

A Quantitative Analysis of Five General
Science Texts


By

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K. S. T. C., Pittsburg, 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 de-
gree of Master of Science in
Education.

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Sept. 15, 1931

ACKNOWLEDGEMENT

The writer wishes to express his appreciation to Doctor F. P. OBrien, Professor of Education, for his instructions and helpful suggestions.

Also special mention is made of the encouragement and assistance of his wife, Blanche G. Broadlick.

J. N. B.

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A QUANTITATIVE ANALYSIS OF FIVE
GENERAL SCIENCE TEXTS

INTRODUCTION

Today, the field of general science textbooks constitutes a land of plenty. Not only is the supply plentiful, but varied as well. Authors of general science textbooks declare in their prefaces their intention to produce books differing from those of their predecessors. A better book, in the sense of a book better meeting the needs of a beginner in science, is the ambition of each writer.

Most pupils and many teachers think that the text must be followed and covered from beginning to end. Undoubtedly the text determines to a very great extent what subject matter is taught and so the question of the text used, becomes of the greatest importance.

Many teachers never have an opportunity to assist in any way in choosing a text. It is my good fortune to be in a system where the teacher's views are respected in the matter of textbook selection. It is my purpose through this analysis to gather data that I shall use in making a selection of a text to be used in my classes.

CHAPTER I

The Problem and Method of Research

Problem

This study concerns itself primarily with two features of the contents of five general science textbooks namely, kind and amount of material.

Through a desire to know the kind and amount of material in these texts are developed the real issues of my task. That is, I wish to learn:

1. What kinds of material are included in the texts?
2. Is this material found in all the texts?
3. How many pages of each type of material does each text contain?
4. How does the amount of space devoted to illustrations compare with the amount of space devoted to printed matter?
5. What is the accumulative ranking by pages in these texts of Astronomy, Bacteriology, Botany, Chemistry, Hygiene, Physical Geography, Physics, Physiology and Zoology?

6. Is it possible to rank the texts on the basis of pages of different types of material they contain? If so, how do the texts rank?

Publishers were kind in offering their books to be studied, hoping their's would show up well and receive a favorable report for adoption.

The texts to be considered are:

- (1) Our Environment
 How We Use and Control It
 By
 George C. Wood
 And
 Harry A. Carpenter
 (Allyn and Bacon)
- (2) Introduction To Science
 By
 Otis William Caldwell
 And
 Francis Day Curtis
 (Ginn and Company)
- (3) Science Of Home
 And Community
 By
 Gilbert H. Trafton
 (The Macmillan Co.)
- (4) Everyday
 Problems In
 Science
 By
 Charles John Pieper
 And
 Wilbur Lee Beauchamp
 (Scott Foresman and Company)

5. Hygiene: The science of the preservation of health.
6. Miscellaneous: Mixed, consisting of several diverse things.
7. Physical Geography: The science that treats of the exterior physical features and changes of the earth, in land, water and air.
8. Physics: This science is comprised of the closely related sciences of mechanics, heat, electricity, light and sound, and to deal only with those phenomena of inanimate matter, involving no change in chemical composition.
9. Physiology: The branch of Biology dealing with the processes, activities, and phenomena incidental to and characteristic of life or of living organisms; the study of the function of the organs and the parts during life. In this analysis this division shall include Anatomy.
10. Zoology: The science of animals; that division of biology which deals with the animal kingdom.
11. Exercises: This division shall include demonstrations, experiments and problems. Page 75.
12. Drawings: Page 75.
13. Plates in color: Page 76.

14. Photographic Reproduction: A picture, the original of which was made by means of a camera. Page 77.
15. Graphs: Diagrams which symbolize a system of interrelations. Page 74.
16. Tables: A collection of numbers, signs, or items in condensed form. Page 78.
17. Questions: Page 81.
18. History: A systematic record of past events in the field of science.
19. Summary: An abstract, abridgement, or compendium, containing the sum or substance of a fuller account; an abridged statement.
20. Glossary: Explanations of words and passages of a work or author.
21. Reference: A specific direction of the attention; a sign or direction referring the reader to another passage or book.
22. Student Aids: Help or assistance through explanatory notes.
23. Preface: A brief introduction at the beginning of a book
24. Contents: The topics or matter treated in a document or book.

- 25. List of Illustrations: A list, giving the name of the illustration and the page number where it may be found.
- 26. Index: An alphabetical list of matter, as in a book.

A scheme will be employed that will record upon each page of each text the judgment of the analyst. These judgments, as to the type of material and space used in each text, are recorded upon a data sheet and then transferred to a summary sheet.

From the summary sheets, tables and graphs of the data will be presented to assist in a study of the kinds and quantities of material found in each of the texts.

The plan for measuring the space occupied by printed matter of the fact-material type will be; first, ascertain the number of words and then reduce that number to the equivalent in terms of standard pages. The amount of space devoted to other types of material such as drawings, exercises, etcetera, will be measured in square centimeters and this in turn reduced to a standard page of a definite number of square centimeters.

CHAPTER II

Related Studies

Textbooks are essential for effective learning by the high school pupil.

"Textbooks," according to Douglass¹, "if rightly and intelligently used permit of a tremendous saving of time and energy to both teacher and pupil. They furnish outlines, organization and facts beyond number, the task of working up even the main part of which, if left, to the individual teacher or even the individual school would constitute a very heavy burden."

The important position held by the textbook in our educational system is pointed out by Butcher:²

"In America the textbook has more importance than in other countries. It has undue importance, but necessarily so in a nation one-half of whose teachers, 300,000, have had no special professional preparation for the work of teaching. Under such teachers the textbook becomes all-important. It must be subject-matter and teacher. If the textbook does not lead, there is no guidance."

Bode³ calms our fears concerning the acceptance of textbooks by saying:

"Our worship of the textbook, then appears to be a joint product of plain ignorance and an ignorant veneration of tradition. A combination of this sort can scarcely fail to make the world safe for the textbook. Some persons will doubtless be

1 Douglass, Harl R. Modern Methods in High School Teaching, p. 13.

2. Butcher, Thomas W. "Some Difficulties Attending The Work Of A Textbook Commission," Elementary School Journal, XIX (October, 1918), p. 500-505.

3 Bode, B. H. "The Use Of Textbooks," Educational Research Bulletin, (January 11, 1928) p. 10-11.

disturbed by this outlook, but they may be reassured by being told that the modern textbook can present a certificate of character to show that it is entitled to confidence. The older textbooks were to a considerable extent the product of guesswork, but our up-to-date textbooks aim to leave nothing to chance or opinion. They have the indorsement of science. Every precaution is taken to make sure that the evil which they contain is kept below the danger line of one-half of one per cent. We need no longer fear to take our textbooks straight."

Educators are beginning to realize that better methods are needed for the selection of textbooks. In the past we had such practices as the head of a school system making the selection of the texts to be used by the children of his community. In other cases, the board of education decided this important question with a letter or no advice from the superintendent or teaching staff. Often textbook salesmen sold the books to the board of education or administrator. Such practices are apparently wrong. We should not have textbooks sold to us but should intelligently select and buy them.

During the past few years a number of articles have been written due to an increased interest in the scientific study of the qualities of textbooks. One by Judd⁴ dealing with the analysis of textbooks, and another by Maxwell⁵ concerning prevailing standards and justifiable

4 Judd, C. H. "Analyzing Textbooks," Elementary School Journal, XIX (October, 1918) p. 143-154.

5 Maxwell, C. "The Selecting Of Textbooks," School And Society, IX (January 2, 1919) p. 44-57.

standards of textbook selection were among the first. Two unsigned editorials appearing in representative magazines⁶ have directed our thinking along sound lines. A pioneer research project in vocabulary burden of textbooks⁷ was carried on by Lively and Pressey. In 1922 Franzen and Knight⁸ wrote a book on "Textbook Selection." Also in 1922 appeared a score card for judging the value of general science textbooks by Peterson⁹. A textbook scorecard¹⁰ was devised by Otis in 1923 which represents an attempt to make textbook measurement objective. Andrews developed a list of one hundred items¹¹ which, in his opinion should be considered in selecting a textbook. Donovan¹² in 1924 discussed methods of selecting textbooks.

6 "Textbooks, Their Cost and Improvement," Journal of Educational Research, I (March, 1920), p. 222-224.

"Teachers Aid in Textbook Selection," American School Board Journal, LXXII (June, 1926), p. 128.

7 Lively, Bertha A., and Pressey, S. L. "A Method For Measuring the Vocabulary Burden on Textbooks," Educational Administration and Supervision, IX (October, 1923), p. 389-398.

8 Franzen, R. H. and Knight, F. B. Textbook Selection, p. 1-94.

9 Peterson, Allen "A Score Card For Judging the Value of General Science Textbooks," School Science and Mathematics, (May, 1922),

10 Otis, E. M. "A Textbook Scorecard," Journal of Educational Research, VII (February, 1923), p. 132-136.

11 Andrews, H. "Selecting A Textbook," American School Board Journal, LXXIII (September, 1926), p. 67, 152, 154, 157-158.

12 Donovan, H. L. "How To Select Textbooks," Peabody Journal Of Education, II (July, 1924), p. 1-11.

Johnson¹³ contributed his checking list for high school textbooks in 1925. Powers¹⁴ made a study of the vocabularies of high school science textbooks in 1925. Weber¹⁵ in 1926 discussed the methods used in the analysis of textbooks. A scorecard that is receiving widespread publicity was submitted in 1926 by Frank¹⁶. An objective study of the principles and applications in twenty general science textbooks published 1915 to 1926 was released in 1928 by Heineman¹⁷. Also in 1928 appeared Fuller's¹⁸ book on "Scientific Evaluation of Textbooks." Two types of committees are called for in Studebaker's¹⁹ plan for the examination and selection of textbooks which he presented in 1929.

13 Johnson, F. W. "Checking List For High-School Textbooks," Teachers College Record, October, 1925.

14 Powers, S. R. "The Vocabularies of High School Science Textbooks," Teachers College Record, (January 1925), p. 368-382.

15 Weber, Oscar F. "Methods Used In The Analysis Of Textbooks," School and Society, (November 27, 1926), p. 678-684.

16 Frank, J. O. How to Teach General Science, p. 68-72.

17 Heineman, Ailsie M. "A Study Of General Science Textbooks," General Science Quarterly, (November, 1928), p. 11-23.

18 Fuller, Florence D. Scientific Evaluation Of Textbooks, p. 1-89.

19 Studebaker, J. W. "A Plan For The Examination And Selection Of Textbooks," American School Board Journal, (June, 1929), p. 152.

An outstanding contribution to the science of textbook analysis is that of Dr. Curtis published in 1929²⁰. A study of the results of many other workers who had analyzed the subject matter of science texts was made. Dr. Otis W. Caldwell, Professor of Education, and Director of Institute of School Experimentation of Teachers College, Columbia University, has this to say concerning Dr. Curtis' book:

"This is the first study of its kind. There have been many excellent analyses which help to determine subject-matter content. This is a synthesis of the available analyses and other relevant course materials dealing with a special subject. The quality and the magnitude of the computational work essential to the proper appraisal of the different elements of this synthesis may be suggested by the fact that Table VII presents several thousand items of information the determination of many of which demanded several separate computations."

²⁰ Curtis, Francis D. A Synthesis And Evaluation of Subject-Matter Topics In General Science, p. 1-83.

CHAPTER III

Presentation and Interpretation of Data

Data gathered from each text, on the twenty-six items listed in the previous chapter, were entered on data sheets. A sample set of data sheets, as used in analysis of one text, is shown on page 83 of the Appendix.

The information gathered by means of the data sheets was compiled on a summary sheet. Summary sheets used in this study are shown on pages 93 to 97 of the Appendix.

Table I indicates the method used in securing units of measurement for the study. For each text, the number of lines per page was counted and the average for the five texts was found to be thirty-five. One hundred complete lines of informational material---reading-for-facts material as found in Astronomy, Bacteriology, Botany, Chemistry, Hygiene, Miscellaneous, Physical Geography, Physics, Physiology and Zoology---were marked and the words counted in each text. The average number of words

per line as computed for the texts was eleven. With these data, a page that can be used as a means of comparison was calculated to have 385 words.

Since the average area of a page for the five texts is 146.93 square centimeters, 150 square centimeters will be used as the area of a standard page in this study.

TABLE I DATA USED IN SECURING NUMBER OF WORDS AND
AREA IN SQUARE CENTIMETERS OF AN AVERAGE
PAGE FOR THIS STUDY

	W. & C.	C. & C.	T.	P. & B.	C. C. & T.	Average
Lines per page	36	33	33	36	37	35
Words on 100 lines	1072	1034	1134	1134	1128	1100
Words per line	10.72	10.34	11.34	11.34	11.28	11.
Length* of line	9.4	9.4	10.2	9.2	10.1	9.66
Depth* of page	15.2	14.6	15.5	15.1	15.6	15.2
Area [!]	142.86	137.24	158.10	138.92	157.56	146.93

* In centimeters

! In square centimeters

Note 1. The texts analyzed are referred to by using authors' initials.

W. & C. --- Wood and Carpenter

Our Environment

How We Use and Control It

C. & C. --- Caldwell and Curtis

Introduction to Science

T. --- Trafton

Science of Home and Community

P. & B. --- Pieper and Beauchamp

Everyday Problems in Science

C. C. & T. --- Clement-Collister and Thurston

Our Surroundings

Note 2. A page as used in the remainder of this study consists of 385 words or 150 square centimeters.

CHART 1. COLOR SCHEME USED IN MARKING PARAGRAPHS
OF THE DIFFERENT DIVISIONS OF SCIENCE MATERIAL

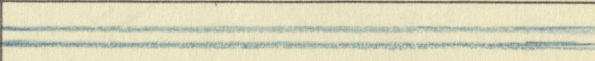
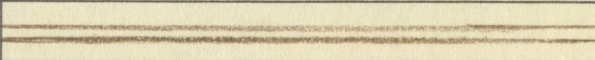
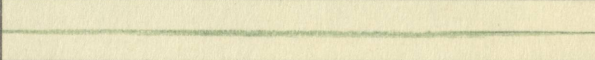
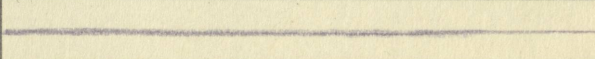
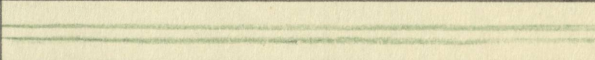
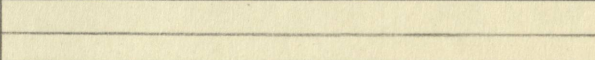
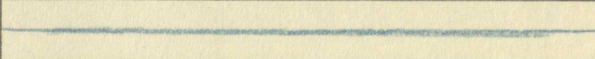
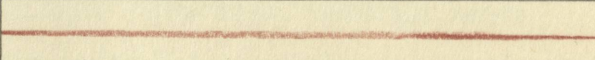
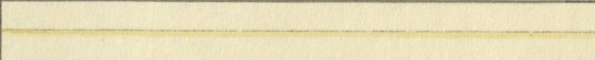
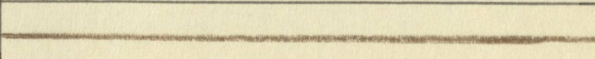
Division	Symbol
Astronomy	
Bacteriology	
Botany	
Chemistry	
Hygiene	
Miscellaneous	
Physical Geography	
Physics	
Physiology	
Zoology	

Chart 1. contains the divisions of subject matter used in this analysis. This subject matter is what some would term as informational or fact-material. It will be listed under "words" in the tables and graphs that follow.

Two parallel blue lines were used to mark fact-material judged to belong to the division of Astronomy, two parallel brown lines were used to mark Bacteriology, a green line was used to mark Botany, a purple line was used to mark Chemistry, two parallel green lines were used to mark Hygiene, a lead pencil line was used to mark Miscellaneous material, a blue line was used to mark Physical Geography, a red line was used to mark Physics, a yellow line was used to mark Physiology and a brown line was used to mark Zoology.

A sample page containing Physics material will be found on page 74 of the Appendix. The number of lines as counted were 22 and the words of short and broken lines were 47. This is written on the margin of the page as $22\frac{47}{}$.

CHART 2. COLOR SCHEME AND SYMBOLS USED IN MARKING
DIVISIONS OF SUBJECT-CONTENT

Divisions	Symbol
Exercises	+
Drawings	D
Plates in Color	P.C.
Photographic Reproductions	P.R.
Graphs	G.
Tables	T.
Questions	Q.
History	Hist.
Summary	S.
References	R.

Using the same color scheme as is indicated in Chart 1, a set of symbols were employed to designate different divisions of subject matter. The symbols are shown in Chart 2. To designate the double line color reference as in Chart 1 the symbols were twice underlined excepting that + was made # .

For purposes of analysis as to the amount of space occupied by each division of subject-content the symbols shown in Chart 2 were used. All passages were marked to indicate their classification. The space was measured in square centimeters.

TABLE II SUMMARY OF PAGES OF DIFFERENT KINDS OF MATERIAL

	W. & C.	C. & C.	T.	P. & B.	C. C. & T.
Astronomy	10.01	36.35	20.24	36.49	22.56
Bacteriology	17.46	15.84	11.22	17.83	15.13
Botany	51.57	66.54	46.18	0.00	53.67
Chemistry	18.91	45.08	15.23	25.05	23.37
Hygiene	142.12	49.96	111.04	125.91	113.59
Miscellaneous	82.23	28.99	64.58	44.15	26.70
Physical Geog.	42.78	85.59	38.19	36.75	54.31
Physics	235.75	172.39	189.14	230.46	193.46
Physiology	12.61	12.86	0.00	0.00	40.77
Zoology	17.08	22.52	10.90	0.00	19.14
Preface	5.24	3.66	5.79	6.94	3.87
"Contents"	4.77	7.32	2.63	4.60	10.50
List of Illus.	12.07	0.00	0.00	0.00	0.00
Student Aids	4.57	10.98	1.50	18.98	0.00
Glossary	0.00	16.92	0.00	0.00	31.51
Index	16.79	16.47	5.48	18.52	22.58
Total	674.96	595.47	522.12	565.68	631.16

Table II contains the number of pages of different kinds of material found in the five texts. The first ten items are considered as subject-matter.

This information was gathered from the summary sheets shown in the Appendix on pages 93 to 97.

TABLE III DIFFERENT KINDS OF MATERIAL EXPRESSED IN
PERCENTAGES OF TOTAL PAGES IN THE TEXT

	W. & C.	C. & C.	T.	P. & B.	C. C. & T.
Astronomy	1.48	6.10	3.87	6.49	3.57
Bacteriology	2.58	2.66	2.14	3.15	2.39
Botany	7.64	11.17	8.84	0.00	8.50
Chemistry	2.80	7.57	2.91	4.42	3.70
Hygiene	21.61	8.39	21.26	22.25	17.99
Miscellaneous	12.03	4.86	10.45	7.80	4.23
Physical Geog.	6.33	14.39	7.31	6.49	8.60
Physics	34.92	28.95	36.22	40.74	30.65
Physiology	1.86	2.15	0.00	0.00	6.45
Zoology	2.53	4.45	2.08	0.00	3.03
Preface	.77	.61	1.10	1.22	.61
"Contents"	.70	1.22	.50	.81	1.66
List of Illus.	1.78	0.00	0.00	0.00	0.00
Student Aids	.67	1.84	.28	3.34	0.00
Glossary	0.00	2.84	0.00	0.00	4.99
Index	2.48	2.76	1.04	3.27	3.57
Total	99.9	99.9	99.9	99.9	99.9

The number of pages of each kind of material as shown in Table II is shown as per cent of the entire text in Table III. That is, 10.01 pages of Wood and Carpenter text are devoted to Astronomy which is 1.48 per cent of 674.96 pages.

TABLE IV SUMMARY OF RANKINGS ACCORDING TO PERCENTAGES
OF DIFFERENT KINDS OF MATERIAL AS FOUND IN
PRECEDING TABLE

	W. & C.	C. & C.	T.	P. & B.	C. C. & T.
Astronomy	5	2	3	1	4
Bacteriology	3	2	5	1	4
Botany	4	1	2	5	3
Chemistry	5	1	4	2	3
Hygiene	2	5	3	1	4
Miscellaneous	1	4	2	3	5
Physical Geog.	5	1	3	4	2
Physics	3	5	2	1	4
Physiology	3	2	4	4	1
Zoology	3	1	4	5	2
Preface	4	2	5	3	1
"Contents"	4	2	5	3	1
List of Illus.	1	2	2	2	2
Student Aids	3	2	4	1	5
Glossary	3	2	3	3	1
Index	4	3	5	2	1

The text having the highest per cent of its pages devoted to a division as indicated in Table III is given the highest rank for the division and is shown by the numeral "1" in Table IV. In the Pieper and Beauchamp text, 6.49 per cent of its pages are devoted to Astronomy, which is higher than the other texts, and is given first rank.

TABLE V SUMMARY OF PAGES OF SUBJECT-CONTENT

	W. & C.	C. & C.	Trafton	P. & B.	C. C. & T.
Drawings	106.49	69.85	69.98	74.22	39.29
Photo. Repro.	82.35	61.74	0.00	44.68	52.60
Plates in Color	4.77	.91	0.00	0.00	1.05
Graphs	9.82	4.94	12.94	6.15	0.00
Tables	9.01	2.36	18.47	8.15	10.85
Exercises	102.10	84.85	50.11	85.95	48.13
Questions	30.19	23.80	10.54	2.13	37.58
"Words"	266.04	343.78	328.46	291.40	385.16
History	18.04	1.01	0.00	0.00	20.06
Summary	34.28	0.00	24.56	0.00	32.22
References	11.87	2.23	7.96	53.00	4.22
Total	674.96	595.47	522.12	565.68	631.16

Table V contains the pages of subject-content found in the five texts. By subject-content is meant, the divisions as indicated in Table V of Astronomy, Bacteriology, Botany, Chemistry, Hygiene, Miscellaneous material, Physical Geography, Physics, Physiology, and Zoology. Under the first five divisions of Table V are listed the illustrated materials.

The data for this table was obtained from summary sheets shown in the Appendix on pages 93 to 97.

TABLE VI SUBJECT-CONTENT EXPRESSED IN PERCENTAGES OF
TOTAL PAGES IN THE TEXT

	W. & C.	C. & C.	T.	P. & B.	C. C. & T.
Drawings	15.77	11.73	13.40	13.12	6.22
Photo. Repro.	12.20	10.36	0.00	7.89	8.33
Plates in Color	.70	.15	0.00	0.00	.16
Graphs	1.44	.82	2.47	1.08	0.00
Tables	1.33	.39	3.53	1.44	1.71
Exercises	15.12	14.24	9.59	15.19	7.62
Questions	4.47	3.99	2.01	.37	5.95
"Words"	39.41	57.73	62.98	51.51	61.02
History	2.67	.16	0.00	0.00	3.17
Summary	5.07	0.00	4.70	0.00	5.10
References	1.75	.37	1.35	9.36	.66
Total	99.9	99.9	99.9	99.9	99.9

The number of pages of each type of subject-content as shown in Table V is shown as a per cent of the entire text in Table VI. That is, 106.49 pages of Wood and Carpenter text are devoted to Drawings which is 15.77 per cent of 674.96 pages.

TABLE VII SUMMARY OF RANKINGS ACCORDING TO PERCENTAGES
OF DIFFERENT KINDS OF MATERIAL AS FOUND IN
PRECEDING TABLE

	W. & C.	C. & C.	T.	P. & B.	C. C. & T.
Drawings	1	4	2	3	5
Photo. Repro.	1	2	5	4	3
Plates in Color	1	3	4	4	2
Graphs	2	4	1	3	5
Tables	4	5	1	3	2
Exercises	2	3	4	1	5
Questions	2	3	4	5	1
"Words"	5	3	1	4	2
History	2	3	4	4	1
Summary	2	4	3	4	1
References	2	5	3	1	4

The text having the greatest per cent of its pages devoted to a division as indicated in Table VI is given the highest rank for that division and is shown by the numeral "1" in Table VII. In Wood and Carpenter text 15.77 per cent of its pages are devoted to Drawings, which is higher than the per cents of the other texts, and is given first rank.

TABLE VIII SUMMARY OF RANKINGS AND EVALUATION OF TEXTS

	W. & C.	C. & C.	T.	P. & B.	C. C. & T.
Number of times scoring first place	5	4	3	8	7
Value*	20	16	12	32	28
Number of times scoring second place	7	8	6	3	6
Value*	21	24	18	9	18
Number of times scoring third place	7	6	6	6	3
Value*	14	12	12	12	6
Number of times scoring fourth place	4	5	8	7	6
Value*	4	5	8	7	6
Number of times scoring fifth place	4	4	4	3	5
Value*	0	0	0	0	0
Total value	59	57	50	60	58
Rank	2'nd.	4'th.	5'th.	1'st.	3'rd.

* First place, four points; second place, three points; third place, two points; fourth place, one point; fifth place, no value.

The data used in preparing Table VIII was obtained from Tables IV and VII. It was observed that the Wood And Carpenter text had scored first place 5 times; second place 7 times; third place 7 times; fourth place 4 times and fifth place 4 times. The other texts were treated in a similar manner.

Each rank was weighted as follows: first, 4 points; second, 3 points; third, 2 points; fourth, 1 point; fifth, 0 points. The total of the weighted rankings was used in evaluating the texts. By this method the final ranking of the texts is: first, Pieper and Beauchamp; second, Wood and Carpenter; third, Clement-Collier and Thurston; fourth, Caldwell and Curtis; and fifth, Trafton.

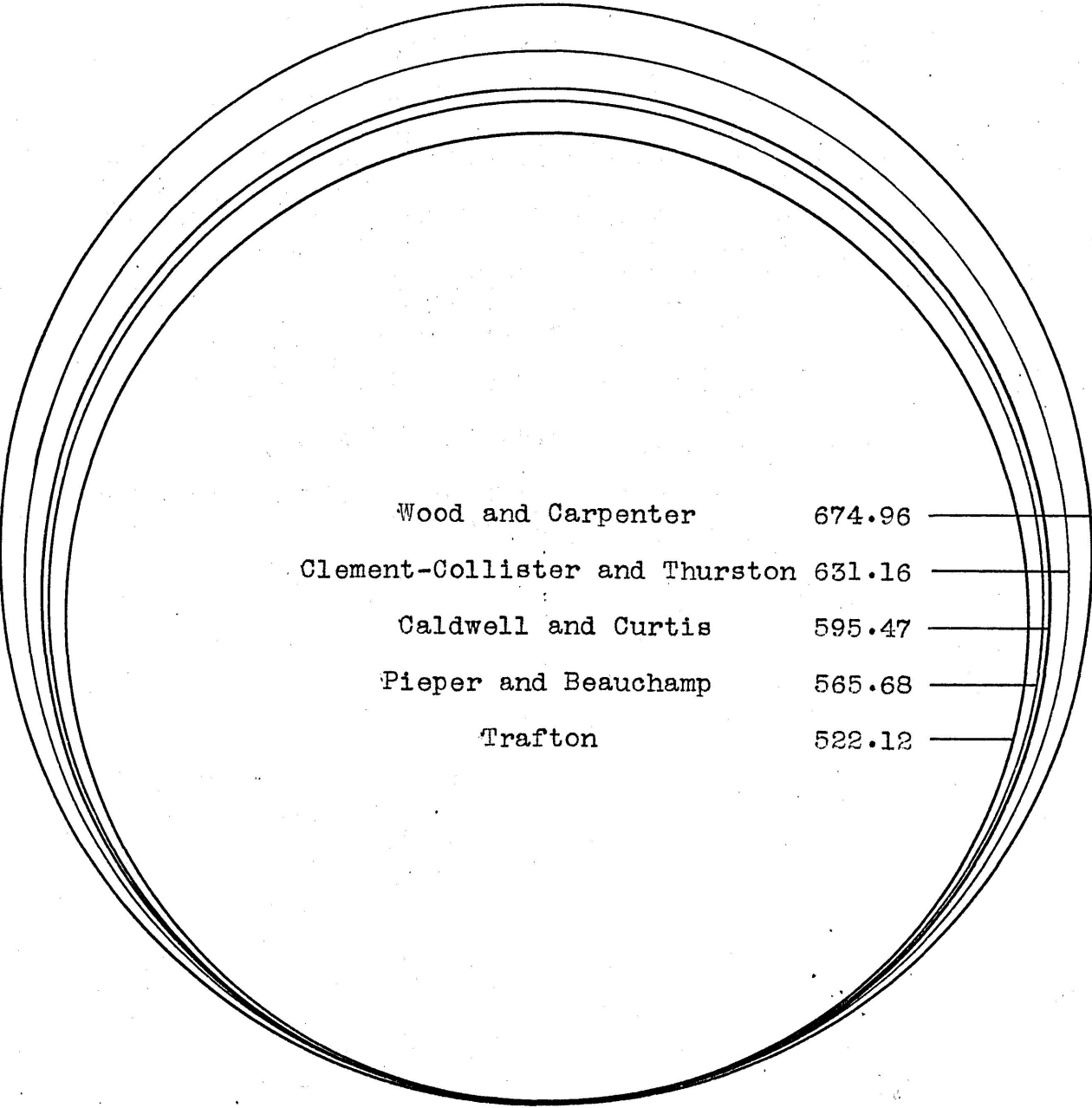
The writer is aware of the short-comings of this method of ranking texts. A premium is placed upon quantity while quality is not considered in a "Quantitative Analysis." Since the texts used in this study are all of recent publication (1925, 1926, 1927, 1928 and 1929) and their authors are well trained, outstanding men in the field of general science; the quality of their contents should not differ greatly.

TABLE IX ILLUSTRATED AND PRINTED MATTER IN TERMS
OF PAGES AND PER CENTS

Text	Pages		Per Cents	
	Illus- trated Matter	Printed Matter	Illus- trated Matter	Printed Matter
Wood and Carpenter	212.44	462.52	31.44	68.49
Caldwell and Curtis	139.80	455.67	23.45	76.49
Trafton	101.39	420.73	19.40	80.63
Pieper and Beauchamp	133.20	432.48	23.53	76.43
Clement-Collister and Thurston	103.79	527.37	16.42	83.52

In Table IX is presented, by pages and in terms of per cents, the amount of space devoted to illustrated and printed matter.

It will be noticed that approximately one-third of the Wood and Carpenter text is devoted to illustrated material; while in Clement-Collister and Thurston text about one-sixth of the text is devoted to illustrated material.



Wood and Carpenter	674.96	—
Clement-Collister and Thurston	631.16	—
Caldwell and Curtis	595.47	—
Pieper and Beauchamp	565.68	—
Trafton	522.12	—

FIGURE 1 SIZE OF TEXTS

Figure 1 is a graph showing the comparative sizes of the texts. One square centimeter of each circle represents three pages of text material.

Wood and Carpenter text has 674.96 pages, Clement-Collister and Thurston text has 631.16 pages, Caldwell and Curtis text has 595.47 pages, Pieper and Beauchamp text has 565.68 pages, and Trafton text has 522.12 pages of text material.

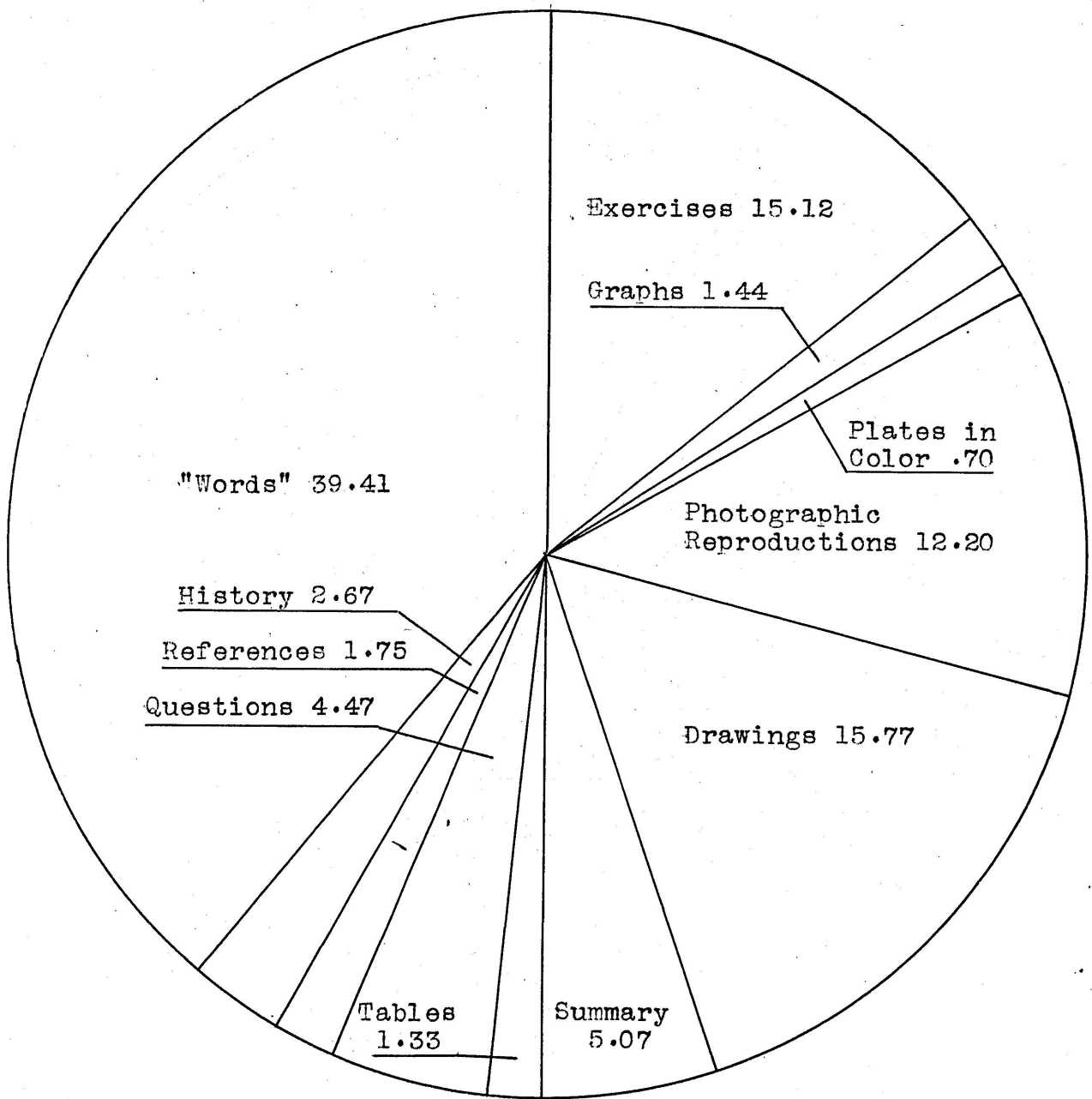


FIGURE 2 DISTRIBUTION OF SUBJECT-CONTENT DIVISIONS IN WOOD AND CARPENTER TEXT ACCORDING TO PERCENTAGES OF TOTAL PAGES DEVOTED TO EACH

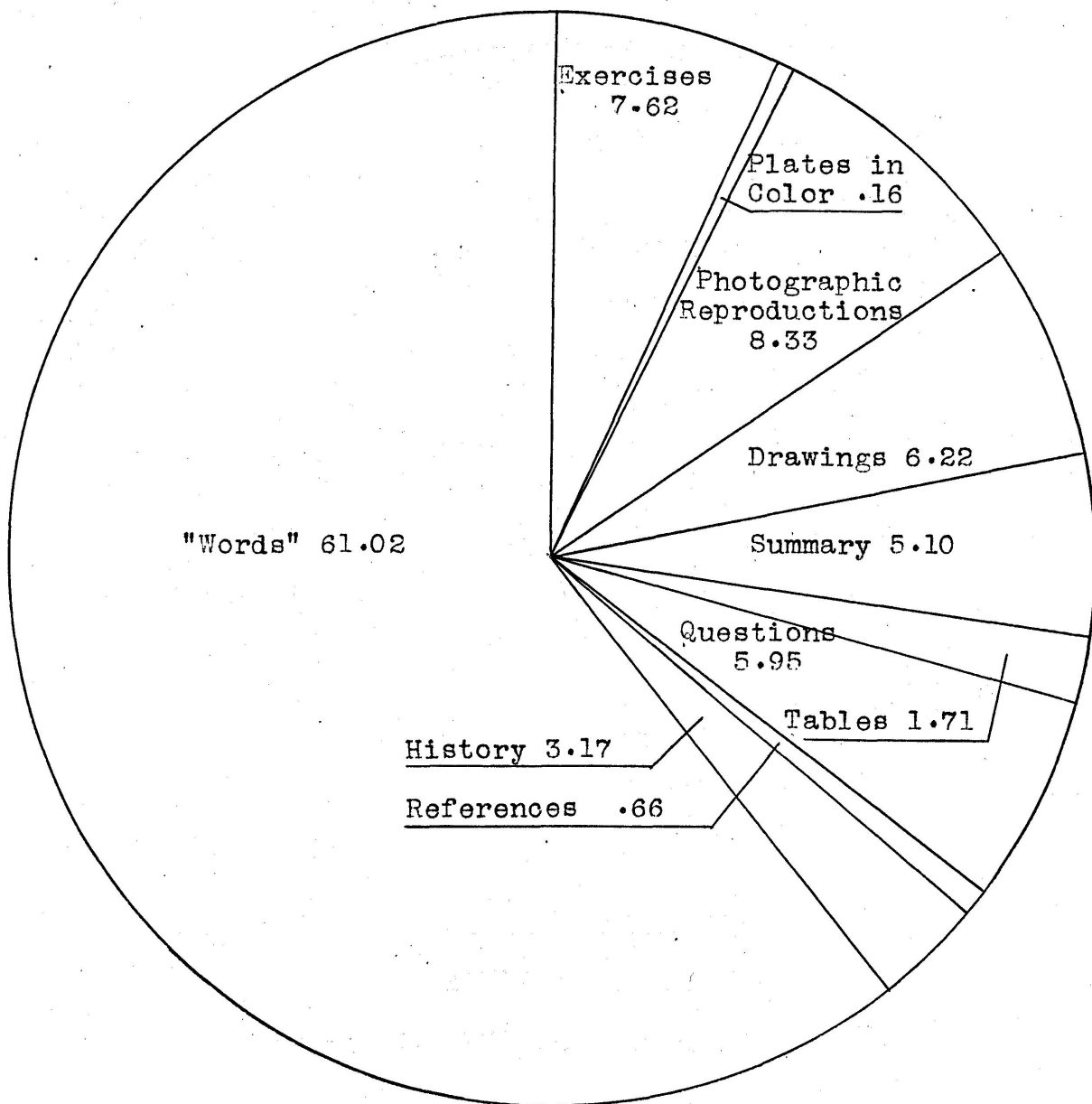


FIGURE 3 DISTRIBUTION OF SUBJECT-CONTENT DIVISIONS IN CLEMENT-COLLISTER AND THURSTON TEXT ACCORDING TO PERCENTAGES OF TOTAL PAGES DEVOTED TO EACH

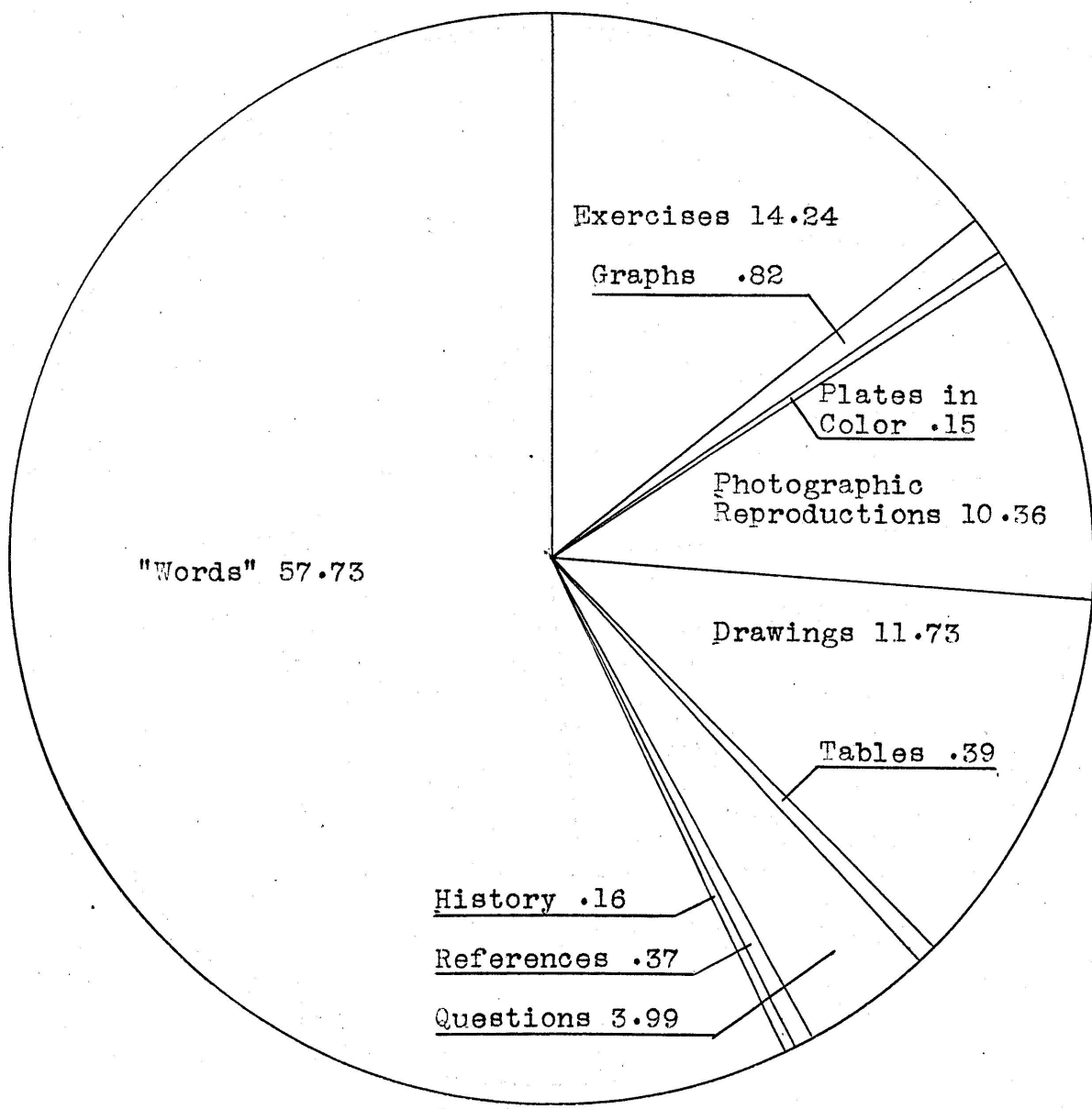


FIGURE 4 DISTRIBUTION OF SUBJECT-CONTENT DIVISIONS IN CALDWELL AND CURTIS TEXT ACCORDING TO PERCENTAGES OF TOTAL PAGES DEVOTED TO EACH

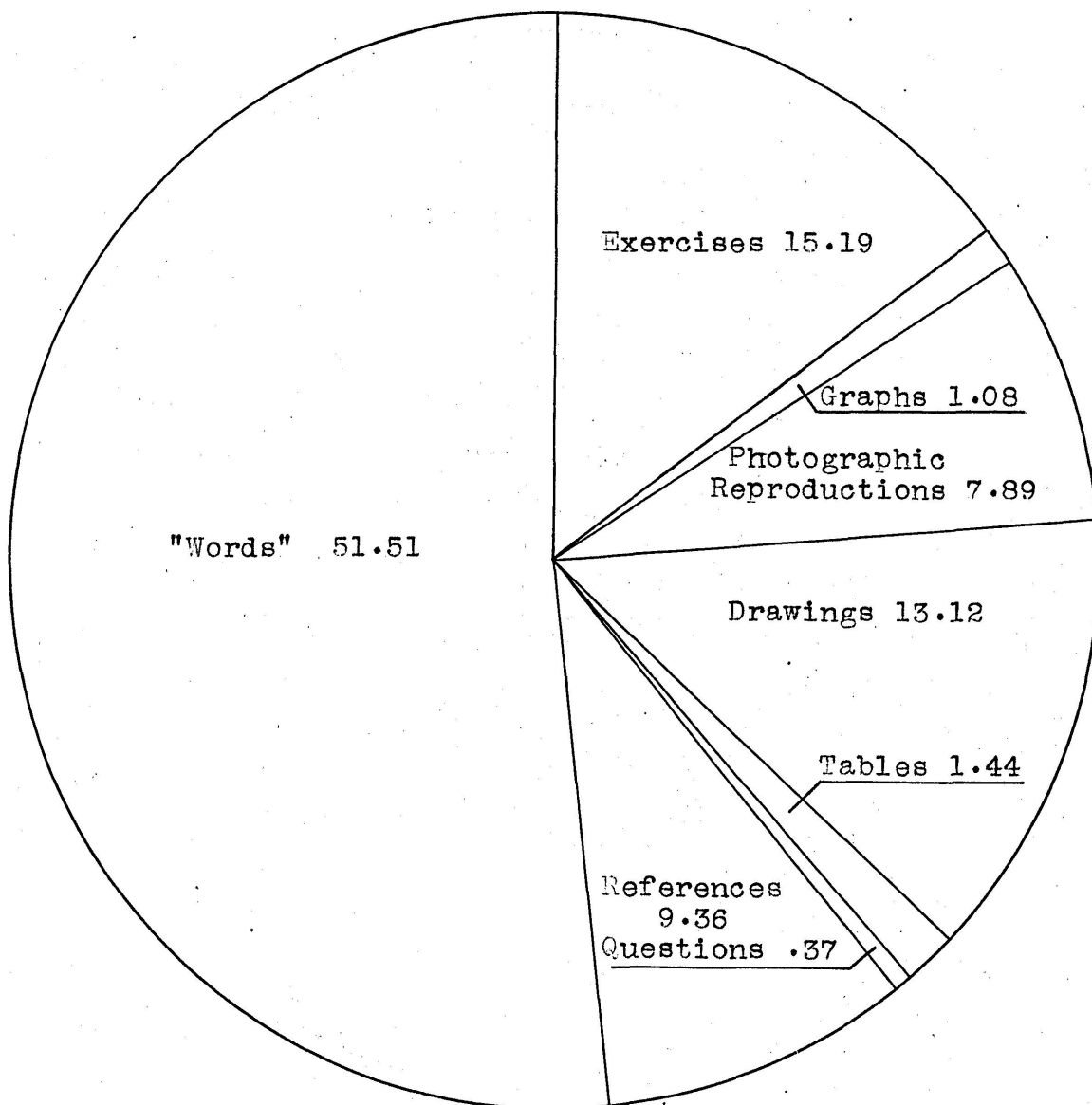


FIGURE 5 DISTRIBUTION OF SUBJECT-CONTENT DIVISIONS IN
PIEPER AND BEAUCHAMP TEXT ACCORDING TO
PERCENTAGES OF TOTAL PAGES DEVOTED TO EACH

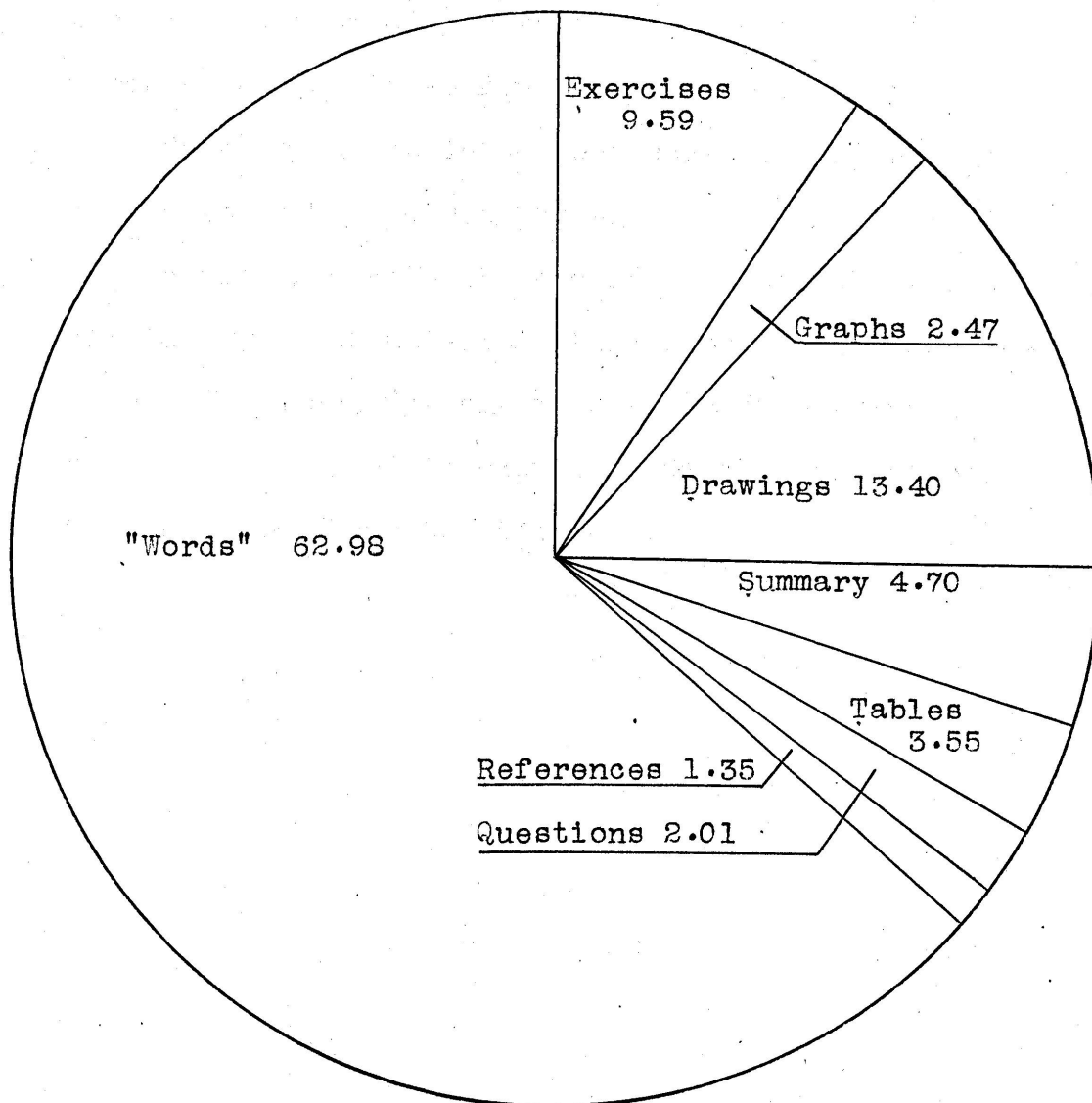


FIGURE 6 DISTRIBUTION OF SUBJECT-CONTENT DIVISIONS IN THE TRAFTON TEXT ACCORDING TO PERCENTAGES OF TOTAL PAGES DEVOTED TO EACH

Figures 2 to 6 are graphical presentations of the distribution of pages of subject-content in terms of per cents as found in the texts.

Each graph was drawn to a scale of one square centimeter equals three pages.

A difference in the amount of space devoted to similar types of material will be observed. For instance, Wood and Carpenter text has over twice as much space devoted to exercises as does the Clement-Collister and Thurston text.

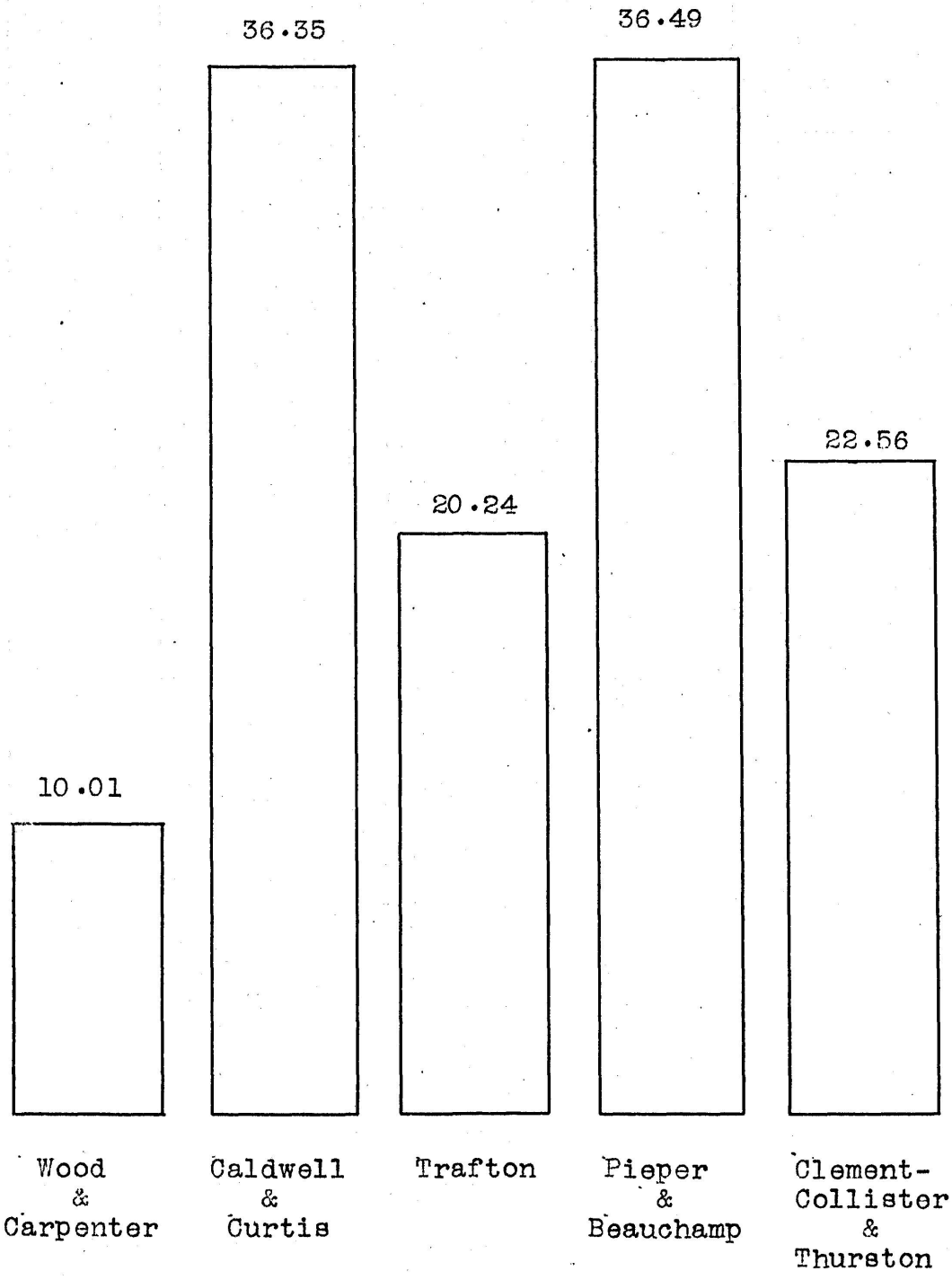


FIGURE 7 PAGES OF ASTRONOMY

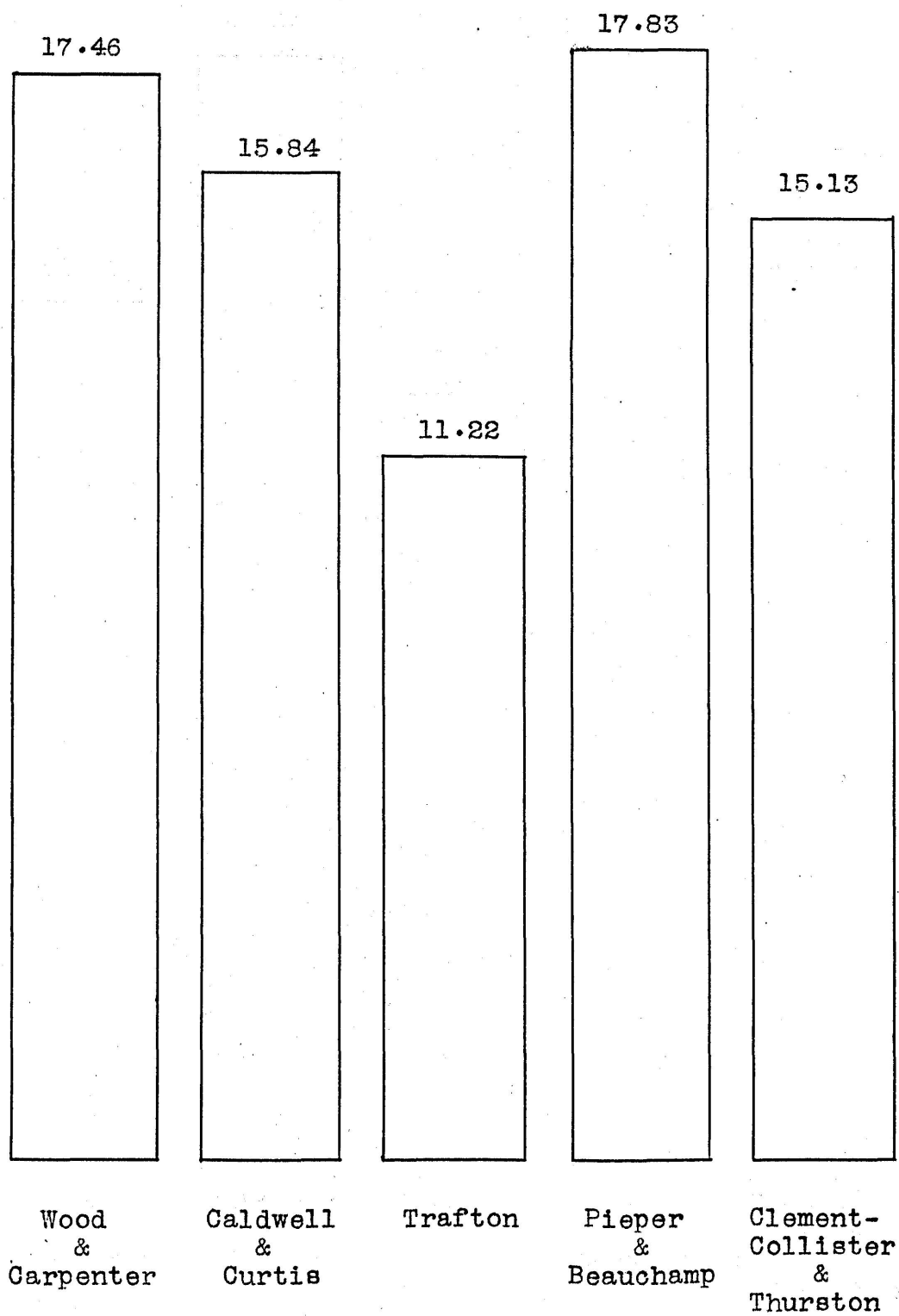


FIGURE 8 PAGES OF BACTERIOLOGY

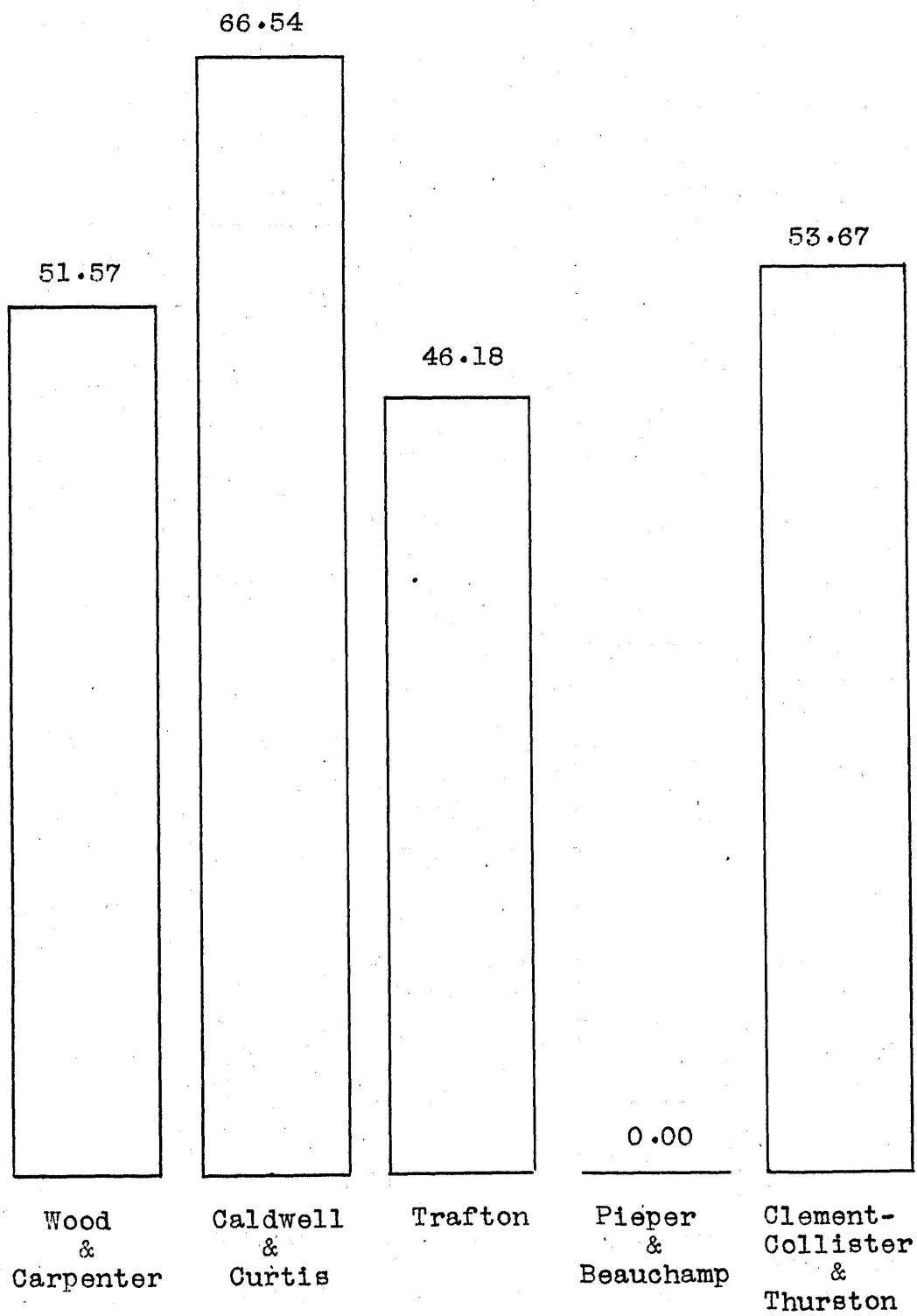


FIGURE 9 PAGES OF BOTANY

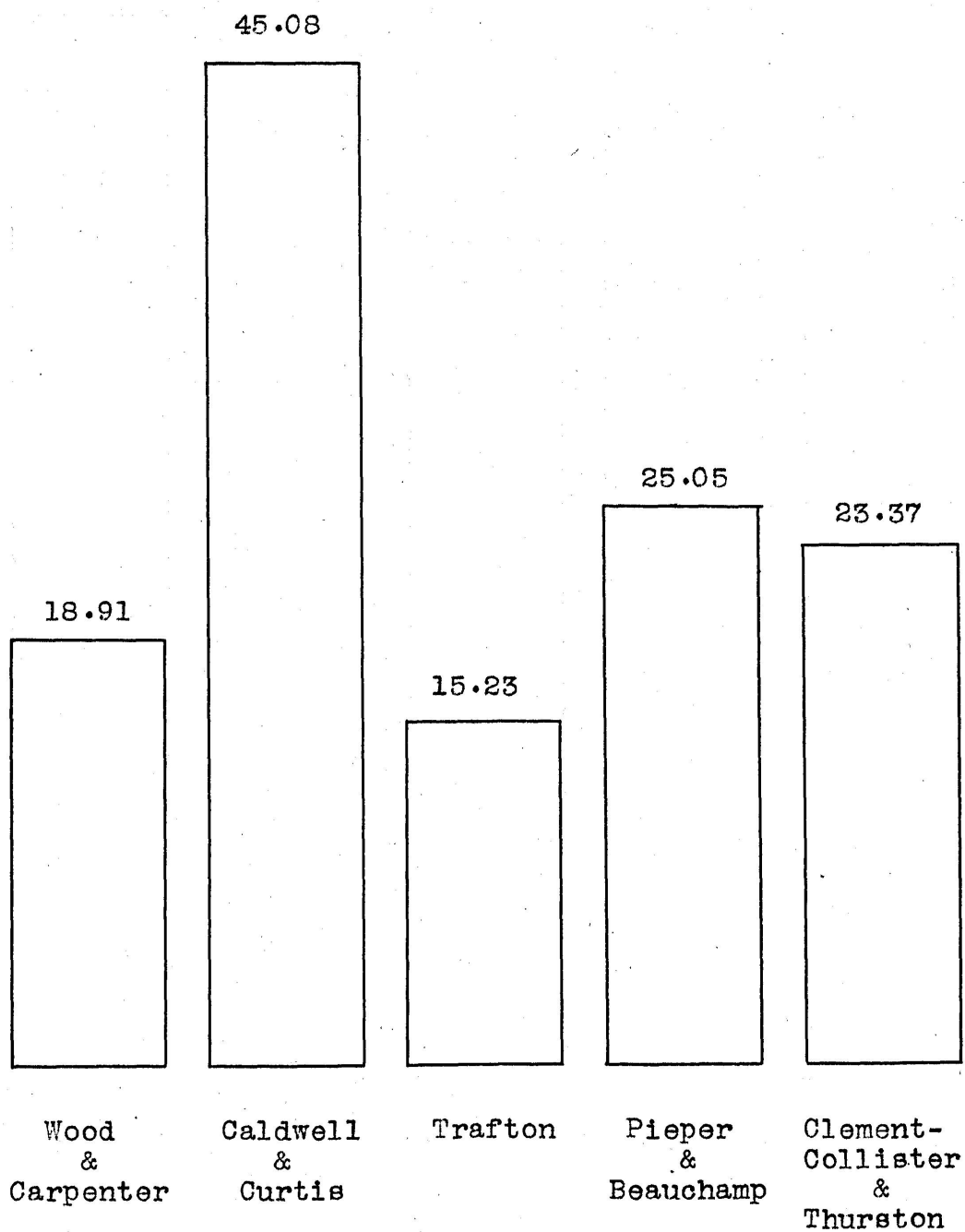


FIGURE 10 PAGES OF CHEMISTRY

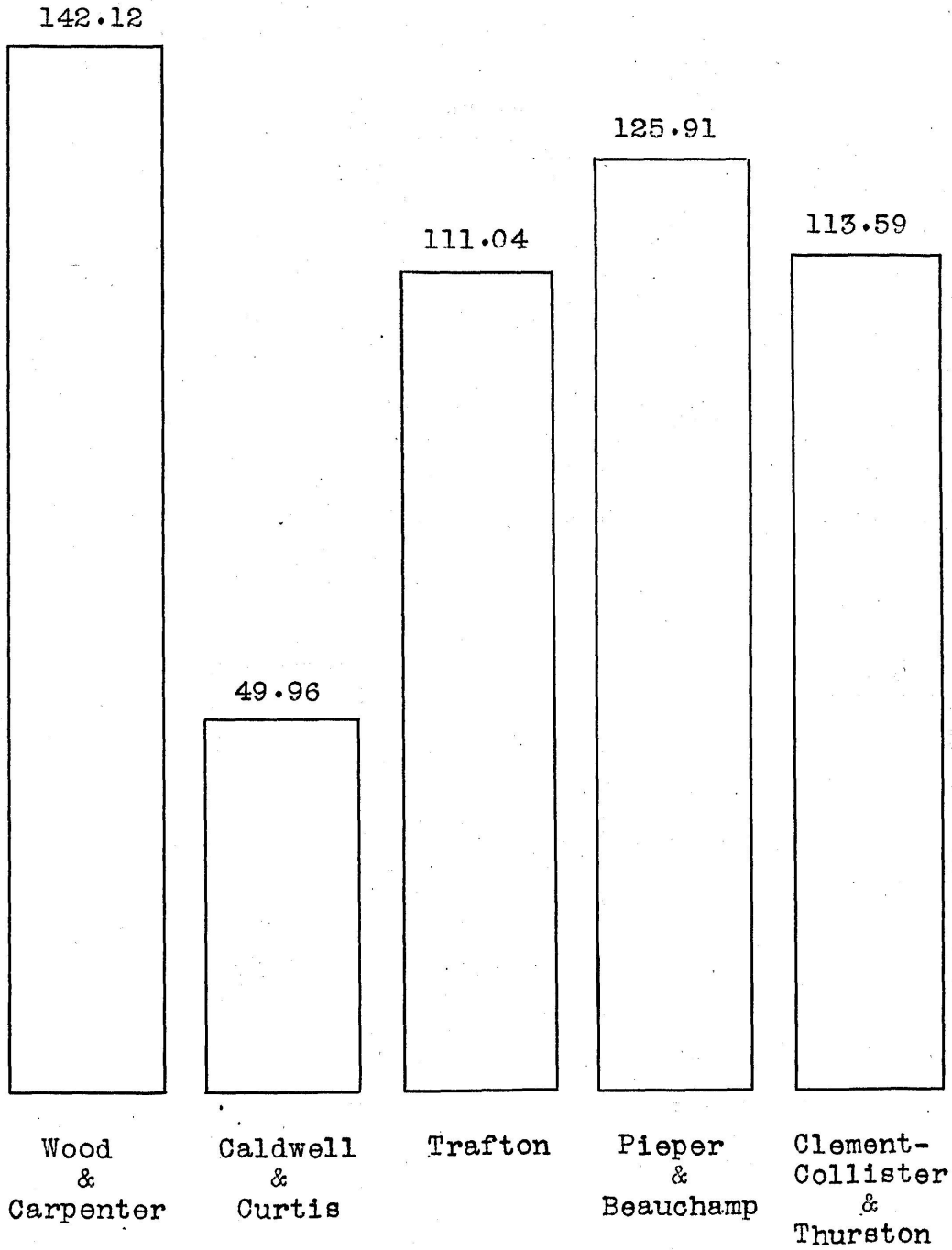


FIGURE 11 PAGES OF HYGIENE

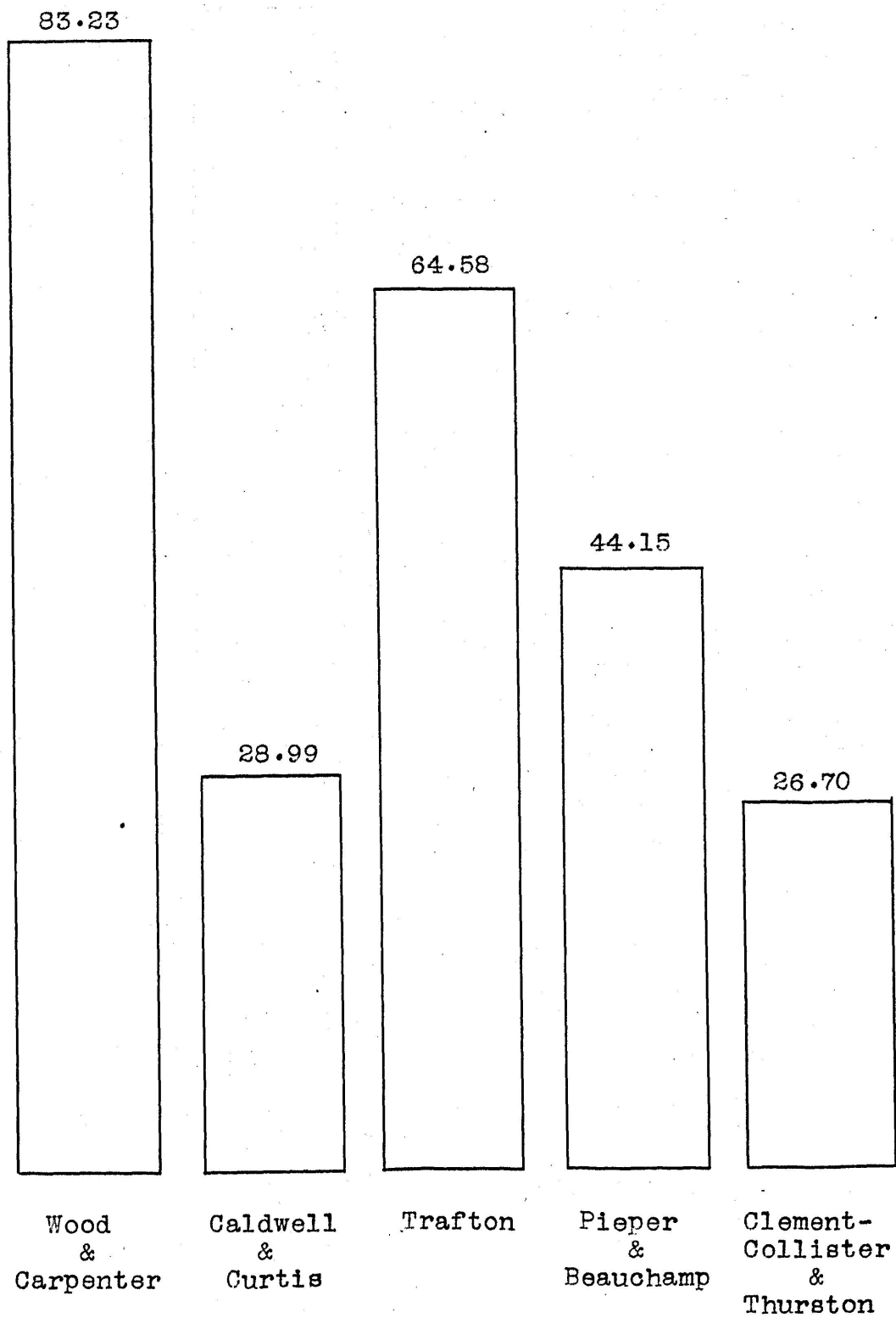


FIGURE 12 PAGES OF MISCELLANEOUS MATERIAL

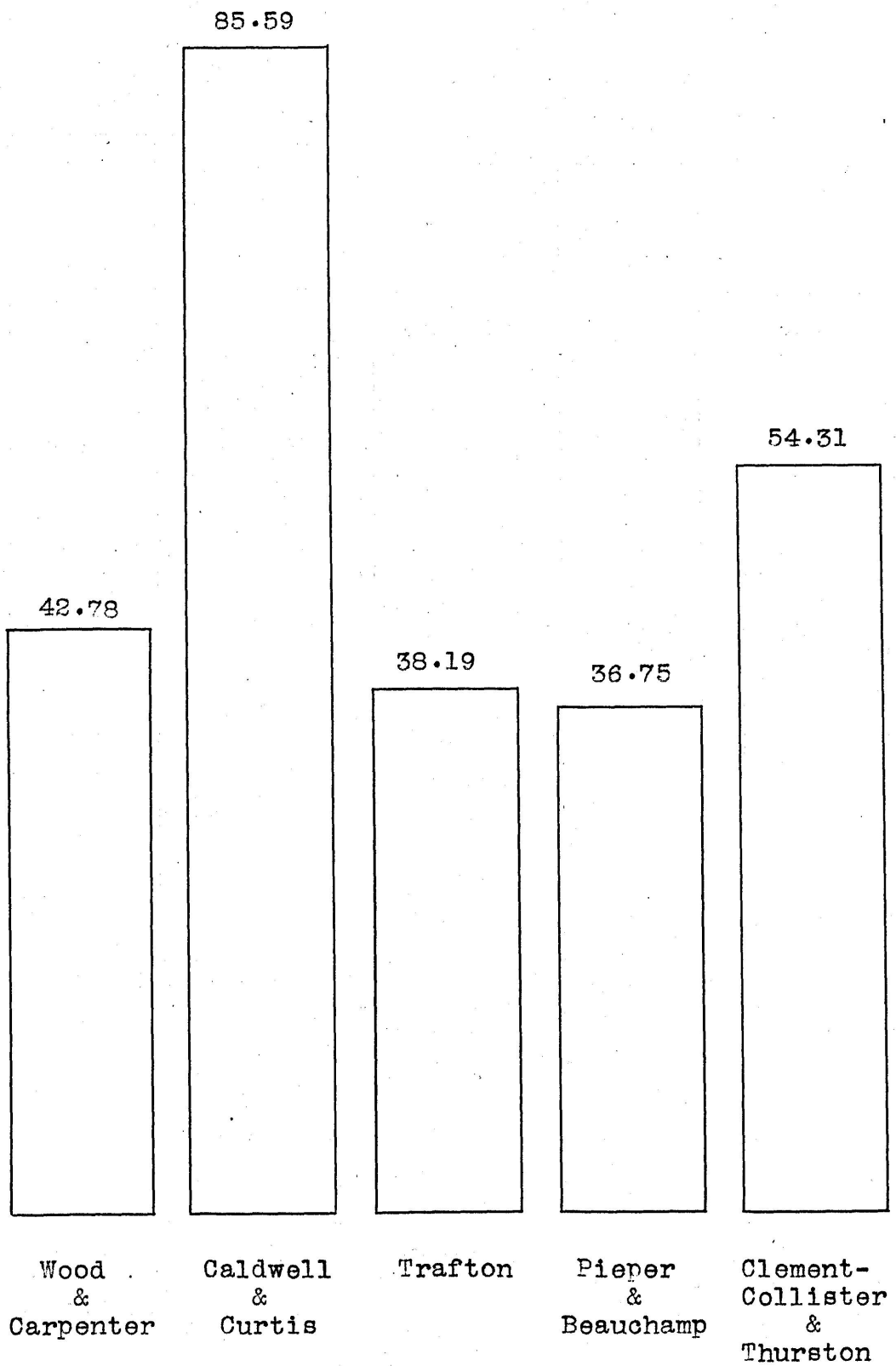


FIGURE 13 PAGES OF PHYSICAL GEOGRAPHY

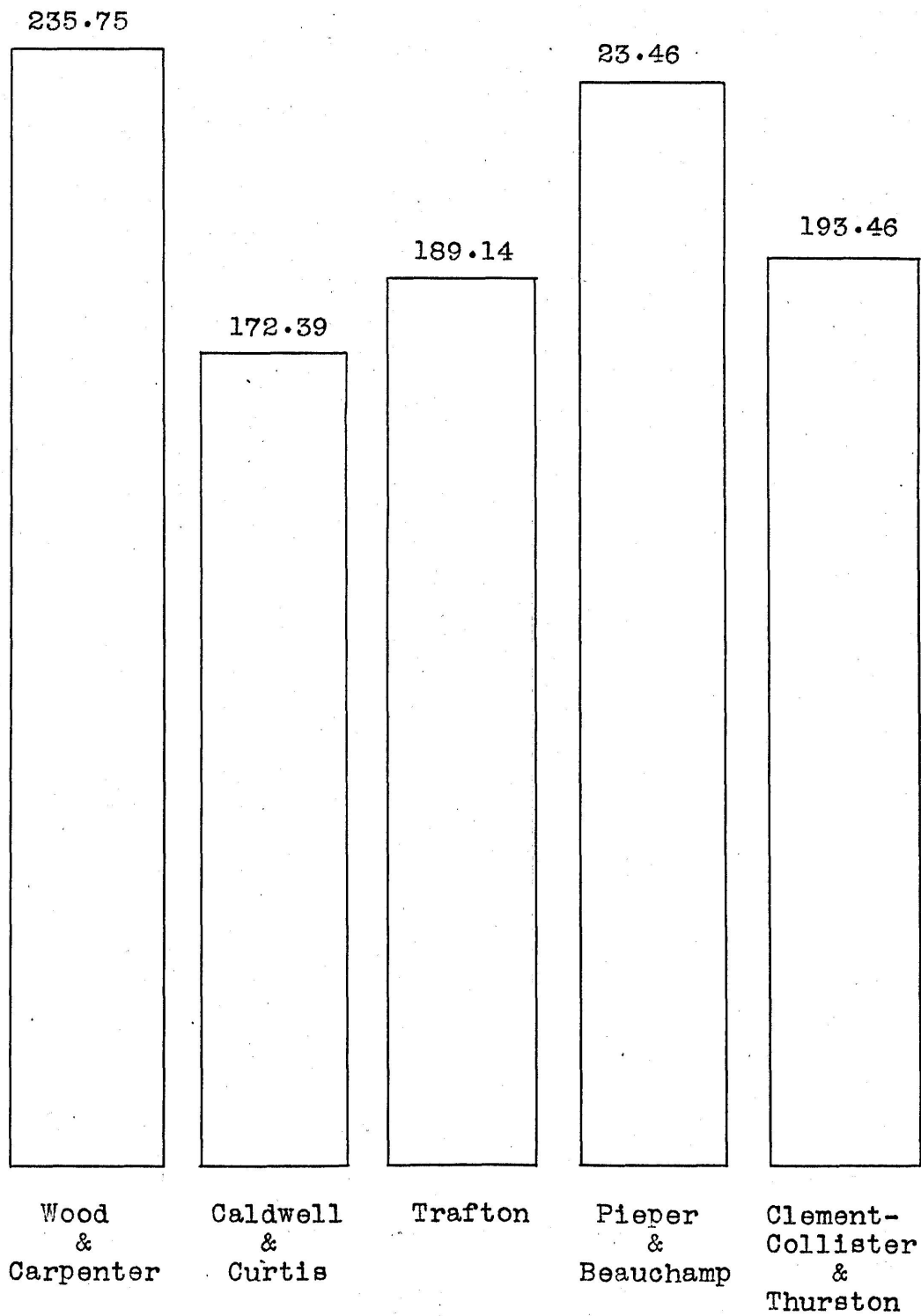


FIGURE 14 PAGES OF PHYSICS

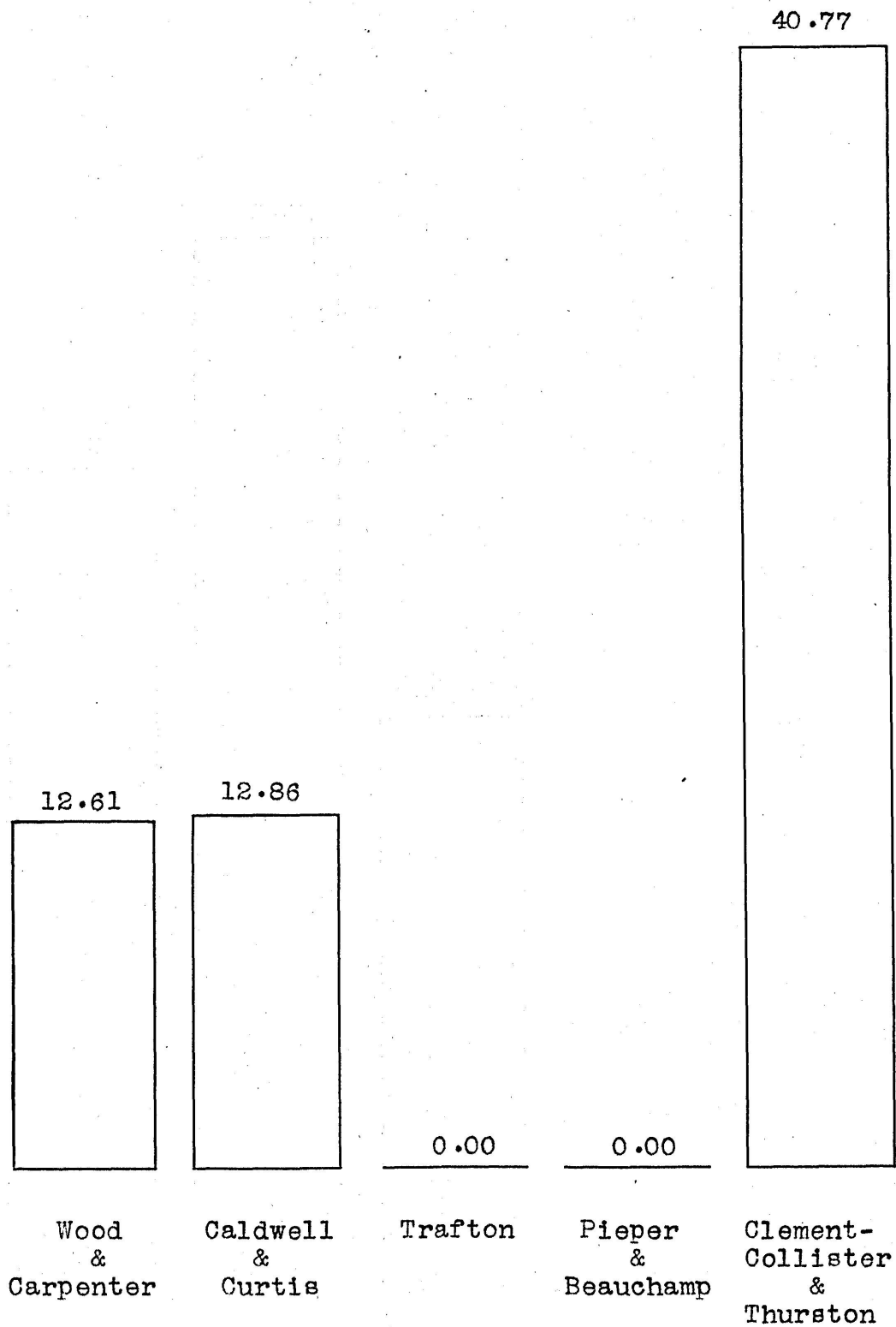


FIGURE 15 PAGES OF PHYSIOLOGY

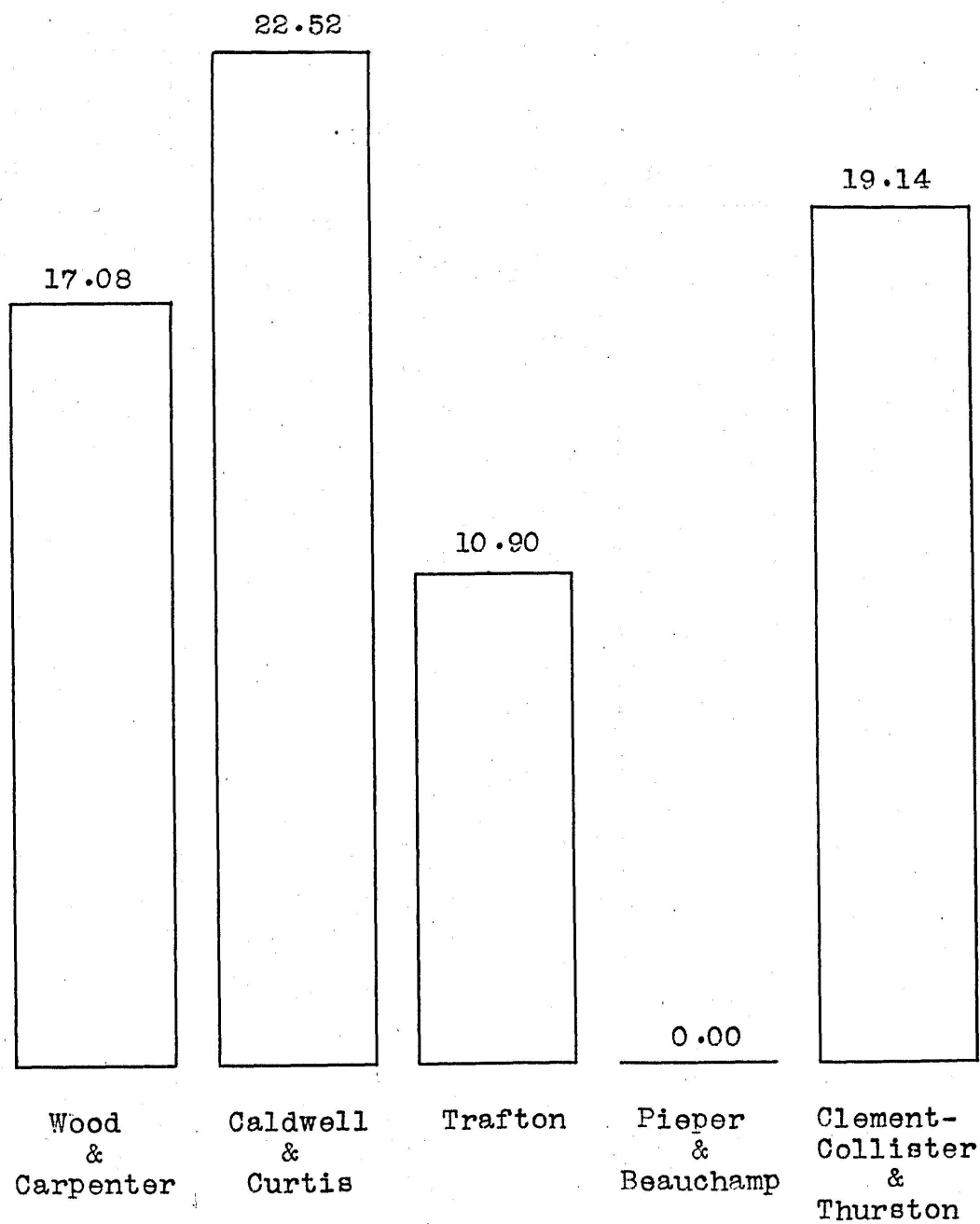


FIGURE 16 PAGES OF ZOOLOGY

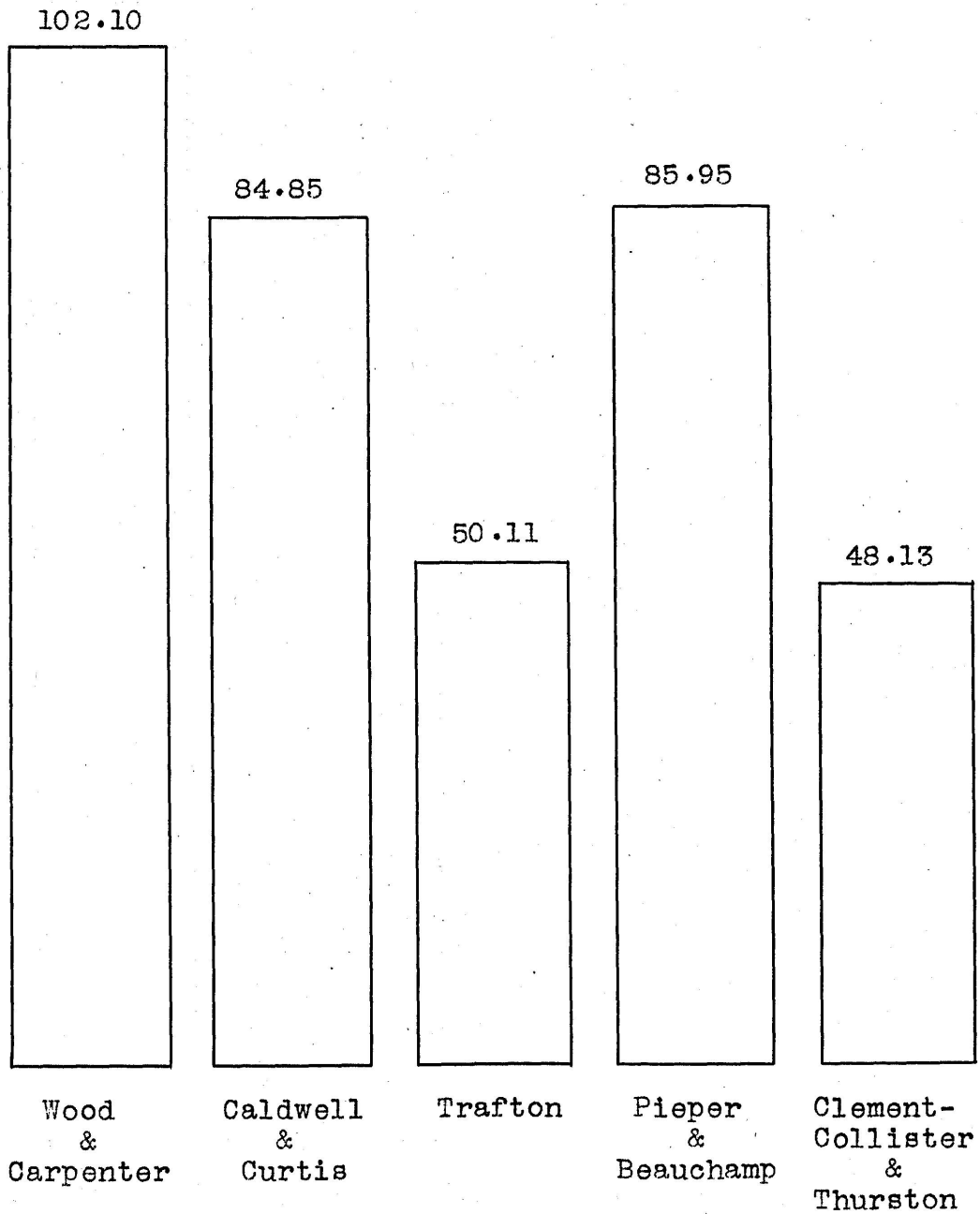


FIGURE 17 PAGES OF EXERCISES

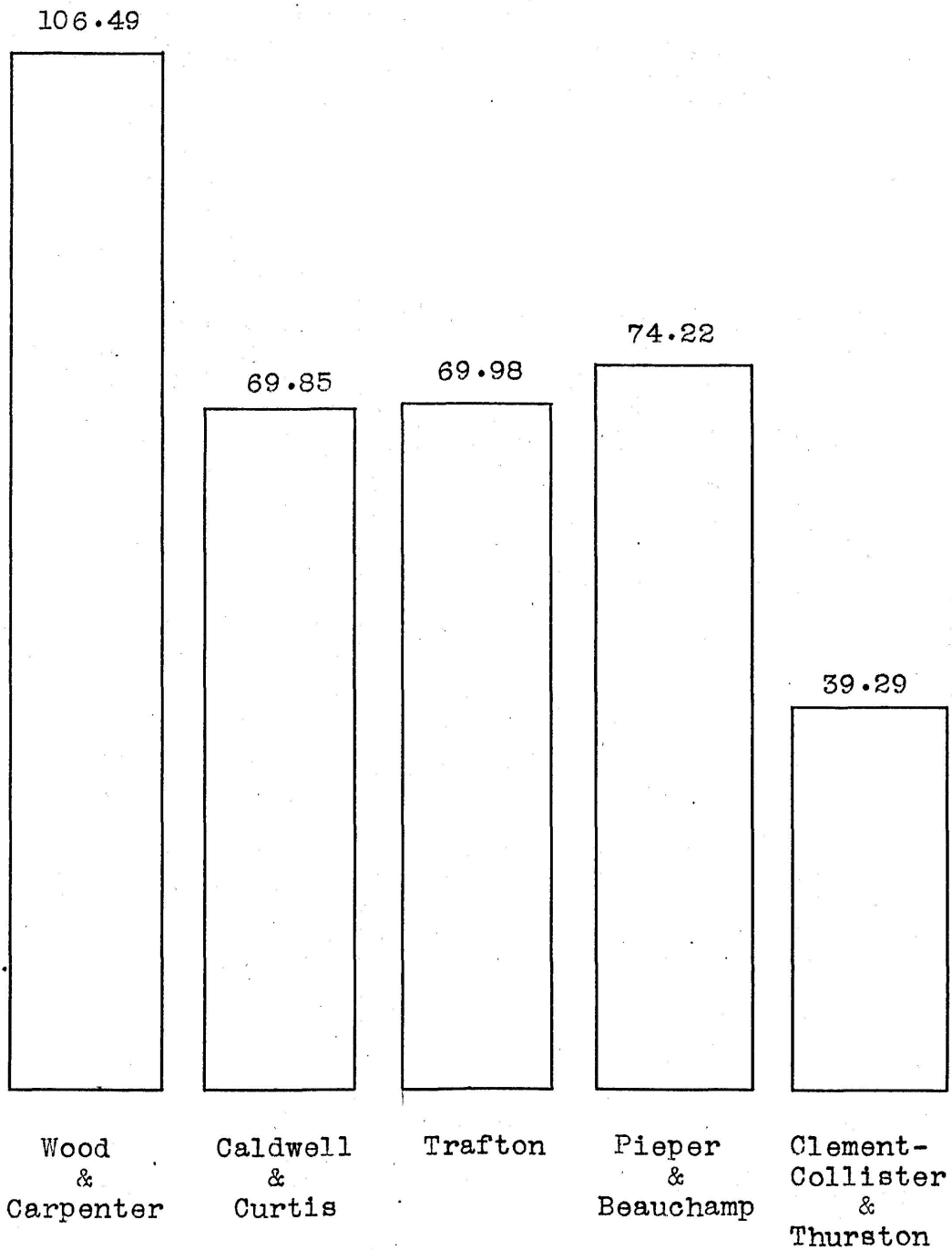


FIGURE 18 PAGES OF DRAWINGS

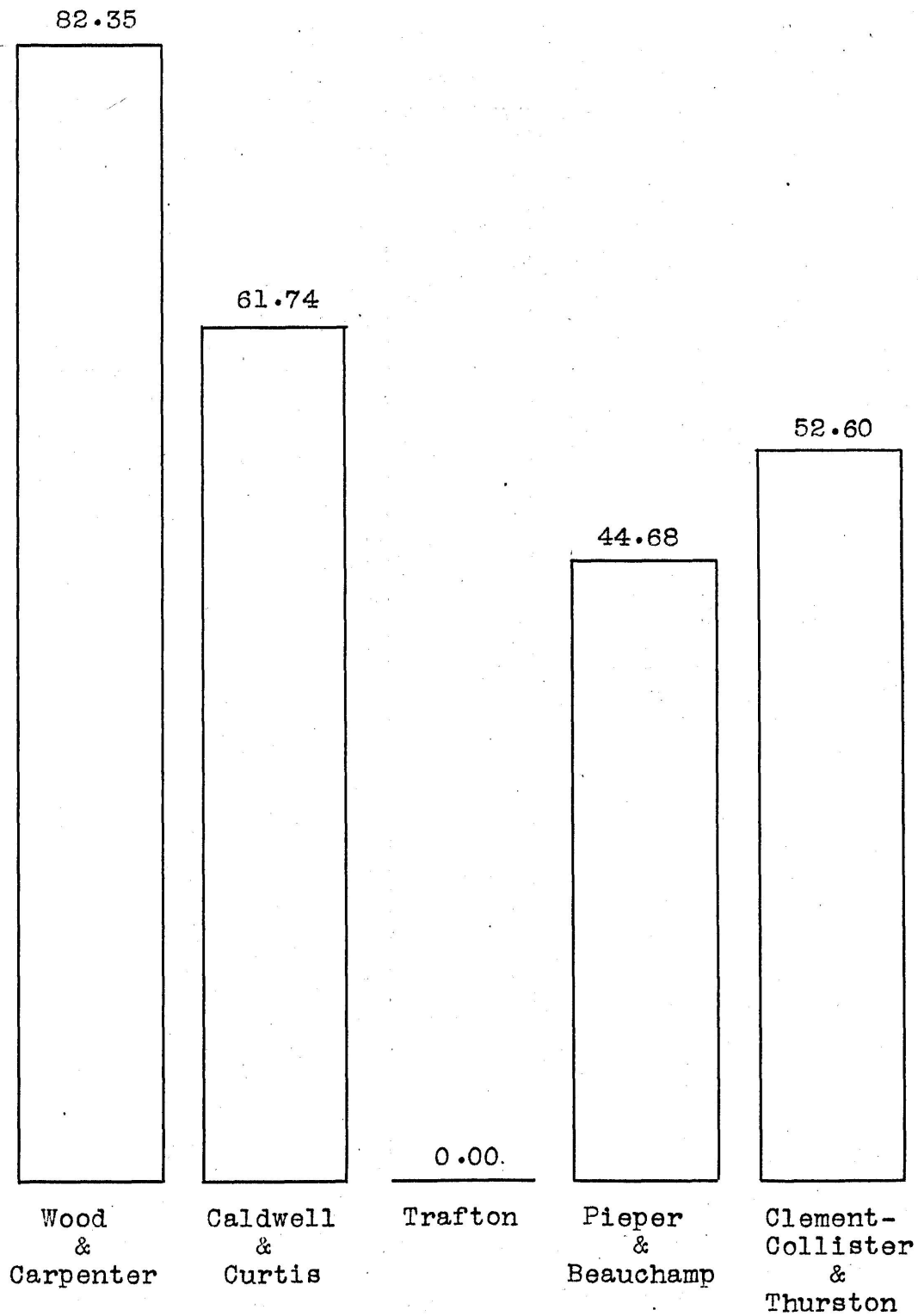


FIGURE 19 PAGES OF PHOTOGRAPHIC REPRODUCTIONS

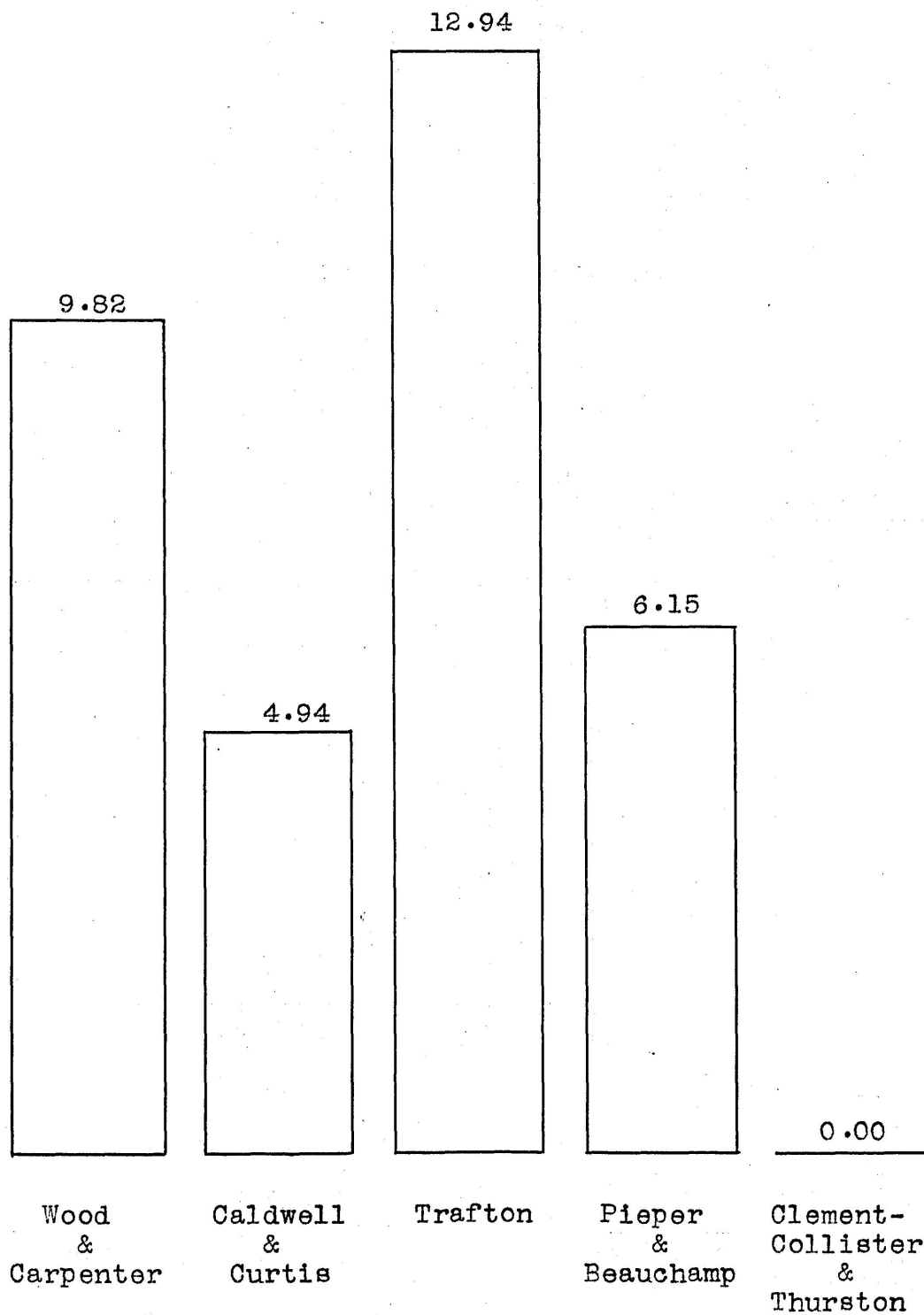


FIGURE 20 PAGES OF GRAPHS

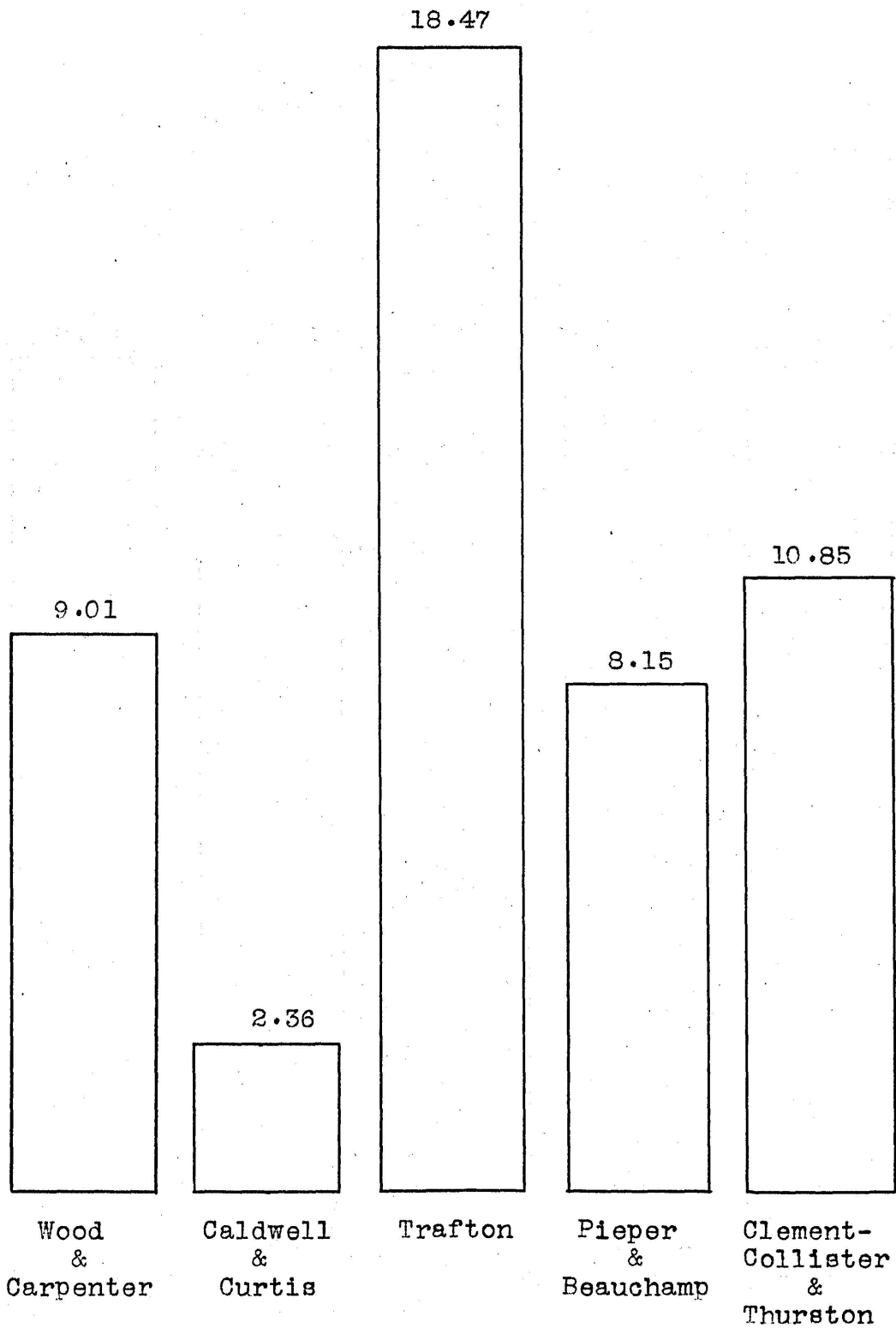


FIGURE 21 PAGES OF TABLES

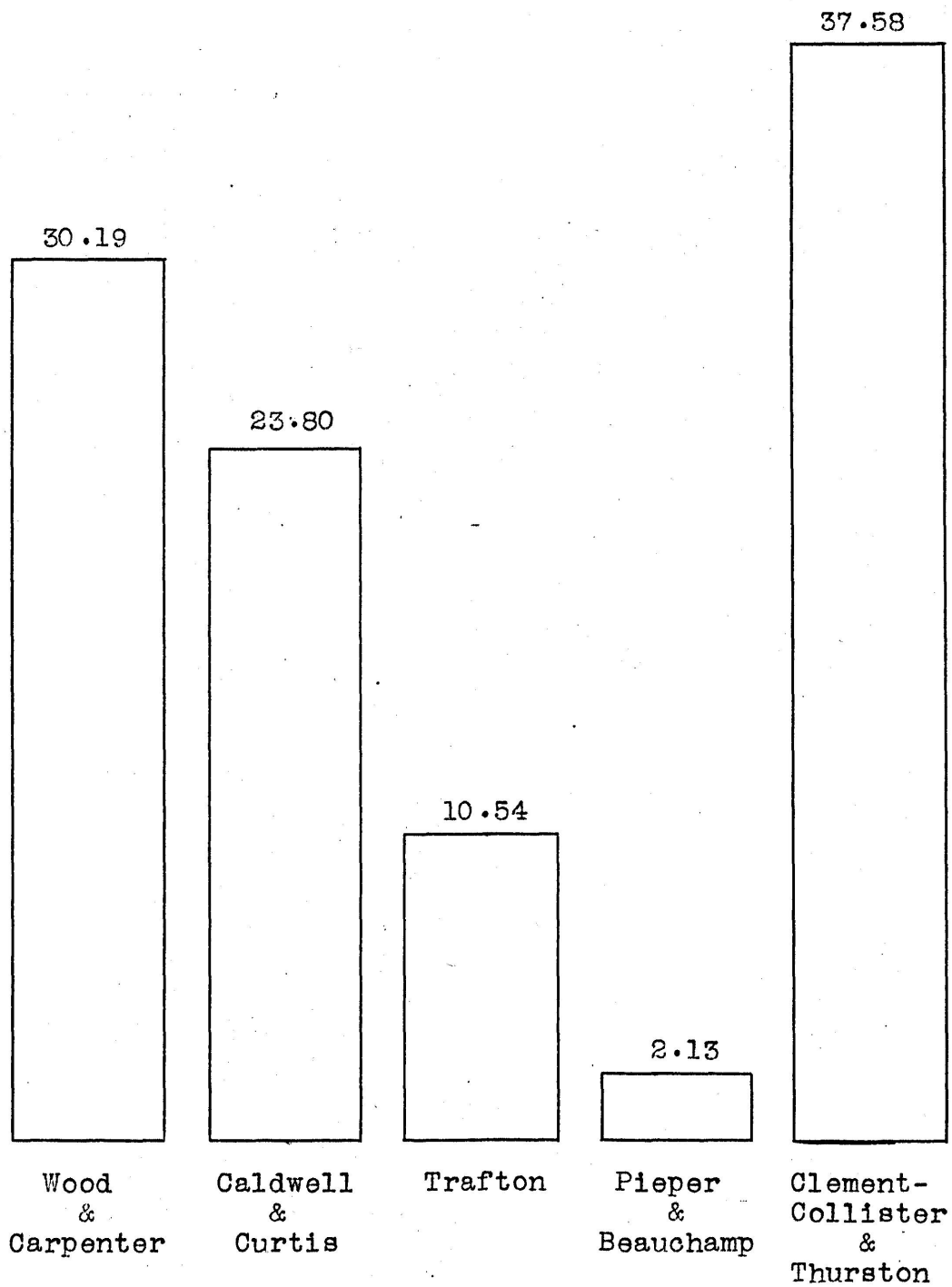


FIGURE 22 PAGES OF QUESTIONS

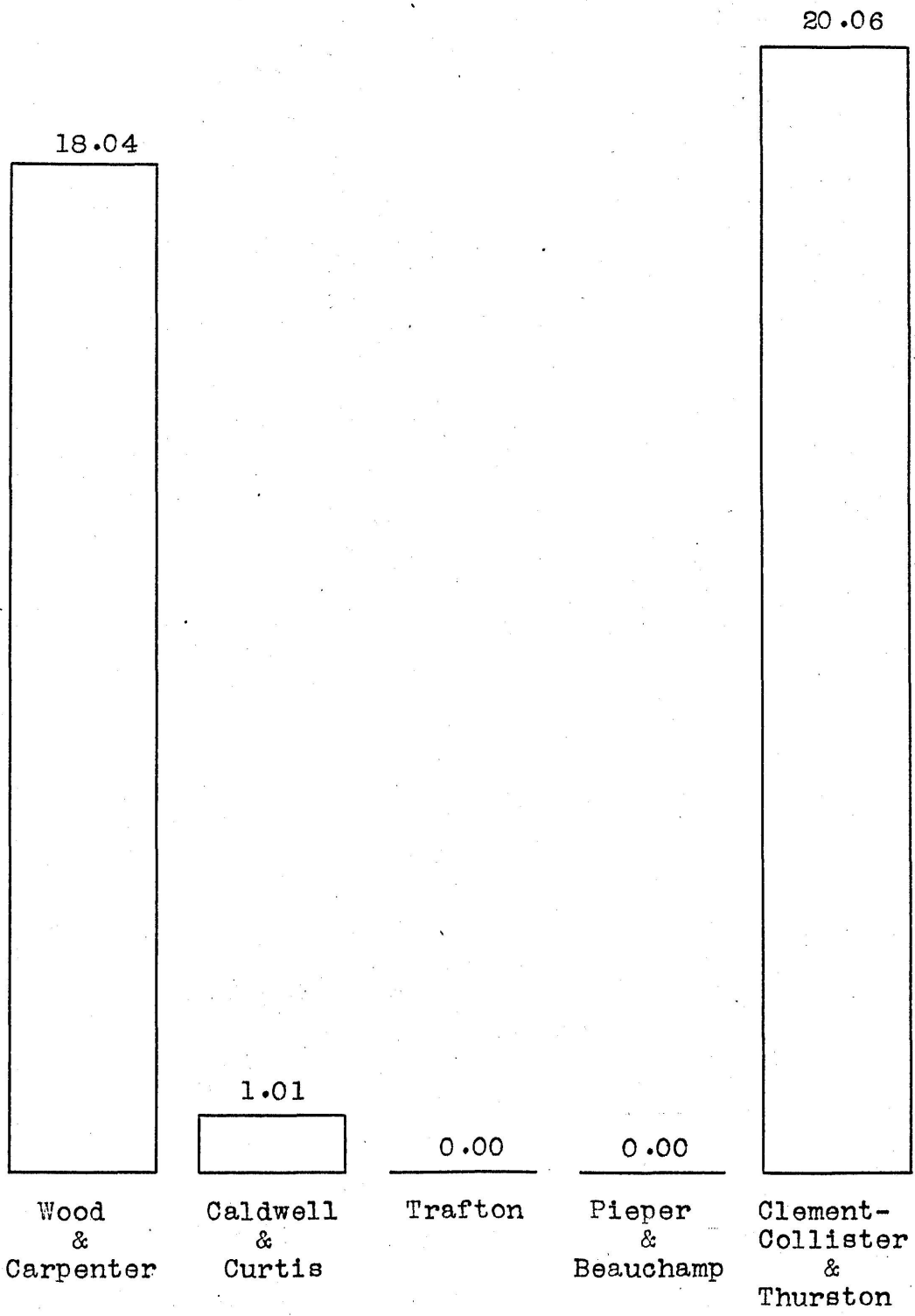


FIGURE 23 PAGES OF HISTORY

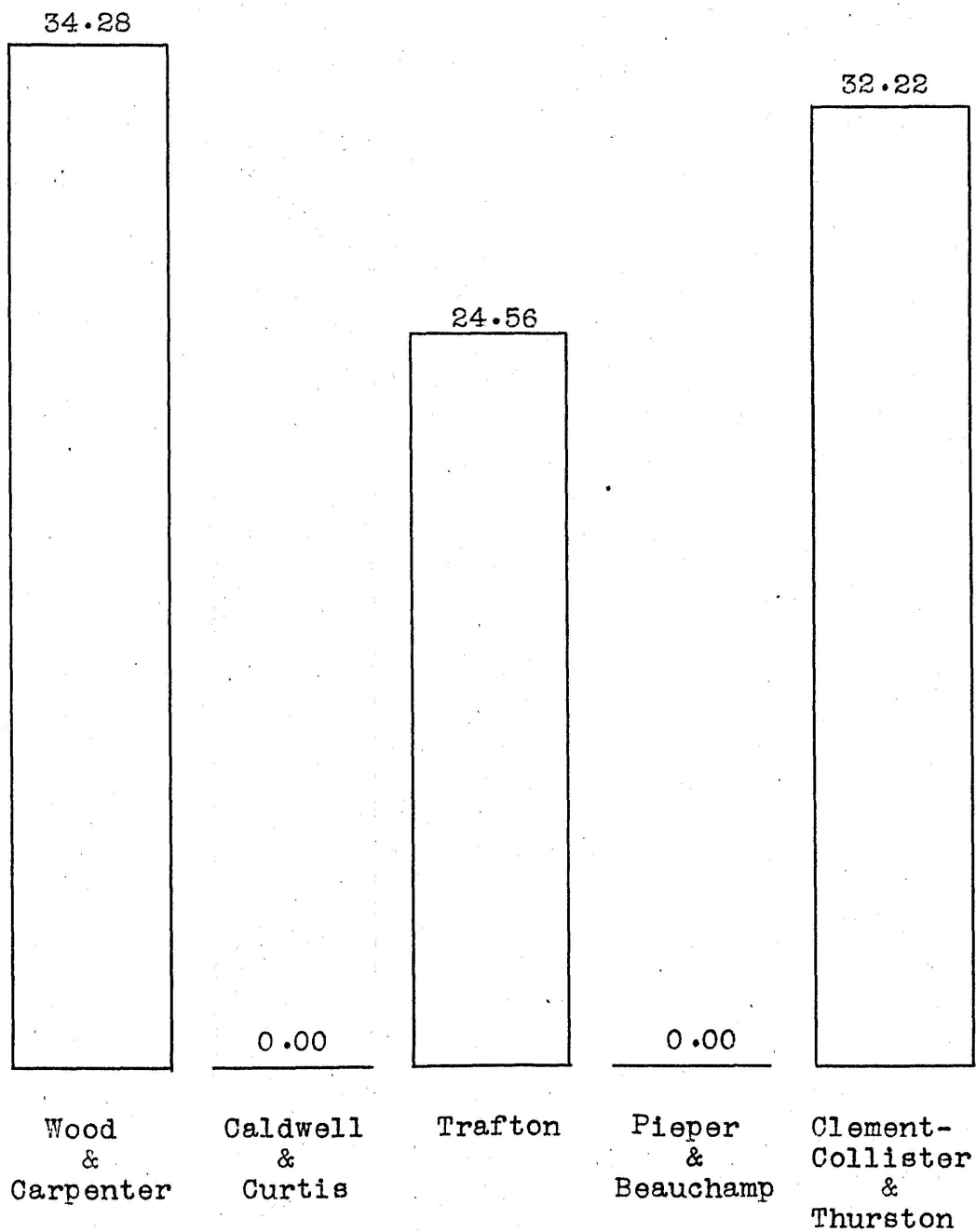


FIGURE 24 PAGES OF SUMMARY

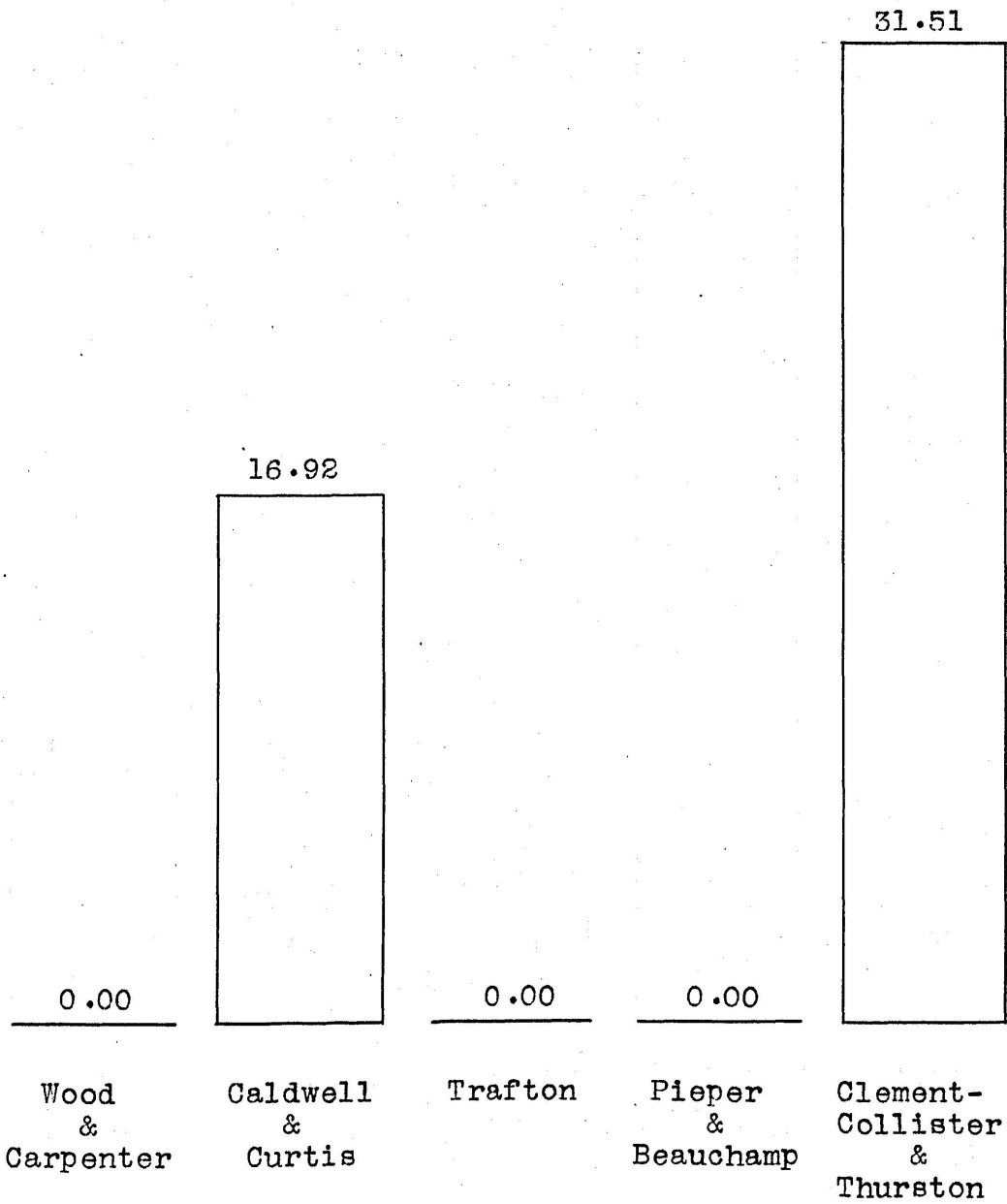


FIGURE 25 PAGES OF GLOSSARY

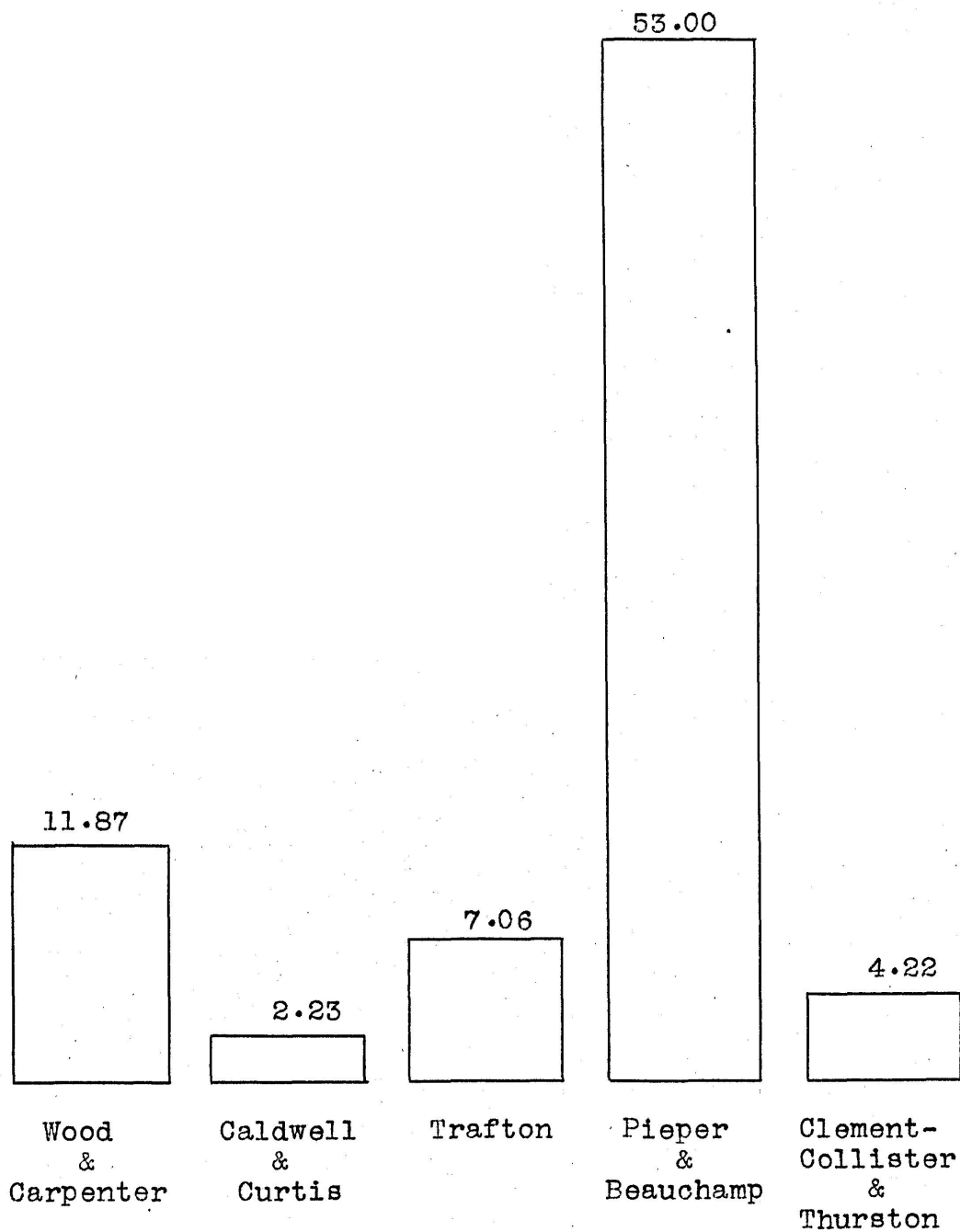


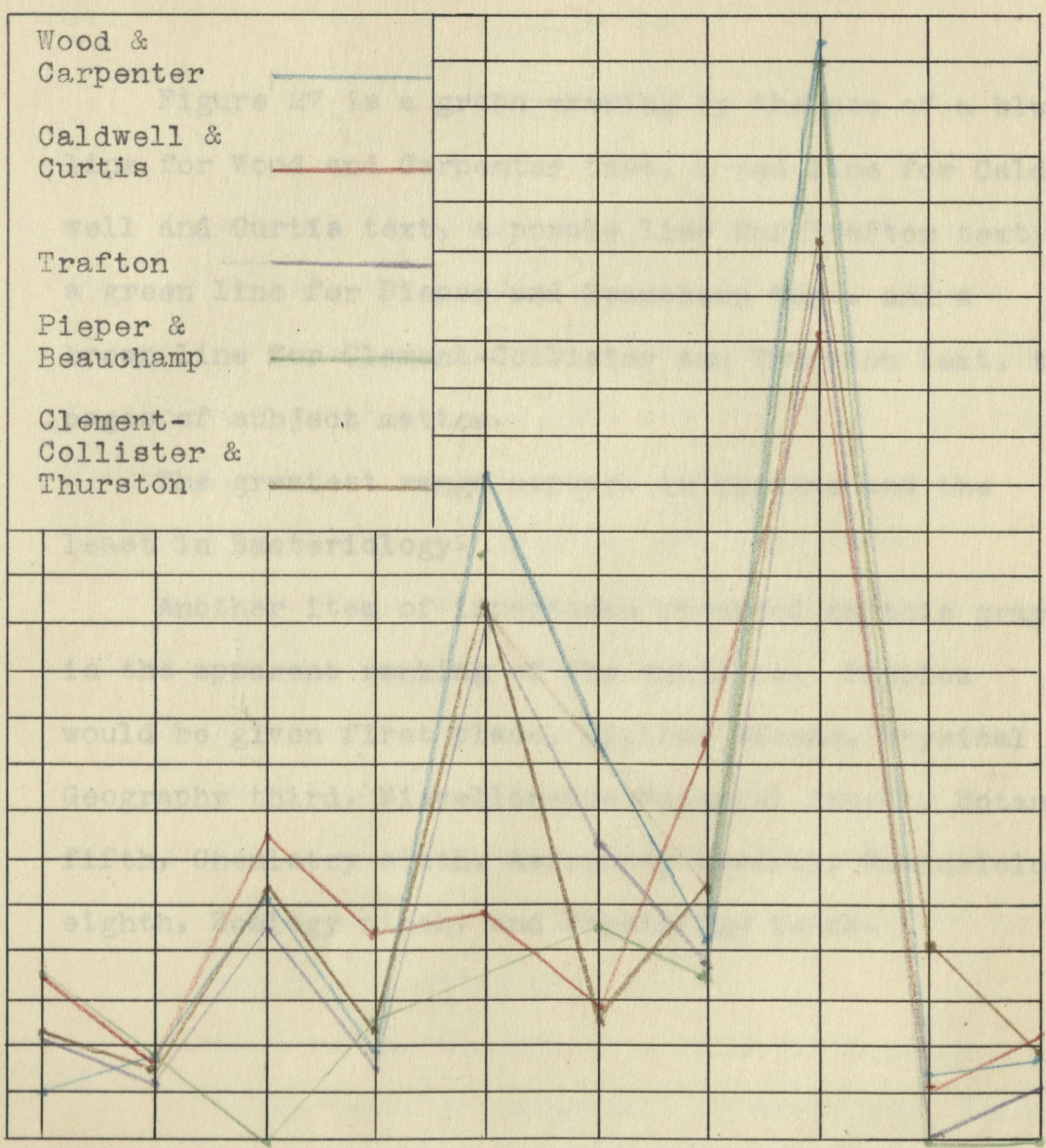
FIGURE 26 PAGES OF REFERENCES

Figures 7 to 26 are graphical presentations for purposes of comparison of twenty types of material as found in the five texts.

The types surveyed in the texts were; Astronomy, Bacteriology, Botany, Chemistry, Hygiene, Miscellaneous material, Physical Geography, Physics, Physiology, Zoology, Exercises, Drawings, Photographic Reproductions, Graphs, Tables, Questions, History, Summary, Glossary and References. Astronomy, Bacteriology, Chemistry, Hygiene, Miscellaneous material, Physical Geography, Physics, Exercises, Drawings, Tables, Questions and References were found in all the texts. In the Wood and Carpenter text the glossary has been omitted; in Caldwell and Curtis text the summary was omitted; in Clement-Collier and Thurston text, graphs were omitted; in Trafton text Physiology, Photographic Reproductions, History and the glossary were omitted; and in Pieper and Beauchamp text, Botany, Physiology, Zoology, History and the Summary have been omitted.

Pages

240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0



Astronomy
Bacteriology
Botany
Chemistry
Hygiene
Miscellaneous
Physical Geog.
Physics
Physiology
Zoology

FIGURE 27 SUBJECT MATTER

Figure 27 is a graph showing by the use of a blue line for Wood and Carpenter text, a red line for Caldwell and Curtis text, a purple line for Trafton text, a green line for Pieper and Beauchamp text, and a brown line for Clement-Collister and Thurston text, the pages of subject matter.

The greatest range appears in Hygiene and the least in Bacteriology.

Another item of importance observed on this graph is the apparent ranking of the subjects. Physics would be given first place, Hygiene second, Physical Geography third, Miscellaneous Material fourth, Botany fifth, Chemistry sixth, Astronomy seventh, Bacteriology eighth, Zoology ninth, and Physiology tenth.

CHAPTER IV

CONCLUSIONS

This study "A Quantitative Analysis of Five General Science Texts", has caused the accumulation of data in an attempt to answer questions arising from the task of selecting a General Science text for the first year high school classes.

The questions involved in this task were:

1. What kinds of material are included in the texts?
2. Is this material found in all the texts?
3. How many pages of each type of material does each text contain?
4. How does the amount of space devoted to illustrations compare with the amount of space devoted to printed matter?
5. What is the accumulative ranking by pages in these texts of Astronomy, Bacteriology, Botany, Chemistry, Hygiene, Physical Geography, Physics, Physiology and Zoology?
6. Is it possible to rank the texts on the basis of pages of different types of material they contain? If so, how do the texts rank?

The results of the analysis warrant^a the following replies to the foregoing questions.

1. Twenty-six divisions were made of the material found in the texts. They are: Astronomy, Bacteriology, Botany, Chemistry, Hygiene, Miscellaneous material, Physical Geography, Physics, Physiology, Zoology, Exercises, Drawings, Plates in Color, Photographic Reproductions, Graphs, Tables, Questions, History, Summary, Glossary, References, Student Aids, Preface, Contents, List of Illustrations, Index.
2. All of the above material was not found in all the texts. Of the first ten divisions, Botany was omitted by Pieper and Beauchamp; Physiology was omitted by Trafton, and Pieper and Beauchamp; Zoology was omitted by Pieper and Beauchamp.
3. The number of pages of each type of material found in each text is given on pages 4 to 7.
4. Table IX on page 34 shows the amount of space devoted to Illustrations---Drawings, Plates in Color, Photographic Reproductions, Graphs and Tables---and the amount of space devoted to Printed Matter.

The per cent of Illustrated Matter found in each text is as follows: Wood and Carpenter, 31.44; Caldwell and Curtis, 23.45; Pieper and Beauchamp, 23.53; Trafton, 19.40; Clement-Collister and Thurston, 16.42; Approximately one-third of the Wood and Carpenter text is devoted to illustrated material while in the Clement-Collister and Thurston text about one-sixth of the text is devoted to illustrated material.

5. The total number of pages in the five texts devoted to Astronomy, Bacteriology, Botany, Chemistry, Hygiene, Physical Geography, Physics, Physiology and Zoology is 2507. Presenting these subjects in order of rank as judged by number of pages; Physics has first place with 1021 pages or 40.7 per cent; Hygiene second, with 543 pages or 21.7 per cent; Physical Geography third, with 258 pages or 10.3 per cent; Botany fourth, with 218 pages or 8.7 per cent; Chemistry fifth, with 128 pages or 5.1 per cent; Astronomy sixth, with 126 pages or 5. per cent; Bacteriology seventh, with 77 pages or 3.1 per cent; Zoology eighth, with 70 pages or 2.8 per cent; Physiology ninth, with 66 pages or 2.6 per cent.

6. With the standard page of 385 words or 150 square centimeters as explained in Table I, page 15 and the rating scheme explained in Table VIII page 32 it was possible to rank the texts on the basis of pages of different types of material they contained. According to this method the texts rank as follows: first, Pieper and Beauchamp; second, Wood and Carpenter; third, Clement-Collister and Thurston; fourth, Caldwell and Curtis; and fifth, Trafton.

It is a fact people differ as to tastes in Art, Literature, Architecture and many of the common things in life. It has been said, teachers differ likewise in what they deem should be included in a text. Communities differ, classes in school differ, one year with another. Consequently the writer is not alarmed concerning the existence of difference in the content of General Science Texts. These differences are acceptable in that they will meet the varying needs of teachers, communities and pupils. After an analytical survey of several texts, one should select a text that best meets his particular needs.

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Figure C. Plate In Color	76
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	Page
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Data Sheet Physical Geography	89
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Data Sheet Physiology	91
Data Sheet Zoology	92
Summary Sheet Wood And Carpenter	93
Summary Sheet Caldwell And Curtis	94
Summary Sheet Trafton	95
Summary Sheet Pieper And Beauchamp	96
Summary Sheet Clement-Collister And Thurston	97

22 ⁴⁷

be wrapped in opposite directions. (See page 455.) When the varying electric current sent out by the transmitter and the secondary coil passes through these electromagnetic coils, the iron receiver disc is attracted by the rapidly changing

magnetic attraction and is caused to vibrate exactly as the metal diaphragm in the transmitter vibrates. The vibration of the receiver disc sets up air waves exactly like those from the vocal chords of the speaker at the transmitter end.

6.2 cm.
5.5 cm.

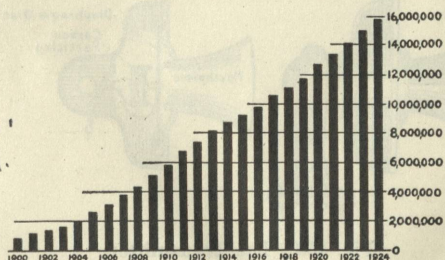


Fig. 460. Growth of Telephones

From less than a million telephones in 1900 the number has grown to nearly 16,000,000 in 1924.

The whole story retold. You can now

understand the ordinary telephone. Let us summarize the important points. The transmitter speaking-tube receives the sound waves of the air set up by the vocal cords; the diaphragm in the transmitter vibrates; the vibrating diaphragm causes changes of pressure on the carbon particles; the changes of pressure cause the changes in the electric current through the primary coil of the induction coil; the variation of the current in the primary coil increases and decreases the current of greater force set up in the secondary coil; the varying current in the secondary coil and line causes differences in the strength of the magnetism in the coil around the magnet in the receiver; this increases and decreases the pull of the permanent magnet on the disc of the receiver; the receiver disc vibrates exactly as the transmitter diaphragm vibrates; these vibrations start air waves like those of the speaker's voice; these air waves strike our ear and produce a sound like the speaker's voice.

The telephone with a modern central station is much like the telephone described, but the battery or dynamo used to

14.85

468 COMMUNICATING WITH OUR NEIGHBORS

Since the waves are set up only when the key is pressed down, or closed, it is possible to send out the waves for short or long intervals, like the dots and dashes of a telegraph code. The waves of short and long intervals may be detected, or "picked up," by a receiving set and heard as short or long buzzes in the head phones. The message sent with the key may, therefore, be understood by anyone who knows the code.

There are many different kinds of sending sets. The sending sets for the radio-telephone used in broadcasting stations are far too complicated to study here. It is enough for us to know that they send out waves through space. The waves are, however, changed somewhat by the voice or music which enters the transmitter of the telephone connected to the sending set.

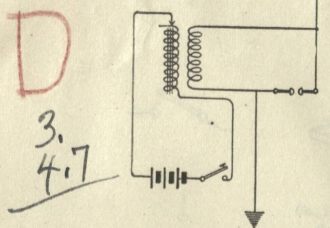


Fig. 464. "Hook-up" for Figure 462

(See Figure 456, page 459.) The sounds in the sending station strike the telephone transmitter membrane, or transmitter, and change the radio waves in much the same way that sound changes the electric current in the ordinary telephone. Because different stations send waves of different lengths, it is necessary for us to "tune" our receiving sets so that we may be able to listen to the station which we wish to hear. Then our set can reproduce the changes in the waves caused by the voice or music at the broadcasting station, and we can enjoy the speech or concert.

Exercise 9. Make a statement summary of everything that happens when the key of the simple sending set is closed.

Exercise 10. Each instrument of the sending set described is shown in Figure 463, and opposite each is the symbol which radio men use to represent the instrument. Figure 464 shows a diagram, or "hook-up," of the set as represented by radio experts. Copy the "hook-up" and label each part. Below your drawing list the name of each part, and following each name state briefly the use of the part. Also, label the primary and secondary circuits.

+

3.5



PLATE II.—THE PASSENGER PIGEON.

This beautiful bird once existed in such large numbers that its flocks darkened the sky with their passing. It is now extinct. Man, wild animals, and perhaps disease brought the species to an end.

A few years ago the Cincinnati Zoo possessed a living specimen for which every effort was made to find a mate, but without success. The bird's death stopped further search.

17 7

448 COMMUNICATING WITH OUR NEIGHBORS

horseback, puffs of smoke from hill tops, and even mail for important messages, have given way to the current of electricity through wires and the waves of wireless. News, warnings of forest fires, floods, and frosts, weather forecasts, correct time, train dispatches, stock and market reports, distress (SOS) calls by ships, greetings, and business messages are but a few of

P.R.

7.2



Keystone View Co.

Fig. 441. A Portable Broadcasting Station

The man at the right is speaking into the microphone of the radio sending set, telling thousands of listeners about each play in the World Series baseball game between the New York Giants and the Washington Senators.

the many communications for which electricity is used (Figure 441). How different the activities of our daily life would be without these modern methods of sending messages, and how little you would know of the great world in which you live!

In this unit you will study the ways of sending messages by electricity. If space permitted, we should consider other important methods of communication, such as printing, the mail service, and codes of various kinds. These you may read about in encyclopedias and in other reference books. They will furnish excellent subjects for reading at your leisure.

Before you begin the study of the problems of this unit, you should have a general idea of the different methods of electric

60

SENDING MESSAGES BY TELEGRAPH 451

for land telegraphy in all foreign countries, and by all radio stations the world over. Note that in the American Morse there are spaces between the dots for the letters C, O, R, Y, and Z. These spaces make sending and receiving very difficult unless the spacing is carefully done at the key by the sender. In the other code only dots and dashes are used. This arrange-

TABLE XV: TELEGRAPH CODES

	AMERICAN MORSE CODE	INTERNATIONAL MORSE OR CONTINENTAL WIRELESS CODE		AMERICAN MORSE CODE	INTERNATIONAL MORSE OR CONTINENTAL WIRELESS CODE
A....	• —	• —	S....	•••	•••
B....	— •••	— •••	T....	—	—
C....	•••	— • — •	U....	•• —	•• —
D....	— ••	— ••	V....	••• —	••• —
E....	•	•	W....	• — —	• — —
F....	• — •	•• — •	X....	• — ••	— •• —
G....	— — •	— — •	Y....	•••	— • — —
H....	••••	••••	Z....	••••	— — ••
I....	••	••	1....	• — — •	• — — —
J....	— • — •	• — — —	2....	•• — ••	•• — — —
K....	— • —	• — —	3....	••• —	••• —
L....	— —	• — ••	4....	••••	••••
M....	— —	— —	5....	— — —	••••
N....	— •	— •	6....	•••••	— ••••
O....	••	— — —	7....	— — ••	— — •••
P....	••••	• — — •	8....	— •••	— — — ••
Q....	•• — •	— — — —	9....	— •• —	— — — — •
R....	•••	• — •	0....	— — — —	— — — — —
Period	•• — — ••	•••••	Com- ma...	— • — •	• — • — — —
Inter- roga- tion..	— ••••	•• — — ••	Dis- tress (SOS)	•••••	••• — — — —

T
12.5

FIGURE E TABLE OF MATERIAL LISTED UNDER THE DIVISION OF PHYSICS

be heard distinctly for over a mile, and sounds have been carried for several miles.

10.8
10.2

OUTLINE SUMMARY

RADIO

I. Uses of radio

1. Uses in connection with receiving sets
2. Radio link
3. Miscellaneous uses

II. Some principles underlying radio

III. Broadcasting stations

IV. The receiving outfit

1. Intercepting
2. Tuning
 - a. Varying the inductance
 - (1) Variocoupler and variometer
 - b. Varying the capacity
 - (1) Variable condenser
3. Detecting
 - a. Crystals
 - b. Vacuum tubes
 - c. Electrons
4. Amplifying
 - a. Types of amplifiers
5. Reproducing
 - a. Head phones
 - b. Loud speakers

QUESTIONS FOR CLASS DISCUSSION

1. Which do you consider the most important uses of radio?
2. How is it possible for electric waves to travel without wires?
3. What bearing do the electron and the ether theories have on the explanation of radio?
4. What purposes does the vacuum tube serve in radio?
5. What are the principles involved in tuning?
6. What is the value of the amplifying part of a receiving set?

FIGURE F ONE LINE AND THREE WORDS, A SUMMARY AND QUESTIONS LISTED UNDER PHYSICS

fond of mathematics and at an early age became distinguished for his knowledge of this subject. In later years he used this knowledge in carrying on his scientific experiments. He invented the thermometer, and discovered the laws of the pendulum and of falling bodies. He introduced into Italy the experimental method of study which was being advocated by Bacon in England.

HIST
6 cm

Galileo was distinguished both as an astronomer and a physicist. By the use of the telescope he was the first to discover the mountainous character of the moon, the phases of the planet Venus, the satellites of Jupiter, and the rings of Saturn. He advocated the Copernican theory of the universe, which represents the sun as the center with the earth and planets moving around it. For this he was greatly persecuted. He died in 1642 at the age of 78.

Harvey.—William Harvey was born at Folkstone, England, in 1578. He was graduated from Caius College, Cambridge, at the age of nineteen and went to the University of Padua, in northern Italy, at that time the most celebrated school of medicine in the world. Later he became the court physician of Charles the First of England. Harvey is known as the man first to demonstrate the circulation of the blood in the body, and as the father of embryology. The latter title was given him because he watched the hatching of hens' eggs, one of which was opened daily to see the progress and the manner of growth of the chick. He died in 1657.

HIST
4.6 cm

Newton.—Sir Isaac Newton was born in Lincolnshire, England, in 1642, the same year in which Galileo died. He was the son of a farmer, who endeavored to educate the boy to follow the same vocation. But the lad neglected his farm duties to make mechanical toys. A sun dial made by him is still in existence. His mother, recognizing his ability, sent him to school. At the age of eighteen he became a student in Trinity College, Cambridge, and took his first degree at the age of twenty-five. He was especially proficient in mathematics and at the age of twenty-seven became professor of mathematics in his college.

HIST
5 cm

Although he wrote many articles on mathematics and physics, he is best known for his discovery of the theory of universal

FIGURE G MATERIAL LISTED AS HISTORY UNDER THE DIVISION OF PHYSICS (Marked with red pencil.)

100

Our Surroundings

Q
9.2

- 13. If a small fire starts in a home, is it advisable to open or to close the windows? Why?
- 14. What should you do if your clothing catches fire? If that of a companion catches fire?
- 15. Why is it not possible to put out an oil fire by throwing water on it?

7. X

PROJECTS

- 1. Make a fire by striking a piece of flint with steel.
- 2. Make and use a small fire extinguisher.
- 3. Note news records of fires for a period of three weeks, making a record of the known causes. Suggest methods of prevention.

X

OUTDOOR OBSERVATION

- 1. Build a small fire in a safe place. Note (a) effects of wind; (b) combustion of different materials; (c) effects of earth or of water in putting it out.
- 2. Provide yourself with an ordinary thermometer and a note book, and take a walk in your neighborhood. Take the air temperature at different points—in hollows, on hills, in the shade, and in the sun. Take the temperature of any running water you pass, or any still pool. Record observations, with conclusions as to causes for differences in temperature readings.
- 3. Observe and report on different types of fire escapes and exits in schools and in large buildings.

R
15

REFERENCES

Introductory Physics, Chapter VI.....*Higgins*
 Fuels of the Household.....*White*
 Elementary Principles of Physics.....*Fuller, Brownlee and Baker*

FIGURE H QUESTIONS, EXERCISES AND REFERENCES

S.A.

Environmental Factors

9.4

19-

7.

7

HOW TO PRONOUNCE

All the words in this book which may be hard for you to pronounce are marked. By following the sounds indicated below you should be able to pronounce any of such words without the least trouble. The pronouncing scheme here used is that found in Webster's dictionary.

ā as in *āle*; â as in *senâte*; â as in *cāre*; ă as in *ăm*; ä as in *ärm*; á as in *sofá*.

ē as in *ēve*; ê as in *êvent*; ě as in *ěnd*; ē as in *makēr*.

ōō as in *fōod*; oō as in *fōot*.

ī as in *īce*; ÿ as in *ÿll*.

ō as in *ōld*; ô as in *ôbey*; ô as in *ôrb*; ǒ as in *ǒdd*.

ou as in *out*; oi as in *oil*.

ū as in *ūse*; ũ as in *ŭnite*; ũ as in *ŭrn*; ŭ as in *ŭp*.

zh as in *azure*. g as in *go*. ŋ for the n in *bank*.

3. Environmental Factors Differ in Their Importance to Living Things. — Your previous study of science has no doubt proved to you that while all animals and plants must use certain factors of their environment in order to live, yet these factors vary in their value to and use by living things. Fish, for example, live in the water and can live nowhere else. Land animals, on the other hand, such as the dog and the horse, would soon die if kept under water. They must breathe free oxygen (ǒk'sí-jěň) through their lungs. All green plants need light in order to grow (Fig. 3), but other plants, such as mushrooms, will thrive in a dark cellar. Some plants need little light. Others, such as roses, need much light. All animals and plants (Fig. 2) must have water, but some need it in greater amounts and more frequently than others. The camel, for example, can go for many days without a fresh drink of water, but man can live only a very few days without it. Some of the lower animals can exist weeks and even months without contact with moisture. Some insects do not like light and run away when exposed to it.

Data Sheet Bacteriology

Clement-Collister & Thurston

<u>Ex.</u> <u>#</u>	<u>Dr.</u> <u>D.</u>	<u>P.C.</u> <u>P.C.</u>	<u>P.R.</u> <u>P.R.</u>	<u>G.</u> <u>G.</u>	<u>T.</u> <u>T.</u>	<u>Q.</u> <u>Q.</u>	<u>Hist.</u> <u>Hist.</u>	<u>S.</u> <u>S.</u>	<u>R.</u> <u>R.</u>
9. 15.6 9.5 4.7	5 5.3-9.1 6.5		10.			6.5 1.7	14.8 15.6 5.7 7.1 1.8	10.5	2.
Areas									
<u>391.88</u>	<u>164.38</u>		<u>101.00</u>			<u>82.82</u>	<u>454.5</u>	<u>106.05</u>	<u>20.20</u>
Pages									
<u>2.61</u>	<u>1.09</u>		<u>.67</u>			<u>.55</u>	<u>3.03</u>	<u>.70</u>	<u>.13</u>
Words (Fact Material)									
L.	W.								
28	19								
23	3								
13	13								
13	11								
13	120								
34	33								
44	36								
33	26								
16	23								
<u>217</u>	<u>284</u>								
			$\frac{(217 \times 11.28) + 284}{385} = 7.09 \text{ pages}$						

Data Sheet

Botany

Clement-Collister & Thurston

Ex.	Dr.	P.C.	P.R.	G.	T.	Q.	Hist.	S.	R.
+	D.	P.C.	P.R.	G.	T.	Q.	Hist.	S.	R.
3.5	10.1-2.1		15.6		3.	.8	4.6	11.5	1.5
6.6	4.-3.4		9.3			7.	11.5	13.2	1.5
8.	5.2-2.4		7.7			7.5	.8	5.	1.
8.	2.4-5.5		9.			9.		12.5	1.
12.	15.6		12.5			7.		7.	1.
3.7	8.7		6.5			6.8			1.
11.7	7.5		5.4-8.2			7.			
15.6	5.3-6.1		4.5-5.5						
15.6			5.2-9.6						
10.5									
1.3									
5.									
6.									
5.									
Areas									
1136.25	414.00		731.01		30.3	455.51	170.69	496.92	60.6
Pages									
7.57	2.76		4.87		20	3.03	1.14	3.31	1.40
Words (Fact Material)									
L	W	L	W	L	W				
16	11	16	94	17	12				
14	6	14	10	16	105				
33	14	34	11	22	69				
19	3	16	12	34	16				
27	39	1	2	12	111				
5	129	12	9	9	8				
26	62	12	7	924	1280				
34	12	29	13	$\frac{(924 \times 11.28) + 1280}{385} = 30.39$					
28	32	13	12						
27	63	32	39						
31	39	16	9						
19	13	33	19						
14	36	14	19						
16	16	67	25						
32	38	37	36						
34	27	29	20						
6	13	28	20						
30	49								

Data Sheet

Hygiene

Clement-Collister & Thurston

Ex. #	Dr. D ₁	P.C. P.C.	P.R. P.R.	G. G	T. T	Q. Q	Hist. Hist.	S. S	R. R
16.8	6.3		11.		11.5	3.2	.8	18.3	1.
6.	10.		10.5		3.	1.5		10.5	2.
23.	4.5-3.		5.5-4.5		12.	14.5		6.6	1.7
4.	4.3-6.		8.5		18.	8.		7.5	1.5
2.			15.6		5.8	11.		8.6	1.
2.			12.5			7.		7.	1.
1.4			11.5			5.3		8.5	1.5
2.2			8.			5.		7.5	2.
1.5			7-5.			7.5		11.5	1.5
3.			9.6			5.8		3.2	1.
3.8			13.5			5.5			
5.			5.5-7.5			7.8			
3.8			7.3-5.			40.3			
			9.			3.8			
			8.5						
			4.9-5.7						
			4.9-5.3						
			5.2-4.8						
			5.						
			8.5						
			5.2-6.2						
			12.5						
			7.3						
Areas									
752.45	203.93		1777.74		508.03	1274.62	8.08	900.92	143.42
Pages									
5.01	1.36		11.85		3.38	8.50	.05	6.00	.95
Over _____ For _____ Words									

Data Sheet (Cont.)

Hygiene

Words (Fact Material)

L.	W.	L.	W.	L.	W.	L.	W.
22	18	34	23	32	21	35	159
8	7	13	22	29	17	22	78
20	21	2	7	33	21	21	24
43	24	30	15	33	15	47	25
5	11	35	13	33	18	66	49
37	50	12	18	32	21	9	1
17	31	33	13	10	11	29	18
16	44	32	32	39	33	21	68
6	104	29	46	20	30	41	27
34	72	1	6	29	39	34	23
48	27	27	28	32	27	17	8
38	63	33	33	17	102	33	29
28	11	32	31	30	35	32	21
32	22	12	5	32	29		
33	13	30	23	33	12	2385	2547
34	8	32	22	33	27		
22	16	32	18	33	18	$(2385 \times 11.28) + 2547 =$	
6	4	33	36	15	115		
29	19	31	34	19	11	385	76.49 Pages
32	27	5	31	12	23		
18	3	31	31	34	12		
19	7	33	13	24	15		
15	114	29	9	61	38		
18	15	63	32	14	11		
18	11	11	15				
		31	48				

Data Sheet

Misc.

Clement-Collister & Thurston

Ex. +	Dr. D.J.	P.C. P.C.	P.R. P.R.	G. G.	T. T.	Q. Q	Hist. Hist.	S. S.	R. R.
4. 2.	8.	15.6	18.6 5.5-8.9 5.5-3.6 5. 7. 9.5			5.5 2.2 1.5 2. 4.5 10.5	15.6 14.5	2. 7.3 13.5	1.5 1. 1.
Areas									
<u>60.60</u>	<u>80.80</u>	<u>158.00</u>	<u>472.66</u>			<u>264.62</u>	<u>304.01</u>	<u>230.28</u>	<u>35.35</u>
Pages									
<u>.40</u>	<u>.54</u>	<u>1.05</u>	<u>3.48</u>			<u>1.76</u>	<u>2.02</u>	<u>1.53</u>	<u>1.23</u>
L W		Words		(Fact Material)					
30	36	L	W.						
25	18								
50	14	33	13						
41	37	30	36						
30	16	31	26						
25	55	32	25						
28	5	16	12						
19	17	<u>610</u>	<u>441</u>						
28	31			$(610 \times 11.28) + 441 = 19.17 \text{ Pages}$					
27	8			385					
27	12								
32	25								
16	6								
28	26								
33	8								
34	15								

Data Sheet Phys. Geog.

Clement-Collister & Thurston

Ex.	Dr.	P.C.	P.R.	G.	T.	Q.	Hist.	S.	R.
+	D.	P.C.	P.R.	G	T.	Q	HIST	S	R.
7.7	2.3-13.		13.1	5.2-5.2	15.5	11.3	1.	10.	2.3
1.	10.8		9.		15.6	2.		2.7	1.2
3.5	4.5-6.		8.3			9.		7.5	1.2
7.	5.5-7.3		18.			10.2		10.5	1.5
5.	9.		9.			3.		15.5	
4.7	8.5		10.			1.			
4.	8.5		8.5			7.5			
8.5	15.6		5.-8.7			2.			
			5.5-5.7			2.			
			5.-5.3						
			5.5-5.						
			5.5-5.						
			5.5-7.						
			7.1						
			5.5-5						
			22.5						
			6.5						
<u>418.14</u>	<u>626.29</u>		<u>1353.55</u>	<u>27.04</u>	<u>213.11</u>	<u>484.80</u>	<u>10.10</u>	<u>466.62</u>	<u>62.62</u>
<u>2.78</u>	<u>4.17</u>		<u>9.02</u>	<u>.18</u>	<u>1.42</u>	<u>3.23</u>	<u>.06</u>	<u>3.11</u>	<u>.42</u>
Words (Fact Material)									
L.	W.		L.	W.		L.	W.		
14.	6		14	17		39.	59		
24	180		37			19	1		
63	51		46	12		21	13		
38	19		14	16		32	30		
5	8		6	164		903	1405		
31	22		21	88					
33	32		9	102					
14	10		32	40					
34	12		35	6					
33	19		5	2					
9	7		28	24					
22	9		25	17					
27	7		20	75					
23	19		23	65					
30	26		11	130					
33	21		19	81					
14	15								
$\frac{(903 \times 11.28) + 1405}{385} = 30.10 \text{ Pages}$									

Ex. +	Dr. D.	P.C. P.C.	P.R. P.R.	G. G.	T. T.	Q. Q.	Hist. Hist.	S. S.	R. R.
4.5	3.-7.1		15.6		4.	2.5	15.6	8.5	1.6
3.7	15.6		8.		4.5	8.6	7.1	12.	1.5
17.3	6.-5.		9.5		7.7	15.6	20.6	9.	1.8
8.-11.5	15.6		10.5			6.5	15.6	13.	1.5
9.5	8.		13.			2.5	15.6	12.3	1.8
3.5	2.5-9.		9.			10.	15.6	8	1.3
12.	7.-5.		8.5			6.3	18	11.5	1.5
7.	6.7-3.		5.3-13.5			2.	8.5	8.	1.
18.6	7.5-3.		4.3-7.			9.3	11.	3.2	1.5
12.5	7.5-3.		5.3-11.			19.4	4.1	3.5	1.5
3.2	5.5-5.		10.			8.1	13.1	11.5	1.5
8.5	6.7		5.-10.			9.8	7.1	8.	2.
3.3	8.		8.5			5.8		9.5	1.5
9.3	8.-5.7		6.			5.		13.	
3.	6.1-6.1		5.-4.5			4.5		18.1	
9.5	6.7		7.3			3.5		6.1	
6.5	2.1-15.6		13.5-5.5			9.			
12.7	7.5		8.5			7.			
8.7	5.4-2.6		9.7			27.5			
3.5	8.		5.			10			
12.	3.-12.5		9.3			12			
16.2	5.-5.7		8.5			13.5			
3.8	8.5		18.6			24.7			
11.7	12.5		8.5			7			
5.2	6.-5.4		6.3						
13.5-4.7	4.5		5.5-4.4						
7.	7.5		9.2						
6.5	5.5-4.3		4.8						
1.	14		14.						
6.3	3.7-5.5		15.6						
5.3	5.3-4.3		5.3-7						
7.3	5.3-8		15.6						
4.3	6.7-4.2		6.5						
4.5	5.5-6.8		2.9-5.3						
5	5.5-5.4		9.						
8.5	13.5-5.5								
5.5	12.								
8.	5.4-4.5								
7.5	6.								
6.	4.9-15.6								
3.5	5.-15.6								
6.5	5.5-3.6								
	15.6								
	5.4-11.7								
	5.3-2.2								
	5.4-3.2								
	6.7								
	6.5-3.								
	6.7-5.3								
3169.29	2681.60		2982.28		163.62	2324.01	1481.67	1658.42	202.00
21.12	17.87		19.88		1.08	15.49	9.87	11.05	1.34
			Over		For	Words			

Data Sheet (Cont.) Physics

Words (Fact Material)

L. W.		L. W.		L. W.			
28	9	13	18	9	53		
31	33	15	19	32	24		
33	18	32	29	8	47		
34	15	28	69	18	127		
16	8	21	221	17	15		
23	25	15	139	30	41		
9	7	6	13	21	25		
8	9	29	31	17	69		
27	12	31	35	19	17		
15	77	14	52	34	18		
6	1		17	33	19		
5	61	33	129	20	5		
19	116	23	33	52	32		
13	5	21	20	24	67		
29	16	39	164	9	15		
37	5	21	166	42	22		
2	58	31	14	29	10		
20	33	43	47	65	54		
34	12	12	23	67	30		
32	13	23	64	18	88		
30	30	4	8	15	73		
33	16	30	12	8	107		
33	30	53	31	8	4		
24	43	37	78				
23	13		189				
6	220		177				
26	28	27	25				
13	15	19	10				
		26	18				
		30	58				
				2771	5614		

$$(2771 \times 11.28) + 5614 =$$

385

95.76 Pages

Data Sheet Physiology

Clement-Collister & Thurston

Ex.	Dr.	P.C.	P.R.	G.	T.	Q.	Hist.	S.	R.
+	D.	P.C.	P.R.	G.	T.	Q.	HIST	S.	R.
4.	5.-10.		15.6		10.	6.5	4.6	9.5	1.5
3.	13.-5.5					9.	4.1	12.	1.
13.5	6.5-7.					8.8		11	1.3
1.5	5.5-4.					7.		11.5	1.5
7.	5.2-5.8							14.5	
3.2	5.3-7.8								
4.5	4.5								
	3.-4.								
	5.5-1.3								
	4.-3.								
	9.5-5.								
	10.8-5.1								
	5.5-7.								
	5.2-7.4								
	11.1-5.								
	9.-4.								
				Areas					
370.67	660.94		157.56		101.	316.13	87.87	570.85	53.53
				Pages					
2.47	4.40		1.05		.67	2.10	.58	3.94	.36
				Words (Fact Material)					
L. W.		L. W.							
27	28	29	31						
11	151	2	6						
5	148	33	25						
21	19	12	130						
30	22	33	21						
16	98	14	147						
11	17	18	6						
19	33	33	17						
31	22	31	49						
24	13	33	29						
22	92	8	140						
6	158	17	89						
33	25	62	34						
30	57	18	108						
23	96	33	13						
		3	119						
		688	1943						
				$\frac{(688 \times 11.28) + 1943}{385} = 25.20 \text{ Pages}$					

	Total	References	Summary	History	Questions	Tables	Graphs	Photographic Reproductions	Plates in Color	Drawings	Exercises	"Words"
Astronomy	10.01	.25	1.22		1.50			.47		3.55	1.72	2.30
Bacteriology	17.46	.84	1.06		1.09			1.50		1.57	4.72	6.70
Botany	51.57	1.25	2.11	.95	2.60	1.09		12.57		4.37	7.53	19.10
Chemistry	18.91			1.90	.65			.59		2.39	6.38	7.00
Hygiene	142.12	3.97	9.21	1.87	6.93	4.49	5.93	14.60		16.94	15.98	62.20
Miscellaneous	83.23	.84	4.35		4.44	.95	2.01	16.61	4.77	7.67	13.49	28.10
Phys. Geog.	42.78	.56	.94		1.78	.72		8.06		14.79	.83	15.10
Physics	235.75	3.63	14.11	11.42	11.48	1.76	1.29	25.87		46.39	49.50	70.30
Physiology	12.61			.95						4.49	.97	6.20
Zoology	17.08	.53	1.28	.95	.72		.59	2.08		4.33	1.00	5.60
Preface	5.24											5.24
Contents	4.77											4.77
List of Illustrations	12.07											12.07
Student Aids	4.57											4.57
Glossary												
Index	16.79											16.79
Total	674.96	11.87	34.28	18.04	30.19	9.01	9.82	82.35	4.77	106.49	102.10	266.04

	Total	References	Summary	History	Questions	Tables	Graphs	Photographic Reproductions	Plates in Color	Drawings	Exercises	"Words"
Astronomy	36.35	.19			1.60		.12	5.40		2.39	5.60	21.06
Bacteriology	15.84	.26		.91	.42		1.28	1.12		.56	1.50	9.79
Botany	66.54				1.40	.24		15.32		6.28	8.07	35.23
Chemistry	45.08	.19			2.19		.42	1.88		4.34	9.82	26.24
Hygiene	49.96	.09			.12		.37	6.44		4.93	5.80	32.21
Miscellaneous	28.99	.24			1.42	.21	.62	3.52	.91	3.85	3.62	14.60
Phy. Geog.	85.59	.30			5.39	1.00	1.01	13.76		8.65	8.52	46.96
Physics	172.39	.60		.10	10.48	.47	1.12	11.52		33.06	34.53	80.51
Physiology	12.86				.53					1.88	3.81	6.64
Zoology	26.52				.25	.44		2.78		3.92	3.58	15.19
Preface	3.66											3.66
Contents	7.32											7.32
List of Illustrations												
Student Aids	10.98											10.98
Glossary	16.92											16.92
Index	16.47											16.47
Total	595.47	2.23	0.00	1.01	23.80	2.36	4.94	61.74	.91	69.85	84.85	343.78

	Total	References	Summary	History	Questions	Tables	Graphs	Photographic Reproductions	Plates in Color	Drawings	Exercises	"Words"
Astronomy	20.24	.20	.97		.27	.38				4.52	.36	13.54
Bacteriology	11.22	.23	1.38		.80	1.08				.51	2.46	4.76
Botany	46.16	.49	2.00		.91	5.05				7.09	7.24	23.40
Chemistry	15.23		.38			.24				1.22	5.02	8.37
Hygiene	111.04	.91	4.66		2.46	4.06	10.73			10.62	7.85	69.75
Miscellaneous	64.58	.47	1.25		.51	2.17	1.16			10.74	5.46	42.82
Phys. Geog.	38.19	.31	1.80		.76	.75				5.32	3.71	25.54
Physics	189.14	4.35	11.72		4.43	4.19				29.50	16.80	118.15
Physiology												
Zoology	10.90	.10	.40		.40	.55	1.05			.46	1.21	6.73
Preface	5.79											5.79
Contents	2.63											2.63
List of Illustrations												
Student Aids	1.50											1.50
Glossary												
Index	5.48											5.48
Total	522.12	7.06	24.56		10.54	18.47	12.94			69.98	50.11	328.46

	Total	References	Summary	History	Questions	Tables	Graphs	Photographic Reproductions	Plates in Color	Drawings	Exercises	Words
Astronomy	36.49	4.48			.62	.42	.93	1.82		5.82	7.41	14.99
Bacteriology	17.83					.12	1.19	2.75		1.46	2.53	9.78
Botany												
Chemistry	25.05					1.29		4.35		2.28	6.77	10.36
Hygiene	125.91	15.66			.88	3.02	2.14	8.58		16.84	18.62	60.17
Miscellaneous	44.15	6.94			.28	.61		7.00		2.72	7.92	18.68
Phys. Geog.	36.75	2.31						6.22		5.46	8.72	14.04
Physics	230.46	23.61			.35	2.69	1.89	13.96		39.64	33.98	114.34
Physiology												
Zoology												
Preface	6.94											6.94
Contents	4.60											4.60
List of Illustrations												
Student Aids	18.98											18.98
Glossary												
Index	18.52											18.52
Total	565.68	53.00			2.13	8.15	6.15	44.68		74.22	85.95	291.40

SUMMARY SHEET

CLEMENT COLLISTER AND THURSTON

	Total	References	Summary	History	Questions	Tables	Graphs	Photographic Reproductions	Plates in Color	Drawings	Exercises	"Words"
Astronomy	22.56	.08	.84	.12	.66			3.75		3.84	1.29	11.99
Bacteriology	15.13	.13	.70	3.03	.55			.67		1.09	2.61	6.35
Botany	55.67	.40	3.31	1.14	3.03	.20		4.87		2.76	7.57	30.39
Chemistry	23.37	.08	.94	2.48	1.50	4.10		.87		.22	4.29	8.89
Hygiene	113.59	.95	6.00	.05	8.50	3.38		11.85		1.36	5.01	76.49
Miscellaneous	26.70	.23	1.55	2.02	1.76				1.05	.54	.40	19.17
Phy. Geog.	54.31	.42	3.11	.06	3.23	1.42		9.02		4.17	2.78	30.10
Physics	193.46	1.34	11.05	9.87	15.49	1.08		19.88		17.87	21.12	95.76
Physiology	40.77	.36	3.94	.58	2.10	.67		1.05		4.40	2.47	25.20
Zoology	19.14	.23	.80	.71	.76			.64		3.04	.60	12.36
Preface	3.87											3.87
Contents	10.50											10.50
List of Illustrations												
Student Aids												
Glossary	31.51											31.51
Index	22.58											22.58
Total	631.16	4.22	32.22	20.06	37.58	10.85		52.60	1.05	39.29	48.13	385.16