Bulletin 1950, No. 9

The teaching of science in public high schools

An Inquiry into Offerings, Enrollments, and Selected Teaching Conditions, 1947–48

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TABULATION OF DATA FOR THIS STUDY WAS DONE IN RESEARCH AND STATISTICAL SERVICE UNDER THE SUPERVISION OF ROBERT C. STORY

FEDERAL SECURITY AGENCY • Oscar R. Ewing, *Administrator*
Office of Education • Earl James McGrath, *Commissioner*

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foreword

THE OFFICE OF EDUCATION has issued several bulletins on the Offerings and Registrations in High-School Subjects. The most recent of these bulletins was for the year 1933-34. Data for a similar bulletin for 1948-49 are now in process of tabulation. These bulletins, because of the large number of subjects and schools involved, cannot report more than the over-all data for any subject area. This leaves school leaders and the general public without data concerning the general conditions and specific factors that relate to any particular subject area such as science.

The data reported in this bulletin were obtained from a sampling of the Nation's public high schools. The bulletin presents a glimpse of the national conditions that influence opportunities for learning science. If leaders in various units of our systems of schools become concerned about these opportunities, it may be wise for them to make a comprehensive survey of the same type involving the schools in their own system. Summaries of such local studies when compared with this national report may help to reveal local problems which can be studied and provide a basis for making needed improvements.

School leaders should recognize that all youth will help to determine the uses to be made of scientific developments. For this they need a general understanding and appreciation of scientific principles and facts. They need to know the types of evidence that make scientific knowledge dependable. They need to know how to determine quality of scientific information. Can the general science courses, and perhaps a course such as biology, provide the science learnings necessary for intelligent living? Are science courses appropriate in content, methods, and experiences to the needs of all youth? What additions or alternatives can be provided in order to bring science offerings in tune with our times?

School leaders should also recognize that among high-school youth are to be found the creative scientists of tomorrow. Are we adequately nur-

turing these young scientists in our high-school activities? Do we find in our schools the facilities and leadership needed to challenge the interests and abilities of these precious minds?

This study was undertaken to reveal the extent and nature of our science education enterprise at high-school levels. It is hoped that many fruitful developments will grow out of a view of what we are currently doing.

GALEN JONES, *Director,*
Division of Elementary and Secondary Schools.

This study reports enrollments in general science, biology, chemistry, and physics in public high schools, the additional science offerings, the number of teachers serving these pupils, class size, grade placement of science subjects, time allotments for recitation and laboratory, and troublesome problems related to the teaching of science.[1] The findings are based on data collected for the school year 1947–48. These data were provided by teachers or administrators in a sampling of the Nation's public high schools.

nature of the sample

THE SAMPLE, including 755, or 3.15 percent, of the 23,947 [2] public high schools, Negro and white, was a stratified random sample in which the schools were selected according to size and type of school. Of the 755 public high schools, 715, or 94.7 percent, provided information which was used for the purposes of the study. These included 34 schools which provided information included in all but a few sections of the study. There were 18 schools, or 2.4 percent, reported as dropped from the list of high schools through consolidations or other administrative changes. Only 22 schools, or 2.9 percent, failed to respond. The 733 schools that responded constituted 3.06 percent of the public high schools of the United States, and the schools that reported usable data constituted 2.99 percent of the Nation's public high schools.

Table 1 compares the sizes of public high schools in the United States with the schools that provided data for this study. Table 2 presents similar comparisons based on the types of public high schools. It should be noted that the sample was somewhat more closely related to all the public high schools in terms of the sizes of the schools than it was in terms of the types of schools.

Table 3 compares the types and sizes of public high schools in the United States with the schools invited to participate in this study. It also reports the number and percent of schools according to the completeness of the reports received from these schools.

It should be noted that the schools that failed to respond were of the same

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[1] In developing the plan for this study, the author received valuable assistance from the Research Committee of the National Association for Research in Science Teaching. The members of this committee who served on the Office of Education Advisory Committee on Research in Secondary School Science Education were: Arthur O. Baker, Cleveland Public Schools; Guybert P. Cahoon, Ohio State University; and Francis D. Curtis (chairman), University of Michigan. The author also wishes to acknowledge the helpful suggestions given by various members of the Office of Education staff.

[2] If ungraded high schools and high schools with an enrollment of fewer than 10 pupils were included, the total number of public high schools would be 24,316.

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general size and type as those involved in reorganizations that had resulted in the dropping of high schools. The failure of some schools to respond may therefore have been due to additional reorganizations which further reduced the number of public high schools in operation during the school year 1947–48. Table 3 indicates that 733 high schools, or 97.1 percent of the selected sample, provided reports for this study. Of these schools, 715, or 94.7 percent of the sample, supplied data which were used in preparing tables and other summaries.

Table 1.—Sizes of public high schools in the United States compared with the high schools whose reports were used in this study

Size (number of pupils)	Total reported for 1945–46 [1]		Reported data for this study	
	Number	Percent	Number	Percent
1	2	3	4	5
10–24	975	4.1	29	4.1
25–49	2,686	11.2	74	10.4
50–74	3,117	13.0	71	9.9
75–99	2,548	10.6	83	11.6
100–199	5,920	24.7	184	25.7
200–299	2,643	11.1	88	12.3
300–499	2,376	9.9	78	10.9
500–999	2,212	9.2	68	9.5
1,000–2,499	1,328	5.6	37	5.2
2,500 and over	142	.6	3	.4
Total	23,947	100.0	715	100.0

[1] From *Statistics of Public High Schools, 1945–46*, Biennial Survey of Education in the United States, 1944–46, ch. V.

Table 2.—Types of public high schools in the United States compared with the high schools whose reports were used in this study

Type of school		Total reported for 1945–46		Reported data for this study	
Code	Description	Number	Percent	Number	Percent
1	2	3	4	5	6
(*)	Regularly organized high schools (no junior high school precedes)	13,625	56.9	333	46.6
0	Separately administered junior high school followed by 2-year senior high school	184	.8	11	1.5
1	Separately administered junior high school followed by 3-year senior high school	2,139	8.9	74	10.3
2	Separately administered junior high school followed by 4-year senior high school	324	1.4	7	1.0
3	Separately administered senior high school preceded by junior high school	1,007	5.0	30	4.2
4	Junior-senior high school, 2-4 plan	1,321	5.5	36	5.0
5	Junior-senior high school, 3-3 plan	1,556	6.5	48	6.7
6	Junior-senior high school, other plans	155	.7	4	.6
7	Undivided high school	3,326	13.9	168	23.5
8	Senior high school with 1-year junior college	3	0	0	0
9	Senior high school with 2-year junior college	107	.4	4	.6
	Total	23,947	100.0	715	100.0

Table 3.—Types and sizes of public high schools in the United States compared with the types and sizes of high schools invited to participate in this study

Type [1] and size of school	Total number of schools as reported in 1945–46	Selected for this study		Reported as dropped since 1945–46		Failed to report		Incomplete but usable reports		Returning full reports	
		Number	Percent of total	Number	Percent of total	Number	Percent of total	Number	Percent of total	Number	Percent of total
1	2	3	4	5	6	7	8	9	10	11	12
(*)	13,625	334	44.2	.....	.....	1	4.5	17	50.0	316	46.4
0	184	44	5.8	17	94.4	16	72.8	2	5.9	9	1.3
1	2,139	74	9.8	.....	.....	.....	.....	6	17.6	68	10.0
2	324	7	.9	.....	.....	.....	.....	.....	.....	7	1.0
3	1,207	32	4.3	.....	.....	2	9.1	3	8.8	27	4.0
4	1,321	37	4.9	.....	.....	1	4.5	.....	.....	36	5.3
5	1,556	48	6.4	.....	.....	.....	.....	2	5.9	46	6.7
6	155	4	.5	.....	.....	.....	.....	.....	.....	4	.6
7	8,326	171	22.7	1	5.6	2	9.1	4	11.8	164	24.1
8	3	0	0	.....	.....	.....	.....	.....	.....	.....	.....
9	107	4	.5	.....	.....	.....	.....	.....	.....	4	.6
Total	23,947	755	100.0	18	100.0	22	100.0	34	100.0	681	100.0
1–9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
10–24	975	65	8.6	18	100.0	18	81.9	3	8.8	26	3.8
25–49	2,686	76	10.1	.....	.....	2	9.1	9	26.5	65	9.5
50–74	3,117	71	9.4	.....	.....	.....	.....	3	8.8	68	10.0
75–99	2,548	83	11.0	.....	.....	.....	.....	3	8.8	80	11.8
100–199	5,920	184	24.4	.....	.....	.....	.....	3	8.8	181	26.6
200–299	2,643	89	11.8	.....	.....	1	4.5	3	8.8	85	12.5
300–499	2,376	78	10.3	.....	.....	.....	.....	1	3.0	77	11.3
500–999	2,212	68	9.0	.....	.....	.....	.....	3	8.8	65	9.5
1,000–2,499	1,328	38	5.0	.....	.....	1	4.5	5	14.7	32	4.7
2,500 and over	142	3	.4	.....	.....	.....	.....	1	3.0	2	.3
Total	23,947	755	100.0	18	100.0	22	100.0	34	100.0	681	100.0

[1] For meaning of code indicating type of school, see table 2, p. 2.

offerings and enrollments in science courses

General science is almost the only science course offered seventh- and eighth-grade pupils in public high schools. Even at the ninth-grade level, general science continues to be the standard science course. Of the 135 high schools offering science courses other than general science, biology, chemistry, and physics, 108 schools were senior high schools and only 21 were junior-senior high schools. The expansion of science offerings is a typically senior high school development. The extent and general nature of this expansion of offerings is reported on pages 22 and 23.

While only 249, or 34.8 percent, of the 715 schools in the sample reported that they were offering seventh-grade general science, and only 335, or 46.9 percent, of the 715 reported that they were offering eighth-grade general science during the first term of the school year 1947–48, it should be understood that only 348, or 48.7 percent, of the 715 schools in the sample were junior, junior-senior, or undivided high schools. Then, too, many schools schedule pupils for the seventh- and eighth-grade general science during one semester only. Therefore, a somewhat different percentage of schools would offer the course, and a larger number of pupils would be enrolled, if data for both terms of the school year had been considered. Some information concerning the prevalence of single semester general science courses can be obtained from table 29, which shows the time per year allotted to the various science courses.

More schools offer the regular science courses and more pupils enroll in them than was reported by the schools for this study. This is due to the fact that some schools make a practice of alternating science courses in successive years. Alternating of courses commonly involves ninth-grade general science and biology, and chemistry and physics. Data concerning the extent to which alternating of science courses is practiced in public high schools were not obtained in this study.

Table 4 summarizes the number and percent of schools offering the various generally accepted science courses and shows the number and percent of pupils in these schools who were enrolled in these science courses during the first term of the school year 1947–48. Some of the schools offered additional science courses during this term; therefore, the total number of pupils who were taking science courses would be higher than that shown in this table, which is limited to the six generally accepted science courses.

Table 4.—Offerings and enrollments in the commonly accepted high-school science courses

Science course	Total schools in sample having grades where course is commonly taught	Schools offering course		Pupils enrolled		
		Number	Percent	In grade [1]	In course	
					Number	Percent
1	2 [2]	3	4	5	6	7
Seventh-grade general science	348	249	71.6	22,923	14,131	61.6
Eighth-grade general science	348	335	96.3	26,777	21,006	78.4
Ninth-grade general science	674	522	77.4	45,514	30,153	66.2
Biology	623	[3] 531	85.2	42,840	32,104	74.9
Chemistry	623	308	49.4	35,962	14,178	39.4
Physics	623	298	47.8	[4] 31,866	9,036	28.4

[1] Enrollment figures are for grades corresponding to level of course. For biology, chemistry, and physics grade enrollments are those of the tenth, eleventh, and twelfth grades, respectively.
[2] Includes a few schools offering biology at the ninth-grade level.
[3] Does not include high-school pupils at the postgraduate level.

Percent of Pupils in Last 4 Years of High School Enrolled in Science

The base selected for reporting percentage enrollment in the various sciences in this section is the total enrollment of pupils in the last 4 years of high school. This base was selected because it has been used in previous reports on offerings and enrollments prepared by the Office of Education. Even though the same general base is used, there are certain noteworthy differences which those who study this section should keep in mind. In the report for 1933–34 [2] more than 70 percent of the schools of the country was included, and nearly 80 percent of the pupils enrolled was involved. In the study here reported, 97.1 percent of the schools in a representative sample reported, and a correspondingly close approach was made toward getting the total number of pupils enrolled in these schools.

Table 5 is based on data from 715 public high schools and includes the pupils who were in their last 4 years of high school. Grades 9, 10, 11, and 12 were included for schools on the 12-year plan. The eighth grade was included for schools on the 11-year plan.

[2] *Offerings and Registrations in High-School Subjects, 1933-34*, Federal Security Agency, Office of Education Bulletin 1938, No. 6.

Table 5.—Percent of pupils enrolled in sciences over the years

Year reported	Ninth-grade general science	Biology	Chemistry	Physics
1	2	3	4	5
1890			10.10	22.21
1895			9.15	22.77
1900			7.72	19.04
1905			6.76	15.66
1910			6.89	14.61
1915		6.90	7.38	14.23
1922	18.27	8.78	7.40	8.93
1928	17.50	13.58	7.07	6.85
1934	17.75	14.60	7.56	6.27
1947[1]	18.32	19.51	8.62	5.49

[1] Based on sample involved in this study.

A basis for comparing percentage enrollments in various science subjects with the percent of pupils enrolled in the various years of high school is data concerning the distribution of pupils in the last 4 years of high school previously reported by the Office of Education. Table 6 gives the percentages for the years shown.

Table 6.—General distribution of pupils in last 4 years of public high school [1]

Year reported	Percent in each of last 4 years			
	First year	Second year	Third year	Fourth year
1	2	3	4	5
1922	39.1	27.4	19.2	14.3
1930	35.4	27.4	20.6	16.6
1938	31.3	27.1	22.6	19.0
1946	30.3	27.7	23.0	19.0

[1] From *Statistics of Public High Schools, 1945–46*, Biennial Survey of Education in the United States, 1944–46. Ch. V, p. 15.

Tables 7 and 8 present the enrollment in ninth-grade general science, biology, chemistry, and physics, according to sex and in comparison with the total enrollment of boys and girls in various sizes and types of public high schools. A study of these tables reveals that boys and girls are distributed in these science courses in about the same proportion as they are found in the high-school enrollment, except for the chemistry and physics courses. In chemistry there is a somewhat larger number of boys than girls, while in physics the boys outnumber the girls more than two to one. The distribution of boys and girls in various sizes and types of schools and their distribution in the regular high-school science courses can also be noted in these tables.

Table 7.—Enrollment in high-school general science and biology compared with total enrollments in last 4 years, by type and size of high school

Type[1] and size of school	Total enrollment in last 4 years			Ninth-grade general science						Enrollment in biology					
	Boys	Girls	Total	Boys		Girls		Total		Boys		Girls		Total	
				Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
(*)	33, 222	39, 030	72, 252	6, 204	42. 9	6, 689	42. 6	12, 893	42. 8	7, 090	47. 2	8, 136	47. 6	15, 226	47. 4
0	547	542	1, 089	223	1. 5	238	1. 5	461	1. 5	73	.5	82	.5	155	.5
1	5, 354	5, 873	11, 227	2, 830	19. 6	3, 266	20. 8	6, 096	20. 2	246	1. 6	203	1. 2	449	1. 4
2															
3	12, 960	14, 762	27, 722	185	1. 3	200	1. 3	385	1. 3	2, 748	18. 3	3, 343	19. 6	6, 091	19. 0
4	8, 845	4, 245	8, 090	792	5. 5	807	5. 1	1, 599	5. 3	784	5. 2	949	5. 6	1, 733	5. 4
5	6, 145	7, 242	13, 387	1, 253	8. 7	1, 331	8. 5	2, 584	8. 6	1, 366	9. 1	1, 527	8. 9	2, 893	9. 0
6	605	679	1, 284	179	1. 2	170	1. 1	349	1. 1	55	.4	69	.4	124	.4
7	13, 371	13, 485	25, 856	2, 734	18. 9	2, 865	18. 3	5, 599	18. 6	2, 358	15. 7	2, 367	13. 9	4, 725	14. 7
8															
9	1, 889	1, 755	3, 644	60	.4	127	.8	187	.6	306	2. 0	402	2. 3	708	2. 2
Total	76, 938	87, 613	164, 551	14, 460	100. 0	15, 693	100. 0	30, 153	100. 0	15, 026	100. 0	17, 078	100. 0	32, 104	100. 0
1–9															
10–24	230	152	382	47	.3	26	.2	73	.2	78	.5	42	.2	120	.4
25–49	1, 226	1, 221	2, 447	381	2. 6	339	2. 1	720	2. 4	219	1. 5	220	1. 3	439	1. 4
50–74	1, 887	1, 956	3, 843	524	3. 6	499	3. 2	1, 023	3. 4	434	2. 9	444	2. 6	878	2. 7
75–99	2, 867	3, 196	6, 063	688	4. 8	753	4. 8	1, 441	4. 8	603	4. 0	657	3. 9	1, 260	3. 9
100–199	9, 534	10, 443	19, 977	2, 158	14. 9	2, 124	13. 5	4, 282	14. 2	1, 831	12. 2	1, 799	10. 5	3, 630	11. 3
200–299	7, 940	8, 621	16, 561	1, 663	11. 5	1, 712	10. 9	3, 375	11. 2	1, 593	10. 6	1, 653	9. 7	3, 246	10. 1
300–499	10, 600	11, 782	22, 382	2, 490	17. 2	2, 412	15. 4	4, 902	16. 3	2, 038	13. 6	2, 262	13. 2	4, 300	13. 4
500–999	16, 269	17, 757	34, 026	3, 563	24. 7	3, 653	23. 3	7, 216	23. 9	2, 628	17. 5	3, 102	18. 2	5, 730	17. 9
1,000–2,499	23, 499	24, 444	47, 943	2, 946	20. 4	3, 324	21. 2	6, 270	20. 8	4, 967	33. 0	4, 899	28. 7	9, 866	30. 7
2,500 and over	2, 886	8, 041	10, 927			851	5. 4	851	2. 8	635	4. 2	2, 000	11. 7	2, 635	8. 2
Total	76, 938	87, 613	164, 551	14, 460	100. 0	15, 693	100. 0	30, 153	100. 0	15, 026	100. 0	17, 078	100. 0	32, 104	100. 0

[1] For meaning of code indicating type of school, see table 2, p. 2.

Table 8.—Enrollment in high-school chemistry and physics compared with total enrollment in last 4 years, by type and size of high school

Type [1] and size of school	Total enrollment in last 4 years			Chemistry						Physics					
	Boys	Girls	Total	Boys		Girls		Total		Boys		Girls		Total	
				Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
(*)	33, 222	39, 030	72, 252	3, 452	43. 7	2, 861	45. 6	6, 313	44. 5	2, 952	46. 0	1, 138	43. 5	4, 090	45. 3
C	547	542	1, 089												
1	5, 354	5, 873	11, 227												
2															
3	12, 960	14, 762	27, 722	1, 811	22. 9	1, 408	22. 4	3, 219	22. 7	1, 511	23. 5	484	18. 5	1, 995	22. 1
4	3, 845	4, 245	8, 090	487	6. 2	416	6. 6	903	6. 4	428	6. 7	310	11. 8	738	8. 2
5	6, 145	7, 242	13, 387	701	8. 9	582	9. 3	1, 283	9. 1	476	7. 4	311	11. 9	787	8. 7
6	605	679	1, 284	40	. 5	56	. 9	96	. 7	65	1. 0	36	1. 4	101	1. 1
7	12, 371	13, 485	25, 856	1, 166	14. 8	825	13. 1	1, 991	14. 0	839	13. 1	318	12. 1	1, 157	12. 8
8															
9	1, 889	1, 755	3, 644	241	3. 0	132	2. 1	373	2. 6	147	2. 3	21	. 8	168	1. 8
Total	76, 938	87, 613	164, 551	7, 898	100. 0	6, 280	100. 0	14, 178	100. 0	6, 418	100. 0	2, 618	100. 0	9, 036	100. 0
1–9															
10–24	230	152	382							13	. 2	7	. 3	20	. 2
25–49	1, 226	1, 221	2, 447	41	. 5	35	. 6	76	. 5	107	1. 7	77	2. 9	184	2. 0
50–74	1, 887	1, 956	3, 843	113	1. 4	113	1. 8	226	1. 6	117	1. 8	55	2. 1	172	1. 9
75–99	2, 867	3, 196	6, 063	148	1. 9	150	2. 4	298	2. 1	245	3. 8	138	5. 3	383	4. 3
100–199	9, 534	10, 443	19, 977	676	8. 6	585	9. 3	1, 261	8. 9	719	11. 2	294	11. 2	1, 013	11. 2
200–299	7, 940	8, 621	16, 561	824	10. 4	608	9. 7	1, 432	10. 1	538	8. 4	147	5. 6	685	7. 6
300–499	10, 600	11, 782	22, 382	990	12. 5	847	13. 5	1, 837	13. 0	744	11. 6	213	8. 1	957	10. 6
500–999	16, 269	17, 757	34, 026	1, 655	21. 0	1, 158	18. 4	2, 813	19. 8	1, 187	18. 5	325	12. 4	1, 512	16. 7
1,000–2,499	23, 499	24, 444	47, 943	3, 051	38. 6	1, 979	31. 5	5, 030	35. 5	2, 527	39. 4	936	35. 8	3, 463	38. 3
2,500 and over	2, 886	8, 041	10, 927	400	5. 1	805	12. 8	1, 205	8. 5	221	3. 4	426	16. 3	647	7. 2
Total	76, 938	87, 613	164, 551	7, 898	100. 0	6, 280	100. 0	14, 178	100. 0	6, 418	100. 0	2, 618	100. 0	9, 036	100. 0

[1] For meaning of code indicating type of school, see table 2, p. 2.

Enrollment in Seventh and Eighth Grade General Science Compared With Total School Enrollment in These Grades, by Type and Size of School

General science in the seventh and eighth grades is rather definitely limited to pupils at the corresponding grade level. In many schools general science is a required subject, but not all of these schools require pupils to enroll in general science throughout the school year. Alternating general science with some other subject is the type of scheduling practiced in some high schools. Therefore, the data in tables 9 and 10, which are based on the first term of the school year 1947–48, show a smaller number of pupils enrolled in general science in grades 7 and 8 than the school enrollment in the corresponding grades would lead us to expect.

This study does not present data indicating the proportion of the seventh- and eighth-grade pupils who were enrolled in general science during the second term. The data presented indicate that during the first term of the school year 1947–48 in the schools having a seventh grade, 61.6 percent of the pupils in that grade were enrolled in seventh grade general science. The corresponding figure for the eighth grade is 78.4 percent.

Enrollments in seventh- and eighth-grade general science in the various types and sizes of schools are basically similar to the distribution of pupils in these types and sizes of schools. However, it can be noted that a few types and sizes of high schools enrolled all or nearly all the pupils of a particular grade in general science, while a few other types and sizes of high schools enrolled considerably less than all of the pupils of a grade in the corresponding general science course. Regularly organized high schools (no junior high school precedes) reported all eighth-grade pupils enrolled in the corresponding general science. Small high schools with enrollments of 74 pupils or fewer showed a relatively high proportion of the pupils at the seventh and eighth grades enrolled in general science.

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Table 9.—Enrollment in seventh-grade general science compared with total enrollment in grade 7, by type and size of high school

Type[1] and size of school	Total school enrollment grade 7						Seventh-grade general science enrollment					
	Boys		Girls		Total		Boys		Girls		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11	12	13
(*)												
0	227	2.00	180	1.56	407	1.78	155	2.2	100	1.4	255	1.8
1	4,855	42.68	4,956	42.92	9,811	42.80	2,517	35.8	2,645	37.2	5,162	36.6
2	315	2.77	298	2.58	613	2.67	258	3.7	212	3.0	470	3.3
3												
4	686	6.03	726	6.29	1,412	6.16	406	5.8	474	6.7	880	6.2
5	1,850	16.26	2,034	17.61	3,884	16.94	1,038	14.8	1,769	16.4	2,207	15.6
6	132	1.16	120	1.04	252	1.10	131	1.9	121	1.7	252	1.8
7	3,310	29.10	3,234	28.00	6,544	28.55	2,518	35.8	2,387	33.6	4,905	34.7
8												
9												
Total	11,375	100.00	11,548	100.00	22,923	100.00	7,023	100.0	7,108	100.0	14,131	100.0
1–9												
10–24	22	.19	18	.16	40	.17	16	.2	14	.2	30	.2
25–49	71	.63	76	.66	147	.64	67	.9	74	1.0	141	1.0
50–74	172	1.51	205	1.78	377	1.65	154	2.2	181	2.5	335	2.4
75–99	225	2.24	247	2.14	502	2.19	208	3.0	198	2.8	406	2.9
100–199	1,640	14.42	1,653	14.31	3,293	14.37	1,403	20.0	1,350	19.0	2,753	19.5
200–299	1,399	12.30	1,371	11.87	2,770	12.08	1,047	14.9	1,067	15.0	2,114	14.9
300–499	2,048	18.00	1,991	17.24	4,039	17.62	1,529	21.8	1,475	20.8	3,004	21.2
500–999	3,585	31.52	3,705	32.08	7,290	31.80	1,915	27.3	1,968	27.7	3,883	27.5
1,000–2,499	2,183	19.19	2,282	19.76	4,465	19.48	684	9.7	781	11.0	1,465	10.4
2500 and over												
Total	11,375	100.00	11,548	100.00	22,923	100.00	7,023	100.0	7,108	100.0	14,131	100.0

[1] For meaning of code indicating type of school, see table 2, p. 2.

Table 10.—Enrollment in eighth-grade general science compared with total enrollment in grade 8, by type and size of high school

Type[1] and size of school	Total school enrollment grade 8						Eighth-grade general science enrollment					
	Boys		Girls		Total		Boys		Girls		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	3	3	4	5	6	7	8	9	10	11	12	13
(*)	1,180	9.02	1,263	9.22	2,443	9.12	1,216	12.1	1,249	11.4	2,465	11.7
0	309	2.36	281	2.05	590	2.20	185	1.8	141	1.3	326	1.6
1	5,092	38.94	5,213	38.05	10,305	38.49	3,325	33.0	3,825	35.0	7,150	34.0
2	299	2.29	290	2.12	589	2.20	237	2.4	231	2.1	468	2.2
3												
4	1,151	8.80	1,262	9.21	2,413	9.01	1,081	10.7	1,118	10.2	2,199	10.5
5	1,570	12.00	1,773	12.94	3,343	12.49	1,233	12.2	1,499	13.7	2,732	13.0
6	192	1.47	215	1.57	407	1.52	198	1.9	215	2.0	408	2.0
7	3,285	25.12	3,402	24.84	6,687	24.97	2,604	25.9	2,654	24.3	5,258	25.0
8												
9												
Total	13,078	100.00	13,699	100.00	26,777	100.00	10,074	100.0	10,932	100.0	21,006	100.0
1–9	45	.34	42	.31	87	.32	33	.3	42	.4	75	.4
25–49	110	.84	120	.88	230	.86	110	1.1	119	1.1	229	1.1
50–74	285	2.18	295	2.15	580	2.17	277	2.8	321	2.9	598	2.8
75–99	488	3.73	513	3.75	1,001	3.74	436	4.3	419	3.8	855	4.1
100–199	2,087	15.57	2,019	14.74	4,056	15.15	1,672	16.6	1,660	15.2	3,332	15.9
200–299	1,391	10.64	1,454	10.61	2,845	10.62	1,213	12.0	1,178	10.8	2,391	11.4
300–499	2,347	17.95	2,462	17.97	4,809	17.96	2,201	21.9	2,299	21.0	4,500	21.4
500–999	3,561	27.23	3,799	27.73	7,360	27.49	2,130	21.1	2,561	23.4	4,691	22.3
1,000–2,499	2,814	21.52	2,995	21.86	5,809	21.69	2,002	19.9	2,333	21.4	4,335	20.6
2,500 and over												
Total	13,078	100.00	13,699	100.00	26,777	100.00	10,074	100.0	10,932	100.0	21,006	100.0

[1] For meaning of code indicating type of school, see table 2, p. 2.

Enrollment in Ninth Grade General Science and Biology Compared With Total School Enrollment in Grade 9 and in Grade 10

Comparison of the general school enrollments at the ninth- and tenth-grade levels with the science enrollments in ninth-grade general science and in biology is presented in tables 11 and 12. The distribution of pupils in various types and sizes of high schools is shown, together with the total and percentage enrollments by grade and subject.

"What percent of our ninth-grade pupils were enrolled in ninth-grade general science?" Data reported provide the answer that during the first term of the school year 1947–48, 66.2 percent of the ninth-grade pupils was enrolled in general science.

Distribution of pupils in ninth-grade general science by type and size of school is similar to the distribution of pupils in the ninth grade of the same type and size of school. The number of boys and girls in ninth-grade general science are likewise in proportion to their numbers in the ninth grade of the schools, except for the few very large high schools included in this study.

In answer to a similar question, as stated above, concerning biology, data show that during the first term of 1947–48, a number equal to 74.9 percent of the tenth-grade pupils were enrolled in biology. Most of these biology pupils were in the tenth grade, but some were in the ninth grade and some were above the tenth grade. The distribution of pupils in biology by grade level is reported in table 22.

Table 11.—Enrollment in ninth-grade general science compared with total enrollment in grade 9, by type and size of high school

Type [1] and size of school	Total school enrollment grade 9						Ninth-grade general science enrollment					
	Boys		Girls		Total		Boys		Girls		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11	12	13
(*)	9,493	43.91	10,514	44.00	20,007	43.96	6,204	42.9	6,689	42.6	12,893	42.8
0	284	1.31	297	1.24	581	1.27	223	1.5	238	1.5	461	1.5
1	4,638	21.46	5,188	21.71	9,826	21.59	2,830	19.6	3,266	20.8	6,096	20.2
2												
3	397	1.84	393	1.64	790	1.73	185	1.3	200	1.3	385	1.3
4	1,233	5.70	1,292	5.41	2,525	5.55	792	5.5	807	5.1	1,599	5.3
5	1,787	8.27	2,076	8.69	3,863	8.49	1,253	8.7	1,331	8.5	2,584	8.6
6	179	.83	170	.71	349	.77	179	1.2	170	1.1	349	1.1
7	3,557	16.45	3,880	16.24	7,437	16.34	2,734	18.9	2,865	18.3	5,599	18.6
8												
9	49	.23	87	.36	136	.30	60	.4	127	.8	187	.6
Total	21,617	100.00	23,897	100.00	45,514	100.00	14,460	100.0	15,693	100.0	30,153	100.0
1–9	95	.44	60	.25	155	.34	46	.3	25	.2	73	.2
10–24	427	1.98	402	1.68	829	1.82	381	2.6	339	2.1	720	2.4
25–49	599	2.77	682	2.52	1,281	2.64	524	3.6	499	3.2	1,023	3.4
50–74	850	3.93	950	3.97	1,800	3.96	688	4.8	753	4.8	1,441	4.8
75–99	2,989	13.83	3,218	13.47	6,207	13.64	2,158	14.9	2,124	13.5	4,282	14.2
100–199	2,511	11.62	2,793	11.69	5,304	11.65	1,663	11.5	1,712	10.9	3,375	11.2
200–299	3,658	16.92	3,911	16.37	7,569	16.63	2,490	17.2	2,412	15.4	4,902	16.3
300–499	5,111	23.64	5,394	22.57	10,505	23.08	3,563	24.7	3,653	23.3	7,216	23.9
500–999	4,881	22.58	5,383	22.53	10,264	22.55	2,946	20.4	3,324	21.2	6,270	20.8
1,000–2,499	496	.2 29	1,184	4.95	1,680	3.69			851	5.4	851	2.8
2,500 and over												
Total	21,617	100.00	23,897	100.00	45,514	100.00	14,460	100.0	15,693	100.0	30,153	100.0

[1] For meaning of code indicating type of school, see table 2, p. 2.

Table 12.—Enrollment in biology compared with total enrollment in grade 10, by type and size of high school

Type[1] and size of school	Total school enrollment grade 10						Biology enrollment					
	Boys		Girls		Total		Boys		Girls		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11	12	13
(°)	8,932	43.67	9,491	42.40	18,423	43.00	7,090	47.2	8,136	47.6	15,226	47.4
0	238	1.16	225	1.01	463	1.08	73	.5	82	.5	155	.5
1							246	1.6	203	1.2	449	1.4
2												
3	4,882	23.87	5,554	24.81	10,436	24.36	2,748	18.3	3,343	19.6	6,091	19.0
4	991	4.84	1,198	5.35	2,189	5.11	784	5.2	949	5.6	1,733	5.4
5	1,649	8.06	1,935	8.64	3,584	8.37	1,366	9.1	1,527	8.9	2,893	9.0
6	57	.28	73	.33	130	.30	55	.4	69	.4	124	.4
7	3,231	15.80	3,437	15.35	6,668	15.57	2,358	15.7	2,367	13.9	4,725	14.7
8												
9	475	2.32	472	2.11	947	2.21	306	2.0	402	2.3	708	2.2
Total	20,455	100.00	22,385	100.00	42,840	100.00	15,026	100.0	17,078	100.0	32,104	100.0
1–9												
10–24	71	.35	49	.22	120	.28	78	.5	42	.3	120	.4
25–49	285	1.39	302	1.35	587	1.37	219	1.5	220	1.3	439	1.4
50–74	447	2.18	484	2.16	931	2.17	434	2.9	444	2.6	878	2.7
75–99	692	3.38	818	3.65	1,510	3.53	603	4.0	657	3.8	1,260	3.9
100–199	2,309	11.29	2,469	11.03	4,778	11.15	1,831	12.2	1,799	10.5	3,630	11.3
200–299	2,061	10.08	2,280	10.18	4,341	10.13	1,593	10.6	1,653	9.7	3,246	10.1
300–499	2,528	12.36	2,918	13.04	5,446	12.71	2,038	13.6	2,262	13.2	4,300	13.4
500–999	3,724	18.21	4,159	18.58	7,883	18.40	2,628	17.5	3,102	18.2	5,730	17.9
1,000–2,499	7,358	35.97	7,557	33.76	14,915	34.82	4,967	33.0	4,899	28.7	9,866	30.7
2,500 and over	980	4.79	1,349	6.03	2,329	5.44	635	4.2	2,000	11.7	2,635	8.2
Total	20,455	100.00	22,385	100.00	42,840	100.00	15,026	100.0	17,078	100.0	32,104	100.0

[1] For meaning of code indicating type of school, see table 2, p. 2.

The table reporting the distribution of pupils in biology by type and size of high school reveals a few situations and conditions which are worthy of note. There were pupils enrolled in biology in schools which did not have a tenth grade. This indicates that some junior high schools were offering biology and enrolling ninth-grade pupils. Some senior high schools with enrollments of more than 2,500 pupils reported more pupils enrolled in biology than the number of pupils enrolled in the tenth grade. This indicates what is substantiated by table 22, namely, that many schools enrolled pupils above the tenth grade in biology. As was the case for general science, the smaller high schools reported a relatively higher proportion of pupils in the biology course, compared to the pupils enrolled in the tenth grade, than did the moderately large high schools.

Enrollment in Chemistry and Physics Compared With Total School Enrollment in Grade 11 and in Grade 12

Chemistry and physics are commonly studied in the eleventh and twelfth grades. Since chemistry is taken somewhat more often in the eleventh grade, and physics in the twelfth grade, the comparisons shown in table 13 are between the school enrollment in the eleventh grade and the chemistry enrollment, while in table 14 the comparisons are between the school enrollment in the twelfth grade and the physics enrollment. Comparisons of these enrollments in different types and sizes of schools are given.

Chemistry is of course not offered as a separate subject in junior high schools, although it is a part of general science in such schools. A comparison of the total enrollments in chemistry and the total enrollments in the eleventh grade reveals that there are no significant variations among various types of schools. The distribution of pupils in chemistry and physics is similar to the distribution of pupils in these various types of schools. It can be noted, however, that there are more boys than girls enrolled in chemistry in all types of schools except one. On the basis of the data reported in the study, one can expect to find 10 girls and 13 boys in an average chemistry class of 23 pupils.

Chemistry is not offered as a subject in the very small high schools. In the high schools with enrollments of fewer than 100 pupils, a number equivalent to less than 25 percent of the pupils in the eleventh grade were enrolled in chemistry, while in high schools of all sizes a number equivalent to 39.4 percent of the eleventh-grade pupils were enrolled.

Since the chemistry pupils came almost equally from the eleventh and twelfth grades, it is of some significance to indicate that about one-fifth of the pupils enrolled in these grades represented the number enrolled in chemistry.

Table 13.—Enrollment in chemistry compared with total enrollment in grade 11, by type and size of high school

Type[1] and size of school	Total school enrollment grade 11						Chemistry enrollment					
	Boys		Girls		Total		Boys		Girls		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	3	3	4	5	6	7	8	9	10	11	12	13
(*)	7,401	43.11	7,757	41.28	15,158	42.15	3,452	43.7	2,861	45.6	6,313	44.5
0												
1												
2												
3												
4	4,078	23.75	4,594	24.44	8,672	24.12	1,811	22.9	1,408	22.4	3,219	22.7
5	809	4.71	929	4.94	1,738	4.83	487	6.2	416	6.6	903	6.4
6	1,425	8.30	1,723	9.17	3,148	8.75	701	8.9	582	9.3	1,283	9.1
7	125	.73	153	.81	278	.77	40	.5	56	.9	96	.7
8	2,623	15.28	2,961	15.76	5,584	15.53	1,166	14.8	825	13.1	1,991	14.0
9	708	4.12	676	3.60	1,384	3.85	241	3.0	132	2.1	373	2.6
Total	17,169	100.00	18,793	100.00	35,962	100.00	7,898	100.0	6,280	100.0	14,178	100.0
1–9												
10–24	30	.17	21	.11	51	.14						
25–49	243	1.41	271	1.44	514	1.43	41	.5	35	.6	76	.5
50–74	312	1.82	353	1.88	665	1.85	113	1.4	113	1.8	226	1.6
75–99	587	3.42	622	3.21	1,209	3.36	148	1.9	150	2.4	298	2.1
100–199	1,936	11.28	2,095	11.15	4,031	11.21	676	8.6	585	9.3	1,261	8.9
200–299	1,664	9.69	1,849	9.84	3,513	9.77	824	10.4	608	9.7	1,432	10.1
300–499	2,084	12.14	2,465	13.12	4,549	12.65	990	12.5	847	13.5	1,837	13.0
500–999	3,514	20.47	3,870	20.59	7,384	20.53	1,655	21.0	1,158	18.4	2,813	19.8
1,000–2,499	6,061	35.30	6,261	33.31	12,322	34.27	3,051	38.6	1,979	31.5	5,030	35.5
2,500 and over	738	4.30	986	5.25	1,724	4.79	400	5.1	805	12.8	1,205	8.5
Total	17,169	100.00	18,793	100.00	35,962	100.00	7,898	100.0	6,280	100.0	14,178	100.0

[1] For meaning of code indicating type of school, see table 2, p. 2.

Table 14.—Enrollment in physics compared with total enrollment in grade 12, by type and size of high school

Type [1] and size of school	Total school enrollment, grade 12						Physics enrollment					
	Boys		Girls		Total		Boys		Girls		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11	12	13
(*)	6,379	43.06	7,481	43.87	13,860	43.50	2,952	46.0	1,138	43.5	4,090	45.3
0												
1												
2												
3	3,567	24.08	4,212	24.70	7,799	24.41	1,511	23.5	484	18.5	1,995	22.1
4	705	4.76	802	4.70	1,507	4.73	428	6.7	310	11.8	738	8.2
5	1,274	8.60	1,480	8.68	2,754	8.64	476	7.4	311	11.9	787	8.7
6	94	.63	111	.65	205	.64	65	1.0	36	1.4	101	1.1
7	2,298	15.51	2,446	14.35	4,744	14.89	839	13.1	318	12.1	1,157	12.8
8												
9	497	3.36	520	3.05	1,017	3.19	147	2.3	21	.8	168	1.8
Total	14,814	100.00	17,052	100.00	31,866	100.00	6,418	100.0	2,618	100.0	9,036	100.0
1–9												
10–24	34	.23	22	.13	56	.18	13	.2	7	.3	20	.2
25–49	250	1.69	255	1.32	475	1.49	107	1.7	77	2.9	184	2.0
50–74	302	2.04	290	1.70	592	1.86	117	1.8	55	2.1	172	1.9
75–99	485	3.28	548	3.21	1,033	3.24	245	3.8	138	5.3	383	4.2
100–199	1,596	10.77	1,771	10.39	3,367	10.56	719	11.2	294	11.2	1,013	11.2
200–299	1,559	10.52	1,545	9.06	3,104	9.74	538	8.4	147	5.6	685	7.6
300–499	1,736	11.72	1,893	11.10	3,629	11.39	744	11.6	213	8.1	957	10.6
500–999	3,072	20.74	3,667	21.51	6,739	21.15	1,187	18.5	325	12.4	1,512	16.7
1,000–2,499	5,108	34.48	5,246	30.76	10,354	32.49	2,527	39.4	936	35.8	3,463	38.3
2,500 and over	672	4.53	1,845	10.82	2,517	7.90	221	3.4	426	16.3	647	7.2
Total	14,814	100.00	17,052	100.00	31,866	100.00	6,418	100.0	2,618	100.0	9,036	100.0

[1] For meaning of code indicating type of school, see table 2, p. 2.

Physics, like chemistry, is not offered in the junior high schools, although physics subject matter is included in general science. Table 14 compares the number of pupils in physics with the number of pupils enrolled in the twelfth grade. The distribution of pupils in physics is about a constant percent of the pupils in the various types of schools. However, the comparative number of boys and girls in physics is different in various types of schools. Except for the senior high schools with 2-year junior college (of which type only a few schools were included in the sample), only the separately administered senior high schools preceded by junior high schools, the regularly organized high schools, and the undivided high schools show the higher ratio of boys to girls. In these schools there are about three boys to each girl enrolled in physics. The over-all average of boys to girls is such that in the average physics class of 19 pupils there are 5 girls.

Physics, in contrast to chemistry, is offered in many of the smaller high schools. In the smaller high schools a number of pupils equal to about one-third of the twelfth-grade class enrolls in the subject. High schools with enrollments between 200 and 299 reported the lowest number of physics pupils compared with their twelfth-grade enrollments. In all sizes of high schools except those with more than 2,500 pupils, few of which were included in the sample, the ratio of boys to girls is high.

Since physics, like chemistry, is taken by both eleventh- and twelfth-grade pupils, it is significant to note that the number of pupils enrolled in physics represents about 13.3 percent of the number of pupils in the eleventh and twelfth grades.

Changes in Science Enrollments Between First and Second Terms

There are several reasons for enrollment changes in science courses between terms. Pupils do drop out of school, and they do change courses. Some high schools, especially the larger ones, have midyear promotions and graduation. These high schools commonly offer some second semester sections during the first term and some first semester sections during the second term. Some students who have made unsatisfactory progress during the first term are advised to start anew in the second term, while others are advised to choose some elective other than science. Since beginning students are seldom allowed to enter a second term section, gains of students in a subject will often be due to the offering of beginning sections in the second term. The loss of students in a course will be due to the completion of a second term section of the course or to students dropping out of the course for a variety of reasons.

Tables 15 and 16 show the changes in enrollments between the first and second terms in four senior high school science courses. There was a net loss of 1,565 pupils in these courses, of which 598 were boys and 967 were

girls. This loss represents almost 1 percent of the number of pupils enrolled in the last 4 years of high school. In ninth-grade general science and in biology the over-all change between terms was a net loss of 1,432 pupils. General science in the ninth grade showed a net loss in all types of schools except one, and net gains were shown only in high schools with enrollments between 25 and 49. Biology showed net losses in all types of high schools except two and showed net losses in all sizes of high schools.

Chemistry and physics showed net losses of 133 pupils. Losses occurred in all types of high schools except the regularly organized high schools. Gains occurred principally in high schools with enrollments of 1,000 pupils or more.

It may be noted further that for each of the four science courses girls more often failed to continue than did boys. In ninth-grade general science and biology the number dropping out was approximately in the same proportion as the number of boys and girls enrolled in these courses. In chemistry net losses were reported for girls, while there were net gains for boys. These losses and gains nearly offset each other. In physics, where girls represent less than one-third of the pupils, the net change in enrollment between terms was a gain of 8 boys and a loss of 124 girls. The reasons pupils have for dropping science courses warrant further study in order to determine their causes and to find solutions for them.

Table 15.—Changes in enrollment in ninth-grade general science and in biology between first and second terms, by type and size of high school

Type[1] and size of school	Ninth-grade general science enrollment									Biology enrollment								
	First term			Second term			Net change			First term			Second term			Net change		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
(*)	6,204	6,689	12,893	6,060	6,514	12,574	−144	−175	−319	7,090	8,136	15,226	7,082	7,898	14,980	−8	−238	−246
0	223	238	461	223	239	462	0	+1	+1	73	82	155	71	85	156	−2	+3	+1
1	2,830	3,266	6,096	2,660	3,076	5,736	−170	−190	−360	246	203	449	233	207	440	−13	+4	−9
2																		
3	185	200	385	184	194	378	−1	−6	−7	2,748	3,343	6,091	2,596	3,168	5,764	−152	−175	−327
4	792	807	1,599	782	789	1,571	−10	−18	−28	784	949	1,733	762	950	1,712	−22	+1	−21
5	1,253	1,331	2,584	1,226	1,343	2,569	−27	+12	−15	1,366	1,527	2,893	1,340	1,520	2,860	−26	−7	−33
6	179	170	349	179	170	349	0	0	0	55	69	124	55	69	124	0	0	0
7	2,734	2,865	5,599	2,702	2,840	5,542	−32	−25	−57	2,358	2,367	4,725	2,318	2,428	4,746	−40	+61	+21
8																		
9	60	127	187	54	122	176	−6	−5	−11	306	402	708	291	395	686	−15	−7	−22
Total	14,460	15,693	30,153	14,070	15,287	29,357	−390	−406	−796	15,026	17,078	32,104	14,748	16,720	31,468	−278	−358	−636
1–9																		
10–24	47	26	73	43	24	67	−4	−2	−6	78	42	120	74	39	113	−4	−3	−7
25–49	381	339	720	388	351	739	+7	+12	+19	219	220	439	212	216	428	−7	−4	−11
50–74	524	499	1,023	507	499	1,006	−17	0	−17	434	444	878	427	436	863	−7	−8	−15
75–99	688	753	1,441	686	739	1,425	−2	−14	−16	603	657	1,260	604	653	1,257	+1	−4	−3
100–199	2,158	2,124	4,282	2,126	2,125	4,251	−32	+1	−31	1,831	1,799	3,630	1,813	1,811	3,624	−18	+12	−6
200–299	1,663	1,712	3,375	1,608	1,673	3,281	−55	−39	−94	1,593	1,653	3,246	1,549	1,656	3,205	−44	+3	−41
300–399	2,490	2,412	4,902	2,475	2,416	4,891	−15	+4	−11	2,038	2,262	4,300	1,991	2,253	4,244	−47	−9	−56
400–499																		
500–999	3,568	3,653	7,216	3,345	3,442	6,787	−218	−211	−429	2,628	3,102	5,730	2,568	3,048	5,616	−60	−54	−114
1,000–2,499	2,946	3,324	6,270	2,892	3,301	6,193	−54	−23	−77	4,967	4,899	9,866	4,855	4,798	9,653	−112	−101	−213
2,500 and over		851	851		717	717	0	−134	−134	635	2,000	2,635	655	1,810	2,465	+20	−190	−170
Total	14,460	15,693	30,153	14,070	15,287	29,357	−390	−406	−796	15,026	17,078	32,104	14,748	16,720	31,468	−278	−358	−636

[1] For explanation of code indicating type of school, see table 2, p. 2.

Table 16.—Changes in enrollment in chemistry and in physics between first and second terms, by type and size of high school

Type[1] and size of school	Chemistry enrollment									Physics enrollment								
	First term			Second term			Net change			First term			Second term			Net change		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
(*)	3,452	2,861	6,313	3,596	2,866	6,462	+144	+5	+149	2,952	1,138	4,090	3,068	1,022	4,090	+116	−116	0
0																		
1																		
2																		
3	1,811	1,408	3,219	1,765	1,383	3,148	−46	−25	−71	1,511	484	1,995	1,460	473	1,933	−51	−11	−62
4	487	416	903	478	417	895	−9	+1	−8	428	310	738	422	310	732	−6	0	−6
5	701	582	1,283	701	569	1,270	0	−13	−13	476	311	787	466	314	780	−10	+3	−7
6	40	56	96	40	56	96	0	0	0	65	36	101	65	36	101	0	0	0
7	1,166	825	1,991	1,166	801	1,967	0	−24	−24	839	318	1,157	817	321	1,138	−22	+3	−19
8																		
9	241	132	373	214	109	323	−27	−23	−50	147	21	168	128	18	146	−19	−3	−22
Total	7,898	6,280	14,178	7,960	6,201	14,161	+62	−79	−17	6,418	2,618	9,036	6,426	2,494	8,920	+8	−124	−116
1–9																		
10–24																		
25–49	41	35	76	37	35	72	−4	0	−4	13	7	20	13	7	20	0	0	0
50–74	113	113	226	108	112	220	−5	−1	−6	107	77	184	99	76	175	−8	−1	−9
75–99	148	150	298	138	153	291	−10	+3	−7	117	55	172	107	52	159	−10	−3	−13
100–199	676	585	1,261	653	589	1,242	−23	+4	−19	245	138	383	243	134	377	−2	−4	−6
200–299	824	608	1,432	792	589	1,381	−32	−19	−51	719	294	1,013	736	297	1,033	+17	+3	+20
300–399										538	147	685	533	146	679	−5	−1	−6
400–499	990	847	1,837	956	836	1,792	−34	−11	−45	744	213	957	710	205	915	−34	−8	−42
500–999	1,655	1,158	2,813	1,613	1,115	2,728	−42	−43	−85	1,187	325	1,512	1,061	327	1,388	−126	+2	−124
1,000–2,499	3,051	1,979	5,030	3,170	2,052	5,222	+119	+73	+192	2,527	936	3,463	2,574	1,002	3,576	+47	+66	+113
2,500 and over	400	805	1,205	493	720	1,213	+93	−85	+8	221	426	647	350	248	598	+129	−178	−49
Total	7,898	6,280	14,178	7,960	6,201	14,161	+62	−79	−17	6,418	2,618	9,036	6,426	2,494	8,920	+8	−124	−116

[1] For meaning of code indicating type of school, see table 2, p. 2.

High Schools Offering Science Courses Other Than General Science, Biology, Chemistry, and Physics

Various science courses other than general science, biology, chemistry, and physics were offered in the high schools. These were listed from the reports received from the schools and arranged into 11 groups for ease of tabulation. A total of 135 high schools, or about 19 percent of the 715 schools in the sample, reported one or more additional or alternate science course. Table 17 shows the 11 groups of science courses and indicates the number of high schools of various types and sizes offering these courses.

The most common kind of additional or alternate science offering was an applied science type. Physiology was next in frequency, followed by related science, earth science, electricity and radio, science of aviation, applied physics, physical science, plant science, photography, and applied chemistry. If these science courses are arranged into three general groups, physical science, broad science courses, and biological science, we can note that 61 schools included offerings of the physical science type, 49 schools included broad science courses, and 25 schools offered additional courses of the biological science type. The more numerous offerings of additional or alternate science courses of the physical science type may indicate that schools were searching for science offerings to interest pupils who did not elect the usual chemistry and physics courses. Several schools reported biology courses which enrolled junior or senior students almost exclusively. These advanced biology courses may be considered as an additional type of science offering, although the schools did not report them as additional science courses.

It can be noted from table 17 that undivided high schools and separately administered senior high schools preceded by junior high school more often reported additional or alternate science courses than did the other types of high schools. High schools with enrollments of more than 100 pupils also offered additional or alternate science courses relatively often.

Table 17.—High schools offering additional science courses, by type and size of high school

Type [1] and size of school	Number of schools, by type of science course										
	Applied chemistry	Applied physics	Applied science	Science aviation	Earth science	Electricity, radio	Photography	Physical science	Physiology	Plant science	Related science
1	3	3	4	5	6	7	8	9	10	11	12
(*)	2	5	13	3	8	10	1	3	6	1	5
0									1		1
1		1	1								2
2		2	7	3	3	2		2	6	2	3
3	1	1	2	1							
4			5	2	1		1		1	2	
5		1	2								1
6			5	2	1	1	2	1	2	1	2
7									3		
8								1			
9											
Total	3	10	35	11	13	13	4	7	19	6	14
1–9											
10–24		1			1				2		1
25–49			2	1		1					
50–74				1							
75–99			2	1	1						
100–199			6		2	1			5		
200–299			4		2	1		1	1		2
300–499	1	3	7	2	1	3	1	1			1
500–999	1	3	6	3	2	2		1	4	2	6
1,000–2,499		3	8	3	3	4	3	4	6	4	
2,500 and over	1				1	1			1		
Total	3	10	35	11	13	13	4	7	19	6	14

[1] For meaning of code indicating type of school, see table 2, p. 2.

full-time and part-time science teachers

In the 715 schools reported in this study, there were 827 full-time science teachers, of whom 520 were men and 307 were women. There were also 1,011 part-time science teachers who taught one or more sections of science along with other teaching or school responsibilities. Of these, 570 were men and 441 were women. About 45 percent of the science teachers taught science full time. Men constituted 59 percent of all the science teachers, whereas in 1946 [4] they represented 36.7 percent of the entire school staff.

The approximate number of science teachers in the public high schools can be estimated by multiplying the number of teachers reported for the 715 schools by the appropriate factor. Table 18 shows the general numbers of science teachers obtained by such a process. On the basis of the sample used in this study it can be estimated that in 1947–48, there were about 61,600 science teachers serving in our public high schools. About 27,700 were full-time science teachers and about 33,900 were part-time. About 36,500 were men and about 25,100 were women.

Table 19 shows the number of full-time and part-time science teachers distributed on the basis of the types and sizes of the schools in the sample. It shows the number of pupils enrolled and indicates the number of school pupils per science teacher serving in these schools. The over-all average indicates that there is 1 full-time science teacher for each 250 school pupils. There is 1 full-time or part-time science teacher for each 112 school pupils. In general, the number of high-school pupils per science teacher increases with the size of the school. It can also be seen that more than half of the schools with enrollments of fewer than 200 pupils had only part-time science teachers in 1947–48. It can be noted that the number of part-time science teachers exceeds the number of full-time science teachers in all types of high schools except in the separately administered senior high schools preceded by junior high school, in junior-senior high schools of the 3–3 plan, and in senior high schools with 2-year junior college. Only high schools with enrollments of 500 pupils or more have more full-time than part-time science teachers.

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[4] From *Statistics of Public High Schools, 1945–46*, Biennial Survey of Education in the United States, 1944–46. Ch. V, p. 18.

Table 18.—Science teachers in public high schools of the United States

Time devoted to science	Number of science teachers—					
	In sample			Equated to represent all public high schools		
	Men	Women	Total	Men	Women	Total
1	2	3	4	5	6	7
Full time	520	307	827	17,400	10,300	27,700
Part time	570	441	1,011	19,100	14,800	33,900
Total	1,090	748	1,838	36,500	25,100	61,600

Table 19.—Science teachers and pupils in public high schools of various types and sizes whose reports were used in this study

Type[1] and size of school	Reports used in this study		Enrollment of these schools			Science teachers in these schools							Number of high-school pupils per science teacher	
						Full-time			Part-time			Total		
	Number	Percent of total	Boys	Girls	Total	Men	Women	Total	Men	Women	Total		Full-time	Full-time and part-time
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(*)	333	46.6	33,439	36,570	70,009	218	123	341	245	164	409	750	205	93
0	11	1.5	1,058	983	2,041	5	3	8	5	8	13	21	255	97
1	74	10.3	14,720	15,487	30,207	47	38	85	50	55	105	190	355	158
2	7	1.0	614	588	1,202	1	2	3	1	3	4	7	400	171
3	30	4.2	12,960	14,762	27,722	79	33	112	21	10	31	143	247	193
4	36	5.0	5,651	6,234	11,885	33	10	43	43	22	65	107	282	182
5	48	6.7	9,579	11,064	20,643	51	29	80	32	37	69	149	258	138
6	4	.6	779	842	1,621	1	3	4	9	12	21	25	405	84
7	168	23.5	18,505	19,498	38,003	79	64	143	157	129	286	428	265	88
8														
9	4	.6	1,828	1,755	3,583	7	2	9	7	1	8	17	398	210
Total	715	100.0	99,133	107,783	206,916	520	307	827	570	441	1,011	1,838	250	112
1–9	29	4.1	297	212	509	5	2	7	10	20	30	37	72	13
10–24	74	10.4	1,398	1,406	2,804	15	12	27	43	40	83	110	103	25
25–49	71	9.9	2,154	2,251	4,405	16	13	29	52	44	96	125	151	35
50–74	83	11.6	3,360	3,705	7,065	19	12	31	69	52	121	152	227	46
75–99	184	25.7	12,618	13,351	25,969	78	34	112	154	129	283	395	231	65
100–199	88	12.3	10,643	11,328	21,971	39	37	76	75	61	136	212	289	103
200–299	78	10.9	14,491	15,702	30,193	72	49	121	71	51	122	243	249	124
300–499	68	9.5	22,759	24,661	47,420	104	56	160	59	25	84	244	296	194
500–999	37	5.2	28,527	29,803	58,330	155	70	225	86	18	54	279	259	209
1,000–2,499	3	.4	2,886	5,364	8,250	17	22	39	1	1	2	41	211	201
2,500 and over														
Total	715	100.0	99,133	107,783	206,916	520	307	827	570	441	1,011	1,838	250	112

[1] For meaning of code indicating type of school, see table 2, p. 2.

average size of science classes

The average class size was determined by dividing the number of pupils enrolled in a course by the number of sections of that course offered during the first term of the school year 1947–48. The over-all average is greatest for the lower junior high-school science courses, where there are 30 pupils for the seventh-grade general science and 29 pupils for the eighth-grade general science. The average for ninth-grade general science and biology is 26 pupils. The average class size for chemistry is 23 pupils, and for physics it is 19 pupils.

Tables 20 and 21 reveal the average class size in the common science subjects in various types and sizes of high schools. In the regularly organized high schools and in the undivided high schools, the average class size is about the same as the over-all average for all types of high schools. The largest averages for class size are commonly found in the various types of junior-senior high schools.

When the average class size for science courses in the various sizes of high schools is compared, it is found that science classes are commonly larger in the larger high schools. There appears to be a direct relationship between the size of the high-school enrollment and the average class size for the sciences.

If we assume that each of the 827 full-time science teachers was responsible for a minimum of 4 classes, and half of them had 5 classes, that would leave each part-time science teacher with the responsibility for 1 or 2 sections of a science subject. The over-all average for full-time and part-time science teachers was less than 3 sections of science each. The data in this report show that about one-third fewer science teachers teaching 5 sections of science could have taught all the sections of science offered by the schools.

Table 20.—Class size in seventh-, eighth-, and ninth-grade general science, by type and size of high school

Type[1] and size of school	Seventh-grade general science			Eighth-grade general science			Ninth-grade general science		
	Total enrollment	Number of sections	Average class size	Total enrollment	Number of sections	Average class size	Total enrollment	Number of sections	Average class size
1	2	3	4	5	6	7	8	9	10
(*)				2,465	82	30	12,893	496	26
0	255	8	32	326	11	30	461	16	29
1	5,162	173	30	7,150	243	29	6,096	222	27
2	470	16	29	468	15	31			
3							385	15	26
4	880	31	28	2,199	69	32	1,599	54	30
5	2,207	61	36	2,732	83	33	2,584	85	30
6	252	8	32	408	11	37	349	10	35
7	4,905	180	27	5,258	202	26	5,599	237	24
8									
9							187	4	47
Total	14,131	477	30	21,006	716	29	30,153	1,139	26
1–9									
10–24	30	3	10	75	5	15	73	11	7
25–49	141	13	11	229	20	11	720	47	15
50–74	335	21	16	598	32	19	1,023	66	16
75–99	406	20	20	855	37	23	1,441	65	22
100–199	2,753	92	30	3,332	117	28	4,282	172	25
200–299	2,114	71	30	2,391	86	28	3,375	128	26
300–499	3,004	100	30	4,500	150	30	4,902	181	27
500–999	3,883	124	31	4,691	152	31	7,216	247	29
1,000–2,499	1,465	33	44	4,335	117	37	6,270	198	32
2,500 and over							851	24	35
Total	14,131	477	30	21,006	716	29	30,158	1,139	26

[1] For meaning of code indicating type of school, see table 2, p. 2.

Table 21.—Class size in biology, chemistry, and physics, by type and size of high school

Type [1] and size of school	Biology			Chemistry			Physics		
	Total enrollment	Number of sections	Average class size	Total enrollment	Number of sections	Average class size	Total enrollment	Number of sections	Average class size
1	2	3	4	5	6	7	8	9	10
(*)	15,226	588	26	6,313	275	23	4,090	220	19
0	155	6	26	.....	.....	.....	.....	.....	.....
1	449	29	15	.....	.....	.....	.....	.....	.....
2	.....	.....	.....	.....	.....	.....	.....	.....	.....
3	6,091	211	29	3,219	124	26	1,995	84	24
4	1,733	62	28	903	40	23	738	34	22
5	2,893	97	30	1,283	53	24	787	40	20
6	124	4	31	96	3	32	101	4	25
7	4,725	206	23	1,991	100	20	1,157	74	16
8	.....	.....	.....	.....	.....	.....	.....	.....	.....
9	708	23	31	373	13	29	168	8	21
Total	32,104	1,226	26	14,178	608	23	9,036	464	19
1-9	.....	.....	.....	.....	.....	.....	.....	.....	.....
10-24	120	12	10	.....	.....	.....	.....	.....	.....
25-49	439	34	13	76	6	13	20	3	7
50-74	878	51	17	226	19	12	184	20	9
75-99	1,260	65	19	298	22	14	172	16	11
100-199	3,690	162	22	1,261	77	16	383	29	13
200-299	3,246	139	23	1,432	65	22	1,013	70	14
300-499	4,300	159	27	1,837	85	22	685	41	17
500-999	5,730	202	28	2,813	115	24	957	55	17
1,000-2,499	9,866	324	30	5,030	181	28	1,512	71	21
2,500 and over	2,635	78	34	1,205	38	32	3,463	134	26
Total	32,104	1,226	26	14,178	608	23	9,036	464	19

[1] For meaning of code indicating type of school, see table 2, p. 2.

In the light of these assumptions fragmentation of science teaching by the assignment of several teachers, each serving only one or two science sections, often results in the read-about-talk-about type of science teaching deplored by school leaders and tolerated by the pupils. One or a few effective science teachers, with full responsibility for the science work in a school, can perhaps change this situation. Competent science teachers will arrange, try out, and use equipment and supplies. They will care for, improvise, and order science materials. They will seek ways to improve science rooms and furnishings. They will demonstrate experiments and require experimentation of the pupils. They will encourage projects and field trips. They will make science a series of vital experiences which part-time teachers find it difficult to achieve. The large number of part-time science teachers revealed in this study suggests that division of responsibility may be the most serious weakness of our science teaching enterprise.

grade levels of pupils in science courses

The study of grade levels of pupils in science courses was limited to biology, chemistry, and physics, since the general science courses are commonly established at definite grade levels. It has been a matter of common knowledge that biology is primarily a tenth-grade offering, but the availability of this course to pupils at other grade levels has not been known. Chemistry and physics have been accepted as eleventh- and twelfth-grade offerings, but the extent to which this is true and the extent to which pupils at other grade levels are permitted to enroll in these courses has not been previously determined.

Grade Levels of Pupils in Biology

There were 531 schools, or 74.3 percent of the 715 responding schools, which reported a biology offering. Of these responding schools, 438, or 82.5 percent, reported tenth-grade pupils in biology. A total of 93 schools, or 17.5 percent of 531 schools, reported that their biology pupils were from grades other than the tenth grade. Table 22 reports the number of schools which enroll the given percentage of biology pupils from the ninth, tenth, eleventh, twelfth, and postgraduate levels. A study of this table indicates that in 360 schools, more than a majority of the pupils are in the tenth grade, while 72 schools indicated that in their biology course, a majority of the pupils were from the ninth grade. In 31 schools a majority of the pupils in biology were from the eleventh grade, while in 22 schools a majority of the pupils in biology were from the twelfth grade. It is probable that some of these biology courses in which eleventh- and twelfth-grade pupils were enrolled were really separate courses in advanced biology. In the remaining 46 schools the pupils in biology came from several grades without a majority coming from any one grade.

Table 22.—Distribution of pupils in biology, by grade level

Grade level	Number of schools, by percent of enrollment										Number of schools enrolling pupils in biology
	1–10 per-cent	11–20 per-cent	21–30 per-cent	31–40 per-cent	41–50 per-cent	51–60 per-cent	61–70 per-cent	71–80 per-cent	81–90 per-cent	91–100 per-cent	
1	2	3	4	5	6	7	8	9	10	11	12
Ninth	17	4	4		12	9	5	3	11	44	112
Tenth	17	17	4	17	23	10	17	39	50	244	438
Eleventh	95	38	24	20	18	7	11	3	2	8	226
Twelfth	92	26	11	13	12	6	5	2	2	7	176
Postgraduate	6	2									8
Total	227	87	43	53	65	32	38	47	65	303	

Grade Levels of Pupils in Chemistry

Chemistry was offered in 308 of the 715 reporting schools in the sample. Since only 623 of these schools had the upper senior high school levels, the course in chemistry was offered in 49.4 percent of the high schools that reported the grades where the course is commonly offered. Of these 308 schools, 257, or 83.4 percent, reported that eleventh-grade pupils were enrolled in the chemistry course, while 51, or 16.6 percent, reported that their chemistry pupils were from levels other than the eleventh grade. Only 8 schools reported that a majority of the chemistry pupils came from the tenth grade, although 33 schools reported tenth-grade pupils in their chemistry courses. Two schools reported ninth-grade pupils in the chemistry course. There were 139, or 45.1 percent of the schools offering chemistry, that reported a majority of pupils from the eleventh grade, while 130 schools, or 42.2 percent of the schools offering chemistry, reported that a majority of the pupils were in the twelfth grade. One school reported that more than a majority of the pupils in chemistry were postgraduate students. Table 23 gives the distribution of pupils in chemistry by grade level and the percent of pupils from various grade levels enrolled in chemistry. From these data it can be noted that chemistry is the science course for eleventh-grade pupils more often than it is a science course for pupils at any other single grade level.

Grade Levels of Pupils in Physics

Physics was offered in 298 of the 715 high schools reporting in the sample. Since only 623 of these high schools had the grades where physics is usually offered, physics was offered in 47.8 percent of the schools having the appropriate grades. In 260, or 87.2 percent of the high schools offering physics, there were pupils from the twelfth grade in the physics course.

Table 23.—Distribution of pupils in chemistry, by grade level

Grade level	Number of schools, by percent of enrollment										Number of schools enrolling pupils in chemistry
	1–10 per-cent	11–20 per-cent	21–30 per-cent	31–40 per-cent	41–50 per-cent	51–60 per-cent	61–70 per-cent	71–80 per-cent	81–90 per-cent	91–100 per-cent	
1	2	3	4	5	6	7	8	9	10	11	12
Ninth	1	.....	.....	.....	1	.....	.....	.....	.....	.....	2
Tenth	14	3	3	1	4	2	.....	3	1	2	33
Eleventh	20	15	18	25	40	30	17	19	17	56	257
Twelfth	16	23	19	18	38	25	16	19	17	53	244
Postgraduate	12	1	.....	.....	.....	.....	.....	1	.....	.....	14
Total	63	42	40	44	83	57	33	42	35	111	.....

In 38, or 12.8 percent of the high schools offering physics, there were no twelfth-grade pupils in the physics course. Table 24 shows the number of schools that reported the specified percent of physics pupils from the ninth, tenth, eleventh, twelfth, and postgraduate levels. A study of this table reveals that in 167, or 56.0 percent of the schools offering physics, a majority of the physics pupils were in the twelfth grade, while in 92 schools, or 30.9 percent of the schools offering physics, the pupils in physics were most often eleventh-grade pupils. In only four schools were a majority of the pupils enrolled in physics from the tenth grade, and in one school the majority of the pupils in physics were postgraduate pupils. There was about an equal percentage of eleventh- and twelfth-grade pupils in physics in 109, or 36.6 percent of the high schools offering physics. These data indicate that the high-school physics is more often a science course for twelfth-grade pupils than for pupils at any other single grade level.

Table 24.—Distribution of pupils in physics, by grade level

Grade level	Number of schools, by percent of enrollment										Number of schools enrolling pupils in physics
	1–10 per-cent	11–20 per-cent	21–30 per-cent	31–40 per-cent	41–50 per-cent	51–60 per-cent	61–70 per-cent	71–80 per-cent	81–90 per-cent	91–100 per-cent	
1	2	3	4	5	6	7	8	9	10	11	12
Ninth	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	1
Tenth	7	1	3	1	3	1	1	1	.....	1	19
Eleventh	13	12	25	24	35	23	16	7	13	33	201
Twelfth	13	9	7	25	39	12	23	23	11	98	260
Postgraduate	8	3	.....	1	.....	.....	.....	.....	1	.....	13
Total	42	25	35	51	77	36	40	31	25	132	.....

Extent to Which High-School Science Courses Were Open to Pupils at Various Grade Levels

Pupils at the ninth, tenth, eleventh, twelfth, and postgraduate levels were reported by one or more schools as enrolled in biology, chemistry, and physics. Thus in a few schools there were one or more ninth-grade pupils in these science courses studying the course with pupils from other grade levels. However, very few schools reported ninth-grade pupils in their chemistry and physics courses. The number of schools reporting pupils at each of the high-school levels in biology, chemistry, and physics is summarized in table 25.

Table 25.—Number of schools reporting pupils at various grade levels in biology, chemistry, and physics

Science course offered	Number of schools offering course	Number of schools reporting pupils at specified level				
		Ninth grade	Tenth grade	Eleventh grade	Twelfth grade	Post graduate
1	2	3	4	5	6	7
Biology	531	112	438	226	176	8
Chemistry	308	2	33	257	244	14
Physics	298	1	19	201	260	13

time allotments for science courses

The schools in the sample were invited to indicate the number and length of recitation periods per week, the number and length of laboratory periods per week, and the total length in weeks of the science course. From such data it was possible to compute the weekly recitation time, the laboratory time, and the total time for both. When the total time per week was multiplied by the number of weeks devoted to the course, the total time for the course was obtained. The extremes in total time allotment varied from a minimum equivalent of a single period per week for the school year, which was the practice in some schools offering general science, to a maximum equivalent of 10 periods per week for the school year, which was the practice in certain biology, chemistry, and physics courses. The most striking fact concerning time allotments is the wide variation in the time allotted to the same subject in different schools. These wide variations indicate that there are large inequalities in the opportunities that schools make available for science education. Detailed data concerning these variations are given in tables 26, 27, 28, and 29.

Time Allotments for Seventh- and Eighth-Grade General Science

The time allotment patterns are similar for seventh- and eighth-grade general science. Of the 249 schools that reported offering seventh-grade general science, 18.1 percent reported time for laboratory work. Of the 335 schools that reported eighth-grade general science, 22.7 percent reported time for laboratory work. One single period per week for laboratory was the most common practice reported. Two periods per week for laboratory was the practice second in frequency. A few schools reported the equivalent of five periods per week for laboratory instruction.

Approximately four of each five schools that reported seventh- and eighth-grade general science indicated only recitation time for these subjects. The most common practice was to report the equivalent of five 45-minute periods per week for recitation. Approximately two-thirds of the schools that offered seventh- and eighth-grade general science reported the equivalent of five or more periods per week for recitation related to these subjects.

When the combined time for recitation and laboratory instruction for seventh- and eighth-grade general science is studied, it can be noted that the equivalent of five periods per week is the practice in a majority of the schools offering these subjects. One, two, or three periods per week is the practice in less than one-quarter of the schools.

A study of the total time devoted to seventh- and eighth-grade general science during the school year indicates that a majority of the schools reported the equivalent of five or more 45-minute periods per week for the entire school year. Of the schools that reported seventh- and eighth-grade general science, about one-quarter indicated the equivalent of five periods per week for one semester as the time allotted to these science subjects. Further details concerning the allotment of time for seventh- and eighth-grade general science may be obtained from columns 2, 3, 4, and 5 of tables 26, 27, 28, and 29.

Time Allotments for Ninth-Grade General Science

General science in the ninth grade showed the same general extremes and common practices reported for seventh- and eighth-grade general science. The principal difference was in the time reported for laboratory instruction, where 41.6 percent, or one school in each two or three, indicated laboratory time. While the equivalent of five 45-minute periods per week continues to be the common practice for recitation time, more than one-quarter of the schools offering ninth-grade general science reported the equivalent of six 45-minute periods or more per week for recitation. The schools that reported laboratory time for ninth-grade general science indicated that the equivalent of two periods per week was the more common practice. The total time per week devoted to the subject reveals that five periods per week is the common practice, although one-fifth of the schools reported a total weekly time which would require the equivalent of six single periods per week. Less than 5.0 percent of the schools offering ninth-grade general science reported a total time per school year, which would suggest that the course was but one semester in length. Detailed data concerning the time allotments for ninth-grade general science are given in columns 6 and 7 of tables 26, 27, 28, and 29.

Time Allotments for Biology

The high schools that reported offering biology indicated the same extremes in time allotments for recitation and laboratory work as were noted for general science. Of the 531 high schools that reported a course in biology, 331, or 62.3 percent, reported time for laboratory work. The time devoted per week to recitation indicates that five 45-minute periods or five 60-minute periods is the usual practice. Two periods per week for laboratory instruction were reported by a majority of the schools. The total time per week for recitation and laboratory instruction indicates that five periods

per week is the common practice, although one-fifth of the schools indicated the equivalent of six single periods or more per week. The total time per school year indicates that biology is almost universally a 1-year course. However, pupils in some schools have twice as much time for instruction in biology as do pupils in some other schools. Detailed data concerning the time allotments for biology are given in columns 8 and 9 of tables 26, 27, 28, and 29.

Time Allotments for Chemistry and Physics

Time allotments for chemistry and physics will be treated together, since there are many similarities in the time allotments reported for each. Of the 308 high schools reporting chemistry courses, 233, or 75.6 percent, indicated laboratory time for instruction. Of the 298 high schools reporting physics courses, 224, or 75.2 percent, indicated time for laboratory instruction. The similarities in recitation time, laboratory time, and total time allotments are equally vivid. Detailed data concerning time allotments for chemistry and physics are given in columns 10, 11, 12, and 13 of tables 26, 27, 28, and 29.

The weekly recitation time allotments most commonly reported were equivalent to five 45-minute periods and five 60-minute periods per week. The laboratory time commonly reported by the schools was equivalent to two 45-minute periods per week. Two 55-minute periods and two 60-minute periods were also frequently reported for laboratory instruction. The equivalent of three 60-minute periods or more was reported by about 15 percent of the schools that allotted time for laboratory instruction.

The total time allotted per week for chemistry and physics indicated that the equivalent of 5 periods per week was the practice in about 50 percent of the schools, the equivalent of 6 periods per week prevailed in about 25 percent of the schools, and 7 to 10 periods per week prevailed in about 25 percent of the schools. The total time per week and the total time per year allotted to chemistry and physics suggests that a very few schools may be offering single semester courses in these subjects. It was not uncommon for pupils in some schools to have half again as much time for their chemistry or physics course as did pupils in some other schools. A few schools allotted twice as much time for chemistry or physics as was the practice in a few other schools.

Table 26.—Number of schools which allot the given recitation time per week to the various sciences

Minutes per week	Seventh grade		Eighth grade		Ninth grade		Biology		Chemistry		Physics	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11	12	13
1–50	5	2.0	5	1.5	1	0.2	1	0.2				
51–70	1	.4	1	.3	1	.2						
71–90	8	3.2	4	1.2	1	.2	1	.2	1	0.3		
91–110	11	4.4	9	2.7	2	.4	2	.4	1	.3	1	0.3
111–130	7	2.8	8	2.4	8	1.5	19	3.6	15	4.9	17	5.7
131–150	16	6.4	25	7.5	31	5.9	38	7.1	38	12.3	30	10.1
151–170	6	2.4	9	2.7	11	2.1	18	3.4	23	7.5	22	7.4
171–190	14	5.6	20	6.0	46	8.8	50	9.4	32	10.4	25	8.4
191–210	17	6.8	26	7.8	60	11.5	52	9.8	26	8.4	26	8.7
211–230	88	35.4	103	30.7	143	27.4	119	22.4	41	13.3	45	15.1
231–250	20	8.0	35	10.4	60	11.5	52	9.8	32	10.4	29	9.7
251–270	2	.8	2	.6	3	.6	5	.9	5	1.6	5	1.7
271–290	23	9.3	36	10.7	39	7.5	54	10.2	31	10.1	29	9.7
291–310	28	11.3	47	14.0	106	20.3	108	20.3	56	18.2	56	18.8
311–350	2	.8	2	.6	4	.7	7	1.3	2	.7	7	2.4
351–370					1	.2	1	.2			1	.3
371–390												
391–410					1	.2			1	.3	2	.7
411–430												
431–450			2	.6	2	.4	2	.4	3	1.0	2	.7
451–470												
471–490												
491–510					1	.2						
511–530												
531–550	1	.4	1	.3	1	.2	2	.4	1	.3	1	.3
551 up												
Total	249	100.0	335	100.0	522	100.0	531	100.0	308	100.0	298	100.0

Table 27.—Number of schools which allot the given laboratory time per week to the various sciences

Minutes per week	Seventh grade		Eighth grade		Ninth grade		Biology		Chemistry		Physics	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
1	2	3	4	5	6	7	8	9	10	11	12	13
1–50	14	31.2	20	26.3	24	11.1	36	10.9	15	6.4	13	5.8
51–70	4	8.9	12	15.8	22	10.1	33	10.0	11	4.7	18	8.0
71–90	11	24.5	13	17.1	44	20.3	68	20.5	44	18.9	56	25.0
91–110	2	4.4	7	9.2	14	6.4	36	10.9	37	15.9	29	13.0
111–130	8	17.8	14	18.4	70	32.3	84	25.4	61	26.2	49	21.9
131–150	2	4.4	2	2.7	4	1.8	4	1.2	4	1.7	2	.9
151–170					8	3.7	21	6.3	19	8.2	19	8.5
171–190	2	4.4	4	5.3	27	12.4	37	11.2	31	13.3	29	13.0
191–210							4	1.2	6	2.6	6	2.7
211–230	1	2.2	1	1.3	2	.9	3	.9	1	.4	1	.4
231–250			1	1.3	1	.5	2	.6	2	.9	1	.4
251–270	1	2.2	1	1.3	1	.5	2	.6	1	.4	1	.4
271–290												
291–310			1	1.3			1	.3				
311–350												
351–370									1	.4		
371–390												
391–410												
411–430												
431–450												
451–470												
471–490												
491–510												
511–530												
531–550												
551 up												
Total	45	100.0	76	100.0	217	100.0	331	100.0	233	100.0	224	100.0

Table 28.—Number of schools which allot the given total time per per week to the various sciences

Minutes per week	Seventh grade		Eighth grade		Ninth grade		Biology		Chemistry		Physics	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11	12	13
1-50	4	1.6	2	0.6	1	0.2	.....	.....	1	0.3	.....	.....
51-70	1	.4	1	.3	1	.2	.....	.....	.....	.....	.....	.....
71-90	8	3.2	4	1.2	.....	.....	.....	.....	.....	.....	.....	.....
91-110	12	4.8	10	3.0	1	.2	.....	.....	.....	.....	.....	.....
111-130	8	3.2	9	2.7	1	.2	.....	.....	.....	.....	.....	.....
131-150	13	5.2	16	4.8	2	.4	4	0.7	1	.3	.....	.....
151-170	6	2.4	6	1.8	2	.4	.....	.....	.....	.....	.....	.....
171-190	9	3.6	10	3.0	2	.4	.....	.....	.....	.....	.....	.....
191-210	5	2.0	23	6.9	49	9.4	18	3.4	4	1.3	5	1.7
211-230	75	30.1	91	27.1	109	20.9	69	13.0	12	3.9	11	3.7
231-250	22	8.8	36	10.7	55	10.5	49	9.2	29	9.4	29	9.7
251-270	11	4.4	10	3.0	11	2.1	14	2.6	7	2.3	9	3.0
271-290	28	11.4	40	11.9	54	10.3	77	14.5	66	21.4	63	21.1
291-310	27	10.9	41	12.2	119	22.8	130	24.5	66	21.4	63	21.1
311-350	8	3.2	11	3.3	53	10.1	72	13.5	56	18.2	56	18.8
351-370	.....	.....	4	1.2	8	1.5	15	2.8	8	2.6	7	2.4
371-390	.....	.....	3	.9	1	.2	12	2.3	7	2.3	5	1.7
391-410	2	.8	2	.6	4	.8	11	2.1	8	2.6	8	2.7
411-430	5	2.0	9	2.7	32	6.1	41	7.7	30	9.7	26	8.7
431-470	3	1.2	4	1.2	8	1.5	9	1.7	8	2.6	6	2.0
471-490	.....	.....	.....	.....	2	.4	3	.6	.....	.....	1	.3
491-510	1	.4	1	.3	4	.8	2	.4	1	.3	5	1.7
511-530	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
531-550	1	.4	2	.6	3	.6	3	.6	2	.7	2	.7
551 up	.....	.....	.....	.....	.....	.....	2	.4	2	.7	2	.7
Total	249	100.0	335	100.0	523	100.0	537	100.0	308	100.0	298	100.0

Table 29.—Total time allotted for the various sciences per school year

Time in thousands of minutes	Schools allotting the given time to the science											
	Seventh-grade general science		Eighth-grade general science		Ninth-grade general science		Biology		Chemistry		Physics	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1	2	3	4	5	6	7	8	9	10	11	12	13
0.1–1.0												
1.1–2.0	5	2.0	4	1.2	1	0.2						
2.1–3.0	8	3.2	5	1.5	1	.2						
3.1–4.0	19	7.6	16	4.8	1	.2						
4.1–5.0	33	13.3	40	11.9	9	1.7	2	0.4	1	0.3	1	0.3
5.1–6.0	17	6.9	22	6.6	6	1.1	5	.9			1	.3
6.1–6.5	7	2.8	11	3.3	3	.6						
6.6–7.0	3	1.2	3	.9								
7.1–7.5	18	7.2	26	7.7	30	5.7	12	2.3	3	1.0	1	.3
7.6–8.0	6	2.4	11	3.3	26	5.0	8	1.5	2	.7	4	1.3
8.1–8.5	44	17.7	55	16.4	86	16.5	56	10.5	11	3.6	8	2.7
8.6–9.0	18	7.2	28	8.3	51	9.8	53	10.0	17	5.5	19	6.4
9.1–9.5	5	2.0	9	2.7	16	3.1	13	2.4	8	2.6	11	3.7
9.6–10.0	19	7.6	25	7.5	42	8.0	43	8.1	34	11.1	29	9.7
10.1–10.5	6	2.4	8	2.4	21	4.0	32	6.0	27	8.8	28	9.4
10.6–11.0	22	8.9	34	10.1	113	21.6	121	22.8	64	20.8	55	18.5
11.1–11.5	8	3.2	12	3.6	42	8.0	60	11.3	41	13.3	50	16.8
11.6–12.0	1	.4	1	.3	7	1.3	13	2.4	12	3.9	10	3.4
12.1–12.5			1	.3	3	.6	7	1.3	5	1.6	5	1.7
12.6–13.0			4	1.2	11	2.1	20	3.8	21	6.8	17	5.7
13.1–13.5			1	.3	1	.2	3	.6	4	1.3	4	1.3
13.6–14.0			2	.6	2	.4	13	2.4	8	2.6	6	2.0
14.1–14.5					1	.2	7	1.3	6	1.9	7	2.4
14.6–15.0					3	.6	6	1.1	4	1.3	2	.7
15.1–15.5	5	2.0	8	2.4	29	5.6	37	7.0	23	7.5	20	6.7
15.6–16.0	2	.8	3	.9	3	.6	5	.9	6	1.9	6	2.0
16.1–16.5			1	.3	7	1.3	4	.8	3	1.0	3	1.0
16.6–17.0	1	.4	1	.3	1	.2	1	.2	1	.3		
17.1–17.5					3	.6	2	.4			1	.3
17.6–18.0							2	.4	2	.7	5	1.7
18.1–18.5			1	.3								
18.6–19.0									1	.3		
19.1–19.5			1	.3	1	.2	1	.2	1	.3	1	.3
19.6–20.0	2	.8	2	.6	2	.4	2	.4	1	.3	2	.7
20.1–21.0							1	.2				
21.1–22.0							2	.4	1	.3	2	.7
22.1–23.0									1	.3		
23.1–24.0												
24.1–25.0												
25.1 up												
Total	249	100.0	335	100.0	522	100.0	581	100.0	308	100.0	298	100.0

troublesome problems related to science teaching

The schools included in the sample were invited to write statements indicating troublesome problems concerning science courses, facilities for instruction, and other conditions relating to the teaching of science in their schools. These statements were listed and then classified in nine groups, including one miscellaneous group. Table 30 reports the frequency with which each of the nine types of problems were mentioned. The frequency is related to the various types and sizes of high schools included in the sample.

Among the various problems, those related to supplies and equipment were most often mentioned. In order of frequency, these were followed by problems concerning science rooms, teaching staff, program and schedules, school and community, finances, pupils, books, and miscellaneous items. A total of 782 problems related to science teaching was reported by the 715 schools included in the sample.

When the total number of troublesome problems is noted for the various types and sizes of high schools, one may observe a higher frequency of problems from the regularly organized high schools and the undivided high schools, and from the high schools with enrollments between 100 and 300 pupils. Table 31 is presented to show whether or not the frequency of problems was different from the distribution of the various types and sizes of schools in the sample. While the table shows a somewhat higher percentage of problems in the types and sizes of schools just mentioned, the over-all picture reveals that the troublesome problems were distributed in about the same proportion as the types and sizes of schools in the sample. This indicates that the problems reported were common to all types and sizes of schools and that whatever can be done to help meet the problems will therefore help all types and sizes of high schools.

Table 30.—Troublesome problems related to science teaching, by type and size of high school

Type [1] and size of school	Number of schools reporting troublesome problems, by area									
	Books	Finances	Program and schedules	Pupils	School and community	Science rooms	Supplies and equipment	Teaching staff	Miscellaneous	Total problems
1	2	3	4	5	6	7	8	9	10	11
(*)	6	10	25	12	32	86	124	54	2	351
0		1				2	2	2		7
1	4	2	11	3	7	15	23	16	2	83
2	1		1		2	4	2	1		11
3	1	2	3	1	1	7	5	3		23
4	1	2	5	1	1	4	13	7	1	35
5	4	3	6	3	3	18	13	9	1	62
6			1			1	2	1		5
7	2	8	15	7	14	47	75	28	5	201
8										0
9		1				1	2			4
Total	19	29	67	27	62	185	261	121	11	782
1–9										
10–24		3	3	1	8	7	12	3		37
25–49			5	1	5	14	22	19		66
50–74	3	4	6		8	16	31	16		84
75–99	3	2	4	3	8	22	34	12	2	90
100–199	4	12	12	3	14	58	84	30	3	220
200–299	2	3	9	8	5	28	31	16	2	104
300–499	1	2	7	3	6	18	23	12	1	73
500–999	4	3	14	6	2	14	16	8	2	69
1,000–2,499	2		7	2	6	6	6	5	1	35
2,500 and over						2	2			4
Total	19	29	67	27	62	185	261	121	11	782

[1] For meaning of code indicating type of school, see table 2, p. 2.

Table 31.—Comparison of the numbers and kinds of problems related to science teaching with the sizes and types of schools whose reports were used in this study

Type[1] and size of school	Percent of reports from each type of school	Problems reported by each type of school	
		Number	Percent of total
1	2	3	4
(*)	46.6	351	44.9
0	1.5	7	.9
1	10.3	83	10.6
2	1.0	11	1.4
3	4.2	23	3.0
4	5.0	35	4.5
5	6.7	62	7.9
6	.6	5	.6
7	23.5	201	25.7
8			
9	.6	4	.5
Total	100.0	782	100.0
1-9			
10-24	4.1	37	4.7
25-49	10.4	66	8.5
50-74	9.9	84	10.8
75-99	11.6	90	11.5
100-199	25.7	220	28.1
200-299	12.3	104	13.3
300-499	10.9	73	9.3
500-999	9.5	69	8.8
1,000-2,499	5.2	35	4.5
2,500 and over	.4	4	.5
Total	100.0	782	100.0

[1] For meaning of code indicating type of school, see table 2, p. 2.

When the various aspects and conditions of science teaching are considered in relation to the problems mentioned, there is some basis for thinking that the problems grew out of a lack of sufficient concern for science education in the schools. It is true that science teachers were still somewhat scarce in 1947–48. It is also true that some items of equipment and supplies were not abundant and that prices for these were higher. However, the emphasis placed on problems related to physical facilities and teaching staffs suggests that most of the problems may have been due to school leaders who were satisfied to get along without well-trained science teachers and who depended upon teachers prepared for work in subject-matter areas other than science to do the science teaching.

Effective science teaching calls for certain unique preparation, experience, and interest. It calls for familiarity with and appreciation of the science equipment and supplies appropriate for use in high schools. It requires a certain love for improvising experiments and an urge to search out examples of applied science in home and community. It requires an alertness to the values of science teaching materials made available by commercial companies and an ability to judge these values. It requires so much devotion to the experimental approach that time will be found and taken so that inventorying, arranging, using, cleaning up, and putting away equipment and supplies

can be properly done. It requires an interest in helping boys and girls learn through their own experimentation, both of the classical and project type. It demands a troubled feeling when classroom and home-study activities rely upon books as the authority, rather than utilizing planned experiments and unbiased observations. It demands a conscious effort to keep ideas tentative for days, weeks, and oftentimes longer while evidence is being obtained. It demands a constant willingness to modify ideas in the light of new or additional evidence.

Science teachers of this type have been, and will continue to be, in short supply, but with such teachers in the high schools the problems related to science teaching are likely to be less troublesome. No approach to perfection in buildings, grounds, equipment and supplies, courses, books, or audio-visual aids can take the place of well-trained science teachers, although obviously science teachers can make their efforts count for much more under favorable conditions. A well-trained science teacher working under favorable conditions can help pupils to understand science and to appreciate the work of scientists. Science courses will be sought after by all pupils because they see the relationship of science both to life and to careers. The principal problem will then be what it has been: Where to find additional well-trained science teachers to meet the needs and interests of the young growing into more and more active and responsible citizenship.

summary

The findings in this study are based on returns from 715 public high schools and are for the school year 1947–48. The schools supplying the information constituted 94.7 percent of the 755 schools in the sample. The sample was randomly selected from 23,947 public high schools, and it was proportionate to the types and sizes of these high schools.

Enrollments in Science Courses

Somewhat more than 60 percent of the pupils in the seventh and ninth grades was enrolled in general science during the first term of 1947–48. Enrollment in the eighth-grade general science and in biology was equivalent to 75 percent or more of the pupils in the eighth and tenth grades, respectively. Less than half of the senior high schools offered chemistry, and less than half offered physics. However, the combined enrollment in chemistry and physics was equivalent to about one-third of the pupils in the eleventh and twelfth grades. This study indicates that more than 50 percent of the high-school pupils was enrolled in the four commonly offered high-school science courses during the first term of 1947–48.

Some schools make a practice of alternating science courses between terms and between years, while a number of schools offer science courses other than general science, biology, chemistry, and physics. Therefore, a percent larger than that indicated above represents the total number of pupils enrolled in science during the school year 1947–48.

Boys and girls were about equally distributed in the science courses except in chemistry, where there was a small majority of boys, and in physics, where there were more than three times as many boys as girls.

Science Teachers and Science Classes

Part-time science teachers outnumbered the full-time science teachers, and men constituted more than 59 percent of all the science teachers. The number of sections of science offered was such that about two-thirds the number of teachers working full time in science could have taught all the regular science sections that were offered. The average class size was smallest for physics, where it was 19 pupils, and largest for seventh-grade general science, where it was 30 pupils.

Grade Levels of Pupils in Science Courses

The seventh-, eighth-, and ninth-grade general science courses were rather definitely arranged for the corresponding grade levels. Biology, chemistry, and physics were being studied by pupils from the ninth grade to the post-graduate levels. Biology was arranged for tenth-grade pupils in most of the schools, although in some schools it was arranged for the ninth grade and in other schools for the eleventh and twelfth grades. More schools enrolled pupils in chemistry at the eleventh grade than at any other grade level. In a majority of the schools that offered it, physics was a twelfth-grade course. Physics and chemistry were offered in alternate years in some schools, and in these and other schools both eleventh- and twelfth-grade pupils were enrolled in the course.

Time Allotments for Science Courses

The study shows that for the school year 1947–48, the most common practice was to allot five periods per week to each of the science courses. Less than five periods per week was relatively uncommon, even for the general science courses. Time equivalent to more than five periods per week was the practice in about half of the schools that offered chemistry and physics. The science pupils in some schools had twice as much time for a science course as did pupils in some other schools. About three-fourths of the schools that reported an offering in chemistry and physics also reported time for laboratory work; however, about half of these schools included the laboratory time within the five periods per week devoted to the subject.

Troublesome Problems Related to Science Teaching

The troublesome problems reported in this study were most commonly related to physical facilities such as equipment, supplies, rooms, and school. Science teachers, programs and schedules, finances, pupils, and books were also mentioned. These problems appeared to be common to all types and sizes of high schools.

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FEDERAL SECURITY AGENCY
U. S. Office of Education
Washington 25, D. C.

Budget Bureau # 51-4806
Approval expires 11/15/48

INQUIRY INTO THE TEACHING OF SCIENCE GRADES 7-12 (1947-48)

Dear Principal:

The U. S. Office of Education has selected your school to participate in a study of the teaching of science. Only a small number of schools in the United States have been selected, and meaningful results require returns from all the selected schools. Please give this request for information your careful attention.

If possible, please fill in and return one copy within three weeks. The enclosed franked envelope requires no postage.

We would be pleased to receive from you accounts of activities and materials which appear to be influencing science teaching constructively in your school. Please send us any such material under separate cover using the enclosed franked mailing label which requires no postage.

Cordially yours,

Commissioner

Enclosure

A. General Enrollment	Number of Students		
	Boys	Girls	Total
1. In grade 6 (if in high school organization)			
2. In grade 7 (if in high school organization)			
3. In grade 8 (if in high school organization)			
4. In grade 9			
5. In grade 10			
6. In grade 11			
7. In grade 12			
8. As special students of high school grade			
9. In post-graduate status (high school NOT junior college)			
10. Total high school (items 1 through 9 inclusive)			
B. Number of persons teaching science in your school	**Men**	**Women**	**Total**
1. Full time devoted to the sciences			
2. Part-time science teachers			
3. Total science teachers (counting no person twice)			

PLEASE TURN TO BACK OF SHEET

6. Information about science courses:
Please insert the information for each subject in the columns provided

Type of data needed	Science courses about which data are desired					
	General science 7th grade	General science 8th grade	General science 9th grade	Biology	Chemistry	Physics
1. Number of sections or classes available and number of pupils enrolled during the FIRST term of school year 1947-48						
a. Number of sections or classes						
b. Enrollment (boys)						
c. Enrollment (girls)						
d. Total enrollment						
2. Number of sections or classes available and number of pupils enrolled during the SECOND term of school year 1947-48						
a. Number of sections or classes						
b. Enrollment (boys)						
c. Enrollment (girls)						
d. Total enrollment						
3. Number and length of periods						
Class or recitation periods:						
a. Number per week						
b. Length of each period (minutes)						
Laboratory periods:						
a. Number per week						
b. Length of each period (minutes)						
4. Number of weeks in course						
5. Number of different persons teaching this course						
a. As a full-time assignment						
b. As a part-time assignment						
6. For the total current enrollment in biology, chemistry, and physics, please indicate in each case the proportion of students from the various grades						
From the 9th grade				___ %	___ %	___ %
From the 10th grade				___ %	___ %	___ %
From the 11th grade				___ %	___ %	___ %
From the 12th grade				___ %	___ %	___ %
Post-graduate				___ %	___ %	___ %

7. Please list any science courses that were offered in your school during the school year 1947-48 in addition to those considered above.

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

8. Will you please indicate troublesome problems concerning science courses, facilities for instruction, and other conditions relating to the teaching of science in your school. (Use separate sheet if necessary.)

Information supplied by:	Position or title:	Date:
1.		
2.		

Please return one copy within three weeks. A franked envelope is provided for your convenience.
Your cooperation is deeply appreciated.