forsythia fortunei</i>
3. Common Lilac	() <i>Fraxinus lanceolata</i>
4. Cutleaf Staghorn Sumach	() <i>Philadelphus coronarius</i>
5. Desmodium	() <i>Thuja orientalis aurea</i>
6. Golden Bell	() <i>Salix aurea</i>
7. Golden Arborvitae	() <i>Symphoricarpos orbiculatus</i>
8. Green Ash	() <i>Celtis occidentalis</i>
9. Hackberry	() <i>Viburnum opulus sterile</i>
10. Indian Currant	() <i>Ampelopsis tricuspidata</i>

Test over Section I (con't)

- | | |
|-------------------------|-----------------------------------|
| 11. Mock Orange | () <i>Ulmus americana</i> |
| 12. Pin Oak | () <i>Syringa vulgaris</i> |
| 13. Red Stemmed Dogwood | () <i>Eleagnus angustifolia</i> |
| 14. Russian Olive | () <i>Lespedeza formosa</i> |
| 15. Snowball | () <i>Rhus typhina laciniata</i> |
| 16. Sugar Maple | () <i>Cornus alba sibirica</i> |
| 17. White Elm | () <i>Ligustrum amurense</i> |
| 18. Yellow Willow | () <i>Pyrus coronaria</i> |
| | () <i>Robinia pseudacacia</i> |
| | () <i>Acer saccharum</i> |

SECTION II

41. Purple leafed plum (*Prunus pissardi*) This ornamental variety of plum is planted because of the unique color of its foliage. It is reproduced from cuttings or graftings as is rue of almost all unusual varieties.

42. Wild Plum (*Prunus americana*) In this bed there was supposed to be another plant grafted upon the root system of the wild plum but instead the nurseryman made a mistake by sending just a wild plum plant. It was left because of the beauty and fragrance of its blossoms.

There are 3 principles quite generally accepted in landscaping. First, avoid straight lines, second, allow for open spaces, third, plant in masses. Landscaping like any art however, encourages individual expression instead of insisting that you follow hard and fast rules. They are for general guidance only. Many of our plantings on the campus may not seem to follow principle No. 3. Keep in mind that they have only recently been set out and will show massed effects better each succeeding year.

43. Japanese Quince (*Cydonia japonica*) Is one of the most beautiful of all shrubs due to the large numbers of dark, red flowers which appear in great profusion in the very early spring. One of the first shrubs to be seen in bloom. It may be remembered by its thorns and by the tiny leaves which clasp the stem, which are often called "ears."

44. Yellow Kerria (*Kerria japonica*) Is also called the yellow or golden glow. These terms are frequently

applied to various plants that have yellow flowers. The twigs tend to stay green late into the winter and the leaves do not fall until late. They can be remembered by the deep serrations and the narrow pointed form of the leaves.

45. Rose Mallow (*Hibiscus moscheutos*) is all called the Hibiscus. The Rose Mallow is the "twin brother" of the Rose of Sharon (*Hibiscus syriacus*), the latter having a flower which is made up of many layers of petals. You will note that in the Rose Mallow there is only one layer in the corolla of the flowers. Otherwise the plants are practically identical. These 2 shrubs are among the choicest of ornamental varieties due to the striking beauty of their large flowers, their size and hardiness.

46. Wild Gooseberry. Can be remembered by its spreading, drooping form, the many thorns scattered along the main stem and the typical shape of the leaf. It belongs, with the currants, to the genus *Ribes*.

It will be found difficult to put an accurate description of many of these leaves into words. One can only remember them by fixing their form and appearance in mind. Examples are the Gooseberry, most *Spireas* and Rose Mallow.

47. Poison Ivy (*Rhus toxicodendron*) is botanically not a true ivy at all but it is in the sumach family. It can be remembered (and you had better) by the compound leaves with 3 leaflets, sometimes 5, having a few very large, rounded teeth at their base. It is found growing wild in all the parks, as many folks can testify to their

sorrow. The leaf resembles the box elder. "Toxico" refers to the word "poison". "Dendron" means "tree". Here is a vine that sometimes assumes an upright tree-like growth. It is then called Poison Oak. A number of plants are poisonous in varying degrees to different people. Common examples are the tomato vine and the elm. This is due to the composition of the blood and the skin. Poisoning is caused by small amounts of fluid or dust-like material which is given off by the plant and to which the skin of some people is susceptible.

48. Smooth Sumach (*Rhus glabra*) A very common wild shrub growing sometimes into a small tree with very large compound leaves. The stems have pithy centers. The "glory of the autumn" is in large measures due to plants like the sumach whose leaves are transformed by the first few frost to rich, flaming colors that brighten the landscape. The scarlet oaks, red ash, sugar maple, chestnut, barberry, and ivy also show these striking autumn colors.

The terms "tree" and "shrub" are not meant to apply to groups of plants that are definitely separated. There is a constant overlapping in plant classifications. Perhaps the best way to distinguish a tree and a shrub is this "If the plant has 2 or more woody stems growing out of the ground it may be regarded as a shrub. If it has only one main woody stem it is a tree." The Dogwoods, Elderberries and Haws are examples of plants classified as trees or shrubs.

49. Redbud or Judas Tree (*Cercis canadensis*). The small specimen underneath the common sumach near the edge of the flower bed. It is named from the large numbers of small red flowers which appear before the leaves in the very early spring. Many of the slopes in the parks and along Cliff Drive are very beautiful at that time of the year on account of the large number of Redbuds growing there. The tree has rather typical heart shaped leaves with the veins branching out from the base of the leaf. (Palmately veined) (T. K. Page 151) Tradition says that Judas chose this tree upon which to hang himself.

50. Climbing Bitter Sweet (*Celastrus scandens*) This illustrates the unreliability of common names. There is no apparent origin for the word bitter sweet in relation to any characteristic of the plant. This vine if trained up on a pole and allowed no chance to spread, will thicken its stem and become a sort of tree. It can be remembered and by the rather light green color of the leaves and of course in the fall and winter by the clusters of brilliant red berries, that are used so much to brighten the home in the winter.

51. Anthony Waterer's Spirea (*Spirea bumalda anthony waterer*) Is found in two shades of color, pink and red, quite commonly growing 2 to 3 feet in height. Its crimson flowers bloom from July to early frosts. It is especially usable in front of large shrubs.

52. White Spirea (*Spirea callosa alba*) Has white

flowers and grows about half as tall as the red spirea. In planting a bed one must be careful not to put low growing shrubs behind those that grow taller. In this bed this bed this plan has been followed and the callosa alba is in front.

53. Froebels Spirea. Another variety much like the Anothony Waterer Spirea. The uppermost leaves have a greater tendency to purple colors and are more upright in form.

54. Smoke Tree (*Rhus cotinus*) Is so named because of the fine, feathery fruit which appears in such large quantities on the nature tree that at a distance it resembles a haze of smoke hanging over it. It can easily be remembered by its rounded leaves, which are different from those of any other shrub. The genus names tells us that it is a sumach.

55. Five-leafed Aralia (*Acanthopanax pentaphyllum*) Penta means 5. Phyllum means divisions. It is a shrub that is not commonly seen, the small green flowers produce a 2 to 5 seeded black berry. It grows to a height of 5 to 10 feet becoming quite graceful in form, and is somewhat spiny.

56. Domesticated Peach (*Prunus persica*) Sometimes called Persian Apple. As the scientific name indicated, is a native of the Orient as are many of our fruits. The peach leaf is typically elongated, finely serrated and has pink blossoms early in the spring.

57. Sand bar or Long leaf Willow (*Salix longifolia*) The willows are among the more difficult to identify because of the almost numberless varieties. Notice the serrations on the leaf, separated by a distance of about half an inch. What do you think is the significance of the name "Sand Bar"?

58. Billiards Spirea (*Spirea billiardi*) Grows into quite an upright shape, the ends drooping over and bearing pointed clusters of fine pink flowers, which hang on, after dying, late into the year. This is an easy method of identification. The leaves are sharply serrated.

59. Fragrant Honeysuckle. (*Lonicera fragrantissima*) Tends to scramble about more than the other honeysuckles you have observed. Here again we have the typical honeysuckles characteristics of leathery leaves, rather rounded, not serrated. The older branches have a smooth scaly bark. *Fragrantissima* refers to the unusual fragrance of the blossoms.

60. Butterfly Bush or Summer Lilac (*Buddleia Lindleyana*) Is herbaceous and very interesting, due to the long clusters of fine purple flowers which somewhat resemble the lilac. This shrub gets its name from the fact that butterflies are very frequent visitors to its blossoms. If you enjoy studying butterflies be sure to have one of these shrubs growing in your yard.

61. Amur privet (*Ligustrum amurense*) Has been used again here. It grows into a ball shape and can be made

very trim by constant pruning. In this bed it is used as a sort of "corner post" to these shrubs around the annex.

62. Common or American Elderberry (*Sambucus canadensis*) Is a common shrub growing with very pith stems. Boys like to use them to make whistles. The elderberry has compound, finely serrated leaves. The berries which are seen upon the plant, are an easy method of identification. It may be difficult at times to decide whether a plant has simple or compound leaves. Use this rule. If at the base of the blades, that seem to be part a compound leaf, there are no buds, you may conclude that the leaf is a compound leaf in which case you will find a bud at the base of the main leafstalk. Look for this bud on the elderberry. Do you find buds at the base of the leaflet? If so you may conclude that the leaf is simple. Often at the base of the simple leaf, or the leaflet, of the compound leaf, will be found narrow leaf-like appendages called "stipules". Do not confuse these with buds. The large white heads of flowers have an unpleasant odor.

63. Weeping Willow (*Salix babylonica*) Is one of the most common and undoubtedly the most beautiful of the willows, which you frequently see. Weeping, refers to the drooping of the many fine branches and is a term also applied to any tree which has a similar habit of growth, such as the birch and mulberry. The petioles and young branches tend to have a reddist color, the leaves are finely serrated, dark green on the upper surface and silvery

beneath. This tree is rich in ancient lore. It can be traced, as very few trees can be, back to the distant time of the Psalmist who referred to it in the familiar lines of the 137th Psalm. "By the waters of Babylon we sat and wept----. As for our harps we hanged them upon the willow trees that are therein." The weeping willow is often called Napoleon's Willow because the great commander sat, in exile under its shade and was buried beneath its shade and from which cuttings have been planted far and wide.

64. Skinners Spirea (*Spirea opulifolius*) Is a variety that one does not commonly see. Note that the outline of the leaf, which is smooth, is similar to the Bridal wreath, but with finer serrations.

65. Pussy Willow (*Salix discolor*) Sometimes called the Apple Leafed Willow because of the resemblance of the leaf. We are all familiar with the appearance of the furry buds when the scales drop off in the March. Let one student of each group of 3 or 4 carefully remove one of the scales from the bud, which you will find at the base of the leaf, and expose the silky hairs which give the plant its characteristic appearance in the early spring, when the bud scales come off naturally. Willows can be grown very rapidly. They are among our most ornamental trees and are not injured by insects as much as some other species. They are, however, the despair of botanists. Over 200 species have been classified and there are as many sub-

species that cannot be exactly placed, even by the specialist. The average student may expect to know only a few of the most distinctive kinds.

66. African Tamarix. (*Tamarix africana*) Another very desirable shrub, unique in appearance due to its fragile slender branches reminding one of asparagus. In the spring, the flowers which are pink or lavender, look very much like colored leaves. Here is another excellent illustration of the leaf resembling a twig. Tamarix should be pruned back within a foot and a half from the ground every other year in order to encourage the best form of growth. It is especially used in seaside plantings as it will thrive under the wash of the salt sea spray.

67. Upright Forsythia or Golden Bell. (*Forsythia viridissima*) This is a different species from the one studied at the north end of the campus. There are many varieties of these Forsythias or Golden Bells, but all have a similar shape of leaf and golden appearance of the twigs. Refer back to No. 35, also called Upright Forsythia, but *Forsythia fortunei*. To an "ordinary" observer these shrubs are the same, but as botanists, let us learn to know them as distinct species. First, notice that the average leaf of *Forsythia viridissima* is narrower and smaller. (There will be some variation here as in most plants). Second, the serrations starting at the tip do not extend more than $\frac{1}{2}$ the distance of the leaf. Third, let one student (for each 5 or 6 pupils) who has a knife, secure a short piece

of stem (about 2 inches) near the base or center of the shrub, next, split the twig lengthwise and observe the pith. You find it in tiny cells or compartments. Such pith is called "chambered". The pith of *Forsythia fortunei* is hollow except at the nodes or joints where a very few chambers of pith are seen. What is the vine which you see climbing on this shrub?

68. Wahoo (*Euonymus americana*) Wahoo is of Indian origin, as are many of our plant names. It can be remembered that by the green color of the twigs and the heavy, finely serrated pointed leaves. It is best remembered by the fruits which consist of 3 chambers with crimson berries, each one in a separate compartment. They remind one of the Climbing Bitter Sweet, a near relative.

69. Pearl Bush. (*Exochorda grandiflora*) A native of China. Is one that you will not often see but makes a very desirable shrub. It has unique appearing leaves with an elongated rounded shape and flowers, something like a cherry blossom, which bloom early in May.

Your attention is directed here to the formal garden. Last year, the removal of the annex left an unsightly looking spot. The students of the Botany classes drew plans to show how they would like to have it landscaped. The best one was chosen and used in the landscaping of this plot. Notice the golden arborvitaes, which have been developed into a variety with a pyramidal shape. In the center are 4 varieties of Roses, surrounded by a ring of English Daisies.

70. *Deutzia*, *Pride of Rochester*. This *Deutzia* grows about twice the height of *Deutzia Lemoinei* and has much rougher leaves, but a similar upright growth. It makes an ideal tall hedge.

71. *Euonymus radicans*. At the base of the Eastern arborvitae at the entrance to the Athletic field. Is a close relative to the *Wahoo* growing by the annex. It grows low, tending to spread over the ground, and stays green all of the winter if the weather is mild, which makes it a desirable plant. Which principle of landscaping is illustrated at the entrance to the Athletic Field?

72. *Nine-Bark* (*Physocarpus opulifolius*) Is a member of the *Spiraea* group and is named because of the many layers which peel off from the bark in the older stems. It is sometimes criticized because of the unusually heavy masses of dead fruits (bladder-like pods) which cling to it in the fall.

73. *White Birch* (*Betula alba*) Note the graceful finely cut leaves with the many catkins clinging to the branches. These developed from pistillate flowers. The bark does not get the typical birch appearance until the tree becomes quite matured, when it possess a beauty combining gracefulness of form and unique coloring that few trees equal. Coleridge paid his compliments to it in these words "most beautiful of forest trees--the Lady of the Woods." Do not judge the beauty of fine large specimens of these trees and shrubs by the small, newly planted ones which we must use here.

74. Tulip Tree (*Liriodendron tulip^{ifera}*) Grows quite rapidly and is considered very ornamental because of the large tulip-like blossoms, which appear on the mature tree in May. In their native habitat of Ohio they sometimes grow to a height of 75 feet. The characteristic outline of the leaf is one easily remembered. It is quite free from insects or fungous attacks. (Text page 251)

75. The Golden Currant (*Ribes aurea*) Has a leaf with 3 main lobes and small yellow flowers in the spring that start, with the leaves but soon outgrow them. The part of the blossom, showing its flame of yellow are the sepals and not the petals.

76. Snowberry (*Symphoricarpos racemosus*) The fruits which you see maturing upon the ends of the twigs will develop into large snow-white berries, which gives the plant its name. It is much like the Indian Currant, to which it is closely related. It does not spread so much and has in general large leaves. The flowers are tiny pink bells and appear from July to September.

77. Hop Vine (*Humulus lupulus*) This vine was transplanted from a road side in the form of a long root, and in time will spread far and wide over this fence. Feel the extremely rough texture of the leaf and notice the fine peculiarly shaped fruits which are used in the making of hops in brewing liquors in European countries. It has greenish inconspicuous flowers.

78. Five-leaf Ivy-Woodbine-Virginia Creeper. (Am-

pelopsis quinquefolia) The scientific name refers to the 5 leaflets that go to make up this palmately compound leaf. This is one of the finest of all vines because of its extreme hardiness, its rapid growth and beautiful foliage. Dark purple berries will be found clinging to a matured vine. Buildings are sometimes entirely covered with this Ivy which climbs by special organs called tendrils. The leaves turn a deep crimson in the Fall.

Let us study next the landscaping which you see around the score board. Note how well the planting sets off in an artistic way what would otherwise be an "eye-sore" in the Athletic field. Notice how the tall pointed Junipers are intended to relieve the square appearance of the score board. The graceful curving shape of the bed in which are 2 varieties of Weigelas serves much the same purpose as a frame does to a picture.

79. Red and Pink Weigela (*Diervilla florida*) The Weigelas are very beautiful in the spring when their long tapering blossoms open up. This shrub may be confused by the student often times with the hydrangea. Avoid this by remembering that the Weigela has usually a purple border around the leaf and has new shoots growing at the bases of the leaves.

80. Common Clematis (*Clematis paniculata*) There are many varieties of Clematis, some having purple, some white, and one variety has red blossoms. The pinnately compound leaflet can be remembered as being usually somewhat cupped or curled up at the base and the veins radiate from the base

of the leaflet. The flowers are in fine lacy masses that resemble an immense fleece.

In the bed to the West of the Clematis you will find plants that you have studied. See if you can identify all of them.

81. Japanese Honeysuckle (*Lonicera Halliana*) Do you recognize the similiarity between the leaves of this honeysuckle and the other related species that you have studied? This vine displays a remarkable example of adaptation by with holding host of its fragrance in the daytime but releasing it in full during the evening and early morning. Why? (Text Par. 118) The leaves are almost evergreen, especially if growing in a south-east corner.

82. White Kerria (*Rhodotypus kerridoes*) At the base of the climbing honeysuckle. Is related to Kerria Japonica which you studied previously but has larger leaves although with similar serrations. They remind one somewhat of the elm leaf. It has white blossoms about half an inch across.

Look across the street at the fine specimens of *Alnus Glandulosus* and *Populus nigra Italica*.

83. Norway Spruce (*Picea abies*) Spruces can be distinguished from the pines by noting that the needles are separate, while in the pines they are in clusters of 2 or more. Since this tree is a native of northern Europe you would expect it to be as hardy as the races of trees and people are from that region. This spruce is the one most commonly planted. Many varieties of it have been produced. It grows up to 150 feet in the Alps where it is the prevailing tree.

From it resin is obtained.

Spruces, firs, pines hemlocks and other conifers do not shed their needle-like leaves at the approach of winter as do the deciduous trees (ashes, oaks, maples, etc.) The conifers have the rather distinctive method of shedding then "on the installment plan" that is few at a time throughout the year.

84. Douglas Fir (*Abies concolor*). Firs may be identified in the following manner. Examine one needle and try to roll it between the fingers. You will see that it is flat. Now examine a needle from the spruce, which you have just studied, and you will see that it will roll easy and is 3 sided. All firs have flattened needles. In a mature tree they are much more easy to identify. This tree is one of the most valuable of all Western timber trees. (Text Page 305) The balsam (resinous material) accounts for the "woody" fragrance of fir forests and is used much in throat medicines.

85. Carolina Poplar-Cottonwood (*Populus deltoides*) *Deltoides* refers to the shape of the leaf which resembles somewhat the triangular Greek letter "Delta." It is one of the most rapidly growing of all our trees, as are all the poplars, but is not very long-lived. It is very susceptible to boring insects and is easily broken by storms. It is often noticed that the leaves of poplars quiver when other tree leaves are hanging motionless. This is due to the special structure of the petiole. Examine it and see how wide it is where attached to the branch but narrow

at the base of the leaf. This form of petiole accounts for the leaf being easily moved by the wind.

86. Silver or Soft Maple (*Acer saccharinum*) This is a good example of a tree struggling to live. Notice how the stem has become diseased. Find the holes where the borers have entered. These boring insects feed upon the living tissues in the tree and very often kill it. This infection undoubtedly originated at the place where you see a branch was cut off and should have been covered with tar or paint to prevent the entrance of insects or fungus diseases. The tree is doing its best to live however and has sent up new shoots from the base of the trunk. Notice the deeply lobed leaves. This is a faster growing tree than the Sugar Maple, but has softer wood and it is much more susceptible to insects as you see illustrated here so well. When the leaves are turned up by the wind they present a silvery appearance, especially at a distance. What country has as its national song "The Maple Leaf Forever?"

87. Black Walnut (*Juglans nigra*) Can be remembered by its compound leaves with finely serrated leaflets, which have the walnut odor when crushed. Note the large leaf scars where the petioles separated from the stem and, above the leaf scars, the buds which will later develop into leaves. The nut trees have long drooping staminate and smaller pistillate flowers, the latter developing into the fruit or nut. The Black Walnut is highly prized in

the manufacture of musical instruments and fine furniture. A large walnut tree in good condition would be worth easily \$200.00 "on the stump."

88. Basswood or Linden (*Tilia americana*) This little tree which we hope some day will be a much better specimen will at least show you the typical shape of the basswood leaf. Notice how it is sharply serrated, rounded, pointed at the ends, and how the petiole is flanked by two lobes at the base of the leaf. Linnaeus (see No. 27) has his name from a favorite Linden tree that stood by his peasant fathers home. In Wurtenburg, Germany, a linden tree, which was used as a "temple of justice" in the middle ages, lived almost a thousand years. Public questions were discussed under it.----Now that you know the leaf, look for large, fine specimens in the parks and study the interesting winged fruits. (Text Page 151)
Where is "Unter den Linden"?

89. Thunbergs Spirea (*Spirea Thunbergi*) Is different from all other spireas because of its delicate form like foliage. It is one of the very first shrubs to bloom in the spring opening its masses of fine white flowers, which are scattered along the stem. Remember that these blossoms which are opened by the first warm days of March started to grow during the spring of the preceding year.

90. Lemoines Mock Orange (*Philadelphus Lemoinei*) You will see at once 2 points of similarity between this mock orange and the one which you studied previously. First,

the red tinted stems. Second, the fine teeth in this margin of the leaf separated by a distance of about half an inch. In this rock orange the leaf is much narrower and more pointed. As a rule the margin is the most reliable part of the leaf to remember since it varies least. In this case however, the teeth will not be found to be always present.

91. Western Plane Tree or Sycamore. (*Platanus occidentalis*) Occidentalis always refers in a scientific name to the Western hemisphere as the native habitat. Orientalis to the Orient or the Eastern hemisphere. This is also an Eastern sycamore. Both species can be recognized almost as far as it can be seen by the bark which scales off in patches leaving large areas of yellow and dark bark. The leaves resemble somewhat the Hard Maple, but are much larger. No relative to this tree is native in this country. Its flowers are staminate and pistillate, the latter growing into balls which give the tree another common name, the Buttonwood. It is most abundant along the Ohio river and its tributaries. "Thru the sycamore the candle lights are gleaming on the banks of the Wabash, far away." It is unfortunate that this specimen is not doing well. Look for the fine row of sycamores the next time you are between Linwood Blvd and 31st on Prospect.

92. Tree of Heaven (*Ailanthus glandulosus*) One of the most interesting of all trees. It is of Chinese origin and gets its name from the high regard that the Orient-

tals had for its shade. It grows almost anywhere, very rapidly and is especially immune to smoke and dust. Notice toward the center of town, where few trees are able to live, these Trees of Heaven will be seen growing up in alleys, between houses and brightening the dingy appearance of many streets by their beautiful fern-like, compound leaves. You will confuse this leaf with the walnut if you do not remember that the Walnut leaflets are finely serrated while those of the Tree of Heaven are not. Look closely at the bark, and observe the many tiny pores. These are the lenticels. (Text Page 103) Study carefully the scars shaped like a horse shoe, where once were attached these large compound leaves. Note the small projections that form a semi-circle around the outer part of the leaf scar. These represent the points where the fibrovascular bundles (Text Par. 11) which originate in the roots and run up through the stem, entered the leaves, forming the veins. Trees of Heaven which bear staminate flowers have a disagreeable odor, so pistillate trees are preferable. The leaf scar can be thought of as the plants signature. If one were sufficiently familiar with these leaf scars he could identify any plant by the structure since they are never the same on any 2 species. Notice that the buds, above the leaf scar, are partially concealed by the bark as a protection against the winter cold.

93. Yellow Pine (*Pinus ponderosa*) Long needle-like leaves in clusters of 3. Do these evergreens look pleasing

to you growing on this slope? They should appear natural since they are so commonly found growing on the mountain side. Notice how the soil has been banked to hold a water supply for the root system. This pine lives to be 300 years old in its native range.

94. Scotch Pine (*Pinus sylvestris*) Needles twisted and somewhat flattened, 2 in a cluster. The more mature tree can be easily identified by the brown papery bark on the larger limbs and which is somewhat noticeable even on this small specimen. Some "wit" has remarked that this tree gets its name "because it does not give in the wind." Perhaps a more scientific reason is that it is the only conifer that is native to Scotland or England. You should be able to identify 4 specimens at the south end of the bleachers.

Test Over Section II

Multiple Choice Test

Place in the parenthesis () before the statement, the number which corresponds to the best answer.

- () 1. The Japanese Quince blooms in the: (1) early Spring; (2) Late Fall; (3) Late Spring; (4) Mid Summer.
- () 2. The best practice in Landscaping is to arrange the shrub beds and trees: (1) in very precise order; (2) extremely irregular; (3) so as to avoid straight lines; (4) follow geometrical patterns.
- () 3. A shrub that can be remembered by its thorns is the: (1) Froebel's Spirea; (2) Rosemallow; (3) Butterfly Bush; (4) Gooseberry.
- () 4. Plants are poisonous to the skin of some people because of (1) the amount of water which they evaporate; (2) presence of prickly spines; (3) fluid or dust-like material which they give off; (4) how much people fear them.
- () 5. Flowers of the Red Bud tree appear: (1) before; (2) one month after; (3) same time; (4) three months after the leaves come out.
- () 6. Anthony Waterers Spirea usually grows in height about: (1) one foot; (2) less than a-foot; (3) three feet; (4) five feet.
- () 7. The Smoke Tree is so named because of the attrac-

- tive structure of the: (1) leaf; (2) stems; (3) fruits; (4) roots.
- () 8. Peach leaves are: (1) elongated; (2) rounded; (3) three feet; (4) roots.
- () 9. The stems of the American Elderberry are: (1) solid; (2) filled with sap; (3) pithy; (4) entirely hollow.
- () 10. Pussy Willow leaves most closely resemble the leaves of the: (1) Dogwood; (2) Apple; (3) Pearl Bush; (4) White Birch
- () 11. To produce the best form, Tamarix should be pruned back within: (1) 1 and 1/2 feet of the ground; (2) twice a year; (3) every Fall; (4) every other year; (5) once each 4 years.
- () 12. The plant whose leaves stay green late in winter is the: (1) Yellow Willow; (2) Virginia Creeper; (3) Basswood; (4) Honeysuckle.

Name Test

Place in each parenthesis () the number which you find in front of the corresponding common name, which is arranged in alphabetical order, to save you time in finding it. Two scientific names will not be used.

Common Names

Scientific Names

- | | |
|-------------------------|-------------------------------|
| 1. American Elderberry | () Cydonia japonica |
| 2. Black Walnut | () Hibiscus moscheutos |
| 3. Butterfly Bush | () Rhus toxicodendron |
| 4. Climbing Bittersweet | () Ailanthus glandulosus |
| 5. Douglas Fir | () Acanthopanax pentaphyllum |

- | | |
|-----------------------|------------------------------------|
| 6. Five-leafed Aralia | () <i>Juglans nigra</i> |
| 7. Hop Vine | () <i>Buddleia lindleviana</i> |
| 8. Japanese Quince | () <i>Rhus glabra</i> |
| 9. Norway Spruce | () <i>Abies concolor</i> |
| 10. Pearl Bush | () <i>Cercis canadensis</i> |
| 11. Poison Ivy | () <i>Picea abies</i> |
| 12. Red Bud | () <i>Salix longifolia</i> |
| 13. Rosemallow | () <i>Celastrus scandens</i> |
| 14. Sand bar Willow | () <i>Betula alba</i> |
| 15. Smoke Tree | () <i>Thus cotinus</i> |
| 16. Smooth Sumach | () <i>Ampelopsis quinquefolia</i> |
| 17. Tree of Heaven | () <i>Humulus lupulus</i> |
| 18. Tulip Tree | () <i>Exochorda grandiflora</i> |
| 19. Virginia Creeper | () <i>Liriodendron tulipifera</i> |
| 20. Wahoo | () <i>Salix babylonica</i> |
| 21. Weeping Willow | () <i>Sambucus canadensis</i> |
| 22. White Birch | () <i>Euonymus americana</i> |
| | () <i>Berberis thunbergi</i> |
| | () <i>Platanus occidentalis</i> |

Test Over Section II (con't)

If you think the statements below are true put an "T" in front of them in the margin. If they are false put an "F". Do not guess. Do not spend much time on any one.

1. Ornamental plants are generally reproduced from seeds.
2. Open spaces should be allowed in proper landscaping.
3. The flower of the Rosemallow is made up of many layers of petals.
4. The leaves of the Froebels Spirea are uniformly green.
5. Tiny leaves, clasping the stem of the Japanese quince, are called "ears".
6. The root system of the Wild Plum is used, by grafting upon it some desired variety of shrub.
7. Leaves of the Yellow Kerria drop off early in the Fall.
8. A shrub is a plant with one main woody stem.
9. Poison Ivy is, botanically, not an ivy but a sumach.
10. White Spirea is well adapted to border planting.
11. The name "Bittersweet" explains a characteristic of the plant.
12. The Five-leaf Aralia has very conspicuous flowers.
13. Billiards Spirea can be identified by the pointed clusters of dead flowers.
14. The Peach is a native of the Orient.
15. In a compound leaf, buds will be found at the base of the leaflets.
16. Sumachs have exceptionally rich autumn colors.
17. Rules in landscaping are meant to be followed without exception.

18. There is no definite boundary line between trees and shrubs.
19. The Redbud has palmately veined leaves.
20. Tamarix leaves have a slender twig-like appearance.
21. The stems of the Butterfly Bush live throughout the winter.
22. Honeysuckles are most fragrant in the daytime.
23. Evergreens do not shed their leaves.
24. The Hop Vine has leaves that have unusually rough texture.
25. Leaves of the Pearl Bush are narrow and very pointed.
26. The Snowberry is closely related to the Indian Currant.
27. Euonymus radicans has a low, spreading growth.
28. The White Birch has staminate and pistillate flowers.
29. The Soft Maple grows slower than the Hard Maple.
30. Fruits of the Virginia Creeper consist of dark purple berries.
31. The needles of all fir trees are flat and pointed.
32. Thunberg's Spirea is one of the last shrubs to bloom in the Fall.
33. The needles of the Scotch Pine are twisted and in clusters of 2.
34. The Wahoo is used for the brewing of liquors.
35. The Carolina Poplar is especially susceptible to boring insects.
36. The Sycamore can be recognized by its bark at a great distance.

37. Smoke and dust in the air are especially harmful to the Tree of Heaven.
38. Prominent serrations are found on the leaf margin of the Linden.
39. Minute projections upon the leaf scar are usually caused by insect sting.
40. The fruit of the Black Walnut develops from the Staminate flower.

Matching Test

In the parenthesis () before each descriptive phrase put the number of the term which best describes or illustrates it. Two descriptive phrases will be left unused.

<u>Terms</u>	<u>Descriptive phrases</u>
1. Purple leaf Plum	() A general rule in landscaping.
2. Conifers	() Veins that branch out from base of leaf
3. <u>Palmate</u>	() Plant with only one main woody stem
4. Stipules	() Pores in the bark by which the tree breathes.
5. Fibrovascular bundles	() Structures that strengthen the plant.
6. Leaf scar.	() Long needle sleeves in clusters of 3.
7. Scotch Pine	() An ornamental tree with unusual foliage.
8. Thunbergs Spirea	() Presents a silvery appear-

- 10. Douglas Fir
 - () Once when turned by the wind.
 - () Horse shoe shaped markings on the stem
- 11. Ninebark
 - () Shrub with fern-like foliage.
- 12. Yellow Pine
 - () Narrow leaf-like appendages at base of leaflet.
- 13. Tree
 - () Plants that are generally parasites
- 14. Soft Maple
 - () A tree whose resin gives it a strong pleasing odor
- 15. Lenticles
 - () Thread-like structures that lead from roots into leaf.
- 16. Linden
 - () Only native Conifer in England
 - () Plant which retains large masses of fruit in the fall.