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Soviet Education Programs

- **FOUNDATIONS**
- **CURRICULUMS**
- **TEACHER PREPARATION**

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OUR STUDY is not a comparative one of the Soviet and American systems of education, nor is it an attempt to evaluate the schooling and teacher education provided in the U.S.S.R. To accomplish both of these tasks, it would require, *first*, an extensive and intensive investigation into every subject area at every level of the educational structure, in order to establish an inventory of quantity and quality, and *second*, research into the historical, philosophical, social, and economic foundations of the two societies from which the schools are created and which they must serve. Any other "comparison" must necessarily be a general listing of differences derived from differing cultural patterns. This latter exercise can nonetheless be useful and be made to abide by scientific methods.

We have aimed here to provide the interested reader with a document based on our own studies of, and experiences in, the Soviet Union's educational domain. We have also drawn on those of others. Our efforts are buttressed by official Soviet views, educational materials in daily use, and Government statements. With special attention to the sciences and polytechnic training, we have presented factual materials which carefully describe these curriculum areas. This approach has enabled us to become further acquainted with Soviet educational practices, and to point out what appear to us to be some of their strengths and weaknesses. While we tend naturally to be influenced by our own cultural experiences in making these observations, we attempt to place them within the Soviet context. The reader is invited to consider these observations.

The School System

Building on modest but strong foundations, educators in the Soviet Union have erected, in a little more than one generation, a system of mass education. Soviet general education is a vigor-

ous and dynamic institution, embracing, until the 1958–59 reforms, the traditional curriculum patterns characteristic of various European schools. It is in form a 4+3+3 (or 7+3) system, with differentiation of pupils at the end of grade 7. The system seems to be designed mainly to provide higher institutions and technical schools with students well grounded in basic mathematics, science, and the mother tongue. Students admitted to higher education include the best ones, determined on a merit (subject-matter achievement) basis. Perhaps the outstanding feature of the system is its trend in recent years toward offering complete secondary education on a mass basis and with a dual purpose—academic and polytechnic. Partly to improve on the opportunities available to all Soviet children aspiring to complete secondary education, and partly to respond to State needs and to weaknesses in the old curriculum, Soviet educators are adjusting their school structures to render them more practical for their society and more accessible to all children. Thus two major aspects of the system stand out: Mass education on a scale hitherto not practiced in Europe and Asia (for the U.S.S.R. is a Eurasian country); and advancement by children through a unified school establishment or "ladder" system in accordance with their individual capacities and, within State-specified limits, their preferences. The changes now underway are considered later in this chapter.

The Teaching

Until recently, the major emphasis in schools has been on formal methods of learning and teaching. Teachers have aimed primarily to give children measurable quantities of fact-learning. A unified curriculum was designed for the academic preparation of pupils going toward higher institutes. Classroom methods of long-established use, like the textbook and recitation, have occupied the center of pedagogical work. Controlled by centralized forms of political authority, this formalism has functioned as an instrument of the authoritarian philosophy of education practiced in the Soviet Union. Coupled with a program of ideological indoctrination, this situation has apparently tended to hinder creative and self-conscious activities among children, activities which might emerge from practicing other pedagogical ideas. Teachers are, on the whole, skilled in the use of their methods and knowledgeable in their respective subject areas. Consistency ap-

pears to reign and to produce satisfactory results for the purpose of Soviet education.

Circles

Classroom teaching is supplemented in many effective ways through circle (club) activities in the Pioneer organizations. School formalism yields to pupil interests and talents in these after-school hours, and so provides a certain balance in the overall education, at least for some children.

The Curriculum

The curriculum is unified, the same for all schools in the country. Slight variations occur in non-Russian nationality areas in literature, history, and geography. Subjects are taught in parallel sequences over a period of years, rather than in concentrations at different levels of the educational ladder. While the parallel method of instruction may allow for more flexible treatment of subjects and interrelationships with other subjects than do some other methods, there are potential disadvantages of limiting the level of maturity achieved in a given branch and of making impossible a flexible program of electives for serving varied interests and specialties. Some evidence of limited maturity was seen in the social studies work carried on in Soviet schools. The question is, however, admittedly open to more extensive research.

We found that Soviet schools offer strong, basic education in mathematics and sciences. The mathematics curriculum in particular is designed to prepare youth for specialization in engineering and scientific work. According to our observations, their programs in mathematics, physics, chemistry, and biology are roughly comparable to those given in American high schools where students take a mathematics-science oriented curriculum in the college preparatory program; but the main difference lies in two areas: First, in the U.S.S.R., all graduates of the Soviet 10-year school receive the same amount of mathematics and science instruction, whereas in the United States some of the same subjects which are *required* of Soviet youngsters are *elective*. Secondly, the Soviet curriculum advances the pupil, especially after grade 5, at a faster rate in mathematics and science concepts than do the usual American high school curriculums. From these standpoints, Soviet high school pupils may appear to have on the average a

better grounding in fundamentals of science and mathematics than do their American counterparts on completing secondary education; but we see these differences primarily as differences in *emphasis*, not necessarily as a difference in the adequacy of mathematics and science preparation for the respective societies. Many American high school science programs are richer and broader than the Soviet curriculum. Each school system has curriculums designed to prepare youth for living in the conditions of their own country. Likewise, each has identifiable strengths and weaknesses within those contexts.

As a kind of diversification from the unified curriculum, Soviet educators encourage pupil participation in the Pioneer circle activities, which in their subject- and cultural-centered programs, provide opportunity for development of talents. We wish to emphasize particularly this aspect of their program, its facilities, organization, and apparent successes. In addition to offering this creative and formative *foyer*, Soviet educators are beginning to provide other afterschool classes for curriculum enrichment, especially in the sciences.

Trends in Soviet curriculum development are definitely toward introducing vastly increased practical and life-related experiences for children and youth during their entire educational career. The aim appears to be twofold: To facilitate mastery of the mathematics and sciences subjects; and to inculcate on pupils an interest in, and respect for, labor. In regard to the practical applications of theory, the Soviet trend contrasts with that in the United States. Some leading American science educators are advocating that teachers pay less attention to application and give greater emphasis to understanding basic scientific principles. There is considerable ferment concerning American mathematics curriculum, and work is going on with the objective of introducing curricular reforms consonant with modern trends in mathematics problems and thinking. We did not detect this particular trend in Soviet education, although their educators do speak about the need to modernize instruction in mathematics and sciences.

Physics curriculum offers another example. For several years the Physical Science Study Committee, with headquarters at the Massachusetts Institute of Technology and supported by a grant from the National Science Foundation, has been working on a revision of the physics curriculum in the high school. A number of physicists working in collaboration with high school teachers have produced curriculum materials which are designed to develop understanding of basic concepts and principles. In this material,

technology, which is the application of science, receives secondary emphasis. It is the belief of the Committee that once the basic understanding of physical notions has been achieved by the pupil, it will be easier for him to comprehend the specific applications later in life as he encounters them. The Committee has felt that in past years too much attention has been given to specific applications, such as the way a refrigerator operates. Numerous similar examples could be cited.

The Soviet school's curriculum in mathematics-science seems comparatively stronger than its social studies-humanities curriculum, with the probable exception of Russian language education and training in the arts. While our mission did not aim to cover the social sciences or arts, opportunities for some observations did occur. Coupled with knowledge of Soviet syllabus and textbook material in this area,[1] these visits left us with an impression that there are shortcomings here, especially in regard to scientifically derived information about other peoples and their cultures. At the same time, ambitious programs are well underway in the teaching of foreign languages.

Teacher Training

Soviet education is moving steadily toward 4-year program of elementary teacher training and has a 5-year program in secondary teacher education, both at the higher (college) level. The 2-year pedagogical school is disappearing, and the universities, as well as the 5-year pedagogical institute, are preparing important segments of secondary school teaching personnel. Soviet secondary teachers (i. e., from grade 5 up), and increasing numbers of elementary teachers, are therefore now receiving preparation similar in time period (but not in total hours) to that now received by corresponding American teachers. While the secondary teacher in the U.S.S.R. receives more instruction in subject-matter areas than does his average American counterpart, we noted certain deficiencies in the general education taken by the Soviet student. Professional training and practice in pedagogy are provided by Soviet programs in considerable measure, but we did not have opportunities to observe student teachers in action. According to criticism by some Soviet educators, facilities for, and the carrying out of, student practice need improvement.

[1] For example, see W. K. Medlin and others, *The Teaching of Social Sciences and Humanities in Soviet Schools*. U.S. Department of Health, Education, and Welfare, Office of Education. Washington: 1959, 49 p.

All graduates of the 5-year programs must write a thesis and pass a State examination in addition to passing regular course tests. Considering the entire teacher education program, our opinion is that, except in the field of general education (liberal arts), the Soviet secondary teacher graduating today has a level of preparation about equivalent to that achieved by a graduate from a 5-year program in an accredited American university or college. Up until the present time, the Soviet student has required 15 years to complete his program; the American, 17 years. We note, however, that Soviet schools are increasing their primary-secondary program to 11 years. It should also be remembered that the school work in the U.S.S.R. goes on 6 days, compared to 5 days in the United States.

In connection with this observation, we wish to point out that in the United States the trend is to require 4 years of college-level preparation for elementary as well as secondary school teachers. At the present time the average classroom teacher in the public elementary and secondary schools of the United States has had 4.7 years of higher education. In an increasing number of the States a fifth year of training is required either before a person may begin to teach in secondary school or within a stated period of time thereafter.

Inservice training for teachers is highly developed in the U.S.S.R. The emphasis, facilities, and personnel relating to the inservice institutes' programs impressed us, and teachers are encouraged to upgrade and update their teaching periodically. This situation appears to aid considerably in the adoption of new methods and practices, which is now taking place on a massive scale.

Educational Research

The magnitude, scope, and energies characterizing Soviet research programs in education impressed us. While this work is more or less centrally directed by the Russian Academy of Pedagogical Sciences in Moscow, much work is going on both systematically according to plans and experimentally. The findings of the large and coordinated staffs in the various research institutes appear to influence considerably what goes on in the schools. In this regard, through current changes, Soviet schools are feeling the effect of educational research and most likely will continue to do so. Limitations imposed by central controls appear, how-

ever, to circumscribe research activities and to hinder development of regional solutions to meet regional needs.

Physical Plant

Buildings and material equipment that we observed seemed inferior in design and construction to standards in U.S. education. Soviet educators with whom we talked tended to put less emphasis on material facilities than on mastery of subject matter. However some of them admitted that more and better material equipment and facilities of higher quality could enable Soviet students to acquire better habits in performing practical work. In the schools we visited, visual aids were plentiful and often skillfully made.

Quality of Education

It is unwise to attempt to reach valid and definitive judgments on the quality of education on the basis of limited observations. In the schools and classes that we visited, indications were that, in the main, Soviet education is effective in teaching certain academic and technical subjects. The academic curriculum directs pupils to steadily rising conceptual maturities in mathematics and sciences at a fairly rapid pace. That has been the design and purpose of Soviet education, but as we know, that design is undergoing change in the U.S.S.R. The same pattern has applied to studies in the social science and humanities area.

In our view, there is no adequate testing system used in the Soviet schools to ascertain the real level of achievement reached by students. National requirements are indeed published annually for examining purposes, but the required content of these examinations varies little from year to year. Furthermore, questions in the sciences are made up from official problems manuals which are available to all schools and which provide pupils with the very material to be used in the examinations; local schools and districts make up their own questions in other subjects (in line with national norms), and these can vary significantly in difficulty and appropriateness; and we do not have any published information by Soviet authorities on the scores made by students on a national scale. All of these factors, and

others of a less tangible nature, prevent true evaluation of Soviet scholastic achievement.

In classes of polytechnic education, we found that the work done in workshops was not as high quality generally as that done in American school workshops. Similarly, the quality of the finished technical drawings that we saw could be improved, although there were exceptions. Furthermore, the scope of the technical drawing courses is narrower than in American schools; for example, architectural plans are not included in these classes. A number of workshops (wood- and metal-working) were poorly lighted, their benches and equipment seemed crowded and in need of space, and machines sometimes lacked safety guards.

Reforms

The most impressive aspect of Soviet schools today is their tremendous effort to reorganize their curriculums and methods. The focus of this effort is to introduce polytechnic-labor education along with the traditional academic program. In this way, Soviet educators aim to transform their schools into dual purpose institutions which can furnish youth the academic basis for higher education as well as a practical preparation for Soviet living. This new program is the first attempt to diversify Soviet secondary education since the reforms of 1931–32. The diversification appears to be limited in scope, concentrating on deepening youths' practical understanding and ability to apply theory, and on training them in a worker specialty in one of several main occupational sectors (industrial, agricultural, trade, transport, etc.) of the national economy. In general, it appears to us that Soviet leaders in education have also assigned themselves the task of building a solid basis for the general and technical upgrading of youth, not only of this generation but also of future generations.

Industrial and agricultural sciences and technical developments are now causing Soviet educators to think about future needs for readapting the schools to give more appropriate instruction for the incipient age of automation, atomic power, and space. We consider the new Soviet program to be a dynamic move, and it seems to promise the crystallization of new philosophic concepts in education as well as the emergence of many practical and material problems. Soviet educators tell us that, on the whole, they are optimistic about the prospect for their important plans. It will be interesting, to say the least, to observe the coming

Soviet educational measures and their role in Soviet cultural development.

In the light of our own experience and our knowledge of American programs resembling polytechnic education, we are of the opinion that at the present time Soviet general schools require more time in practical arts work than do similar American schools generally. At the same time, the Soviet curriculum is narrower in scope than the American curriculum. We feel that differences in economic requirements and technical background in the two societies account in the main for this situation. The size, character, and future plans of the polytechnic program in the U.S.S.R. are such that we must consider it as an integral part of the Soviet philosophy of education. It is not a subject but in fact a *type* of education, and other subjects in the curriculum, such as physics, mathematics, chemistry, and biology, contribute to the polytechnic area. Geography and language training are also considered to be pertinent to the development of polytechnic education.

The new polytechnic curriculum, if fully implemented, will give the Soviet general school a technical-work experience program not before attempted by schools of a modern industrial nation on such a vast scale. The skills aspect of this program, begun in the school shop (or garden plot) and culminated in the factory (or on the farm), aims to provide pupils with a choice of specialty training, but this choice tends to be limited by the enterprise located near the school, with which the school officials arrange cooperative work programs. The shop work and cooperative work experience with industry and agriculture are so organized as to contribute to the national economy while teaching youths the applications of theory, general technical knowledge, and inculcating attitudes toward labor and laboring people. After the tenth grade, however, it seems to us that the work experience has more productive than educative significance. By that time, the student has chosen his work specialty, knows its basic requirements and techniques, and has acquired a certain proficiency. Apparently related to this situation is the Government's new requirement that first-time enrollees in schools of higher education have 2 years' work experience.

One important part of the reforms under way is the growing number of boarding schools. While our visits to this type of school were brief, it was clear to us that Soviet authorities are giving careful attention to this new school.

Our educational mission to the U.S.S.R. helped to deepen our understanding of Soviet education, already nourished by others'

previous visits and reports, and helped us to determine more precisely than before the actual performance of teacher and pupil. This understanding enables us to appreciate the fact that the schools in Russia and other Soviet republics have been striving, on an increasingly mass basis, to meet the *particular* needs of their type of society. These needs are determined mainly by industrial plans and by a centralized political system dedicated to a materialistic philosophy. We are encouraged by the fact that our Soviet visit reconfirmed our dedication to developing American educational institutions along the lines that they have historically taken and to stimulating that development still more through such experiences as this one.

What the end-results of the major Soviet reform in education will be is not for speculation here. We have attempted to describe some of the prominent aspects of that reform and the path designated by Soviet authorities for it to take. We sincerely hope that our efforts will be of service to American educators, and to interested educators everywhere.

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Appendixes

THE DOCUMENTARY MATERIALS that follow have been selected so as to give as complete a factual account as possible of the situation and developments in Soviet education, with special reference to our mission. An attempt is made to give the interested reader and student a body of reference materials in English, not otherwise available, which can be of assistance both in making studies and in following trends of general-polytechnic and teacher education in the U.S.S.R.

To accomplish fully this service, an even more complete documentation could be provided. Normal space considerations, however, require representative selections.

NOTE.—The curriculum tables that follow have been adapted from official study plans (*Uchebnye plany*) published by the R.S.F.S.R. Ministry of Education and the U.S.S.R. Ministry of Higher and Special Secondary Education. Curriculums for pedagogical institutes are taken from, *Uchebnye plany pedagogicheskikh institutov* (1957).

In each of the curriculums reproduced here, the following symbols have been used consistently:

"R" after the number of hours per week in a semester column and separated by a diagonal (/) indicates a *report* required in that semester; for example, 3/R. This report is an oral test taken by the student in the presence of the instructor in charge.

"E", similarly placed, indicates an *examination* required in that semester.

"P", similarly placed, indicates a special *project* required in that semester.

"LR", similarly placed, indicates a *laboratory report* due in that semester.

APPENDIX I
Curriculums for Schools of General Education R.S.F.S.R.

Table A.—Curriculum for 10-year school (1955-56)

Subjects	Number of hours a week in each grade [1]										Total hours	
	1	2	3	4	5	6	7	8	9	10	By the week	By the year
1	2	3	4	5	6	7	8	9	10	11	12	13
1. Russian language and literature [2]	13	13	13	9	9	8	6	6/5	4	4	84.5	2,788
2. Mathematics	6	6	6	6	6	6	6	6	6	6	60	1,980
3. History				2	2	2	2	4	4	4	20	660
4. Constitution of the U.S.S.R. [3]										1	1	33
5. Geography				2	3	2	2	2/3	3		14.5	479
6. Biology				2	2	2	3	2	1		12	396
7. Physics						2	3	3	4	5/4	16.5	544
8. Astronomy										1	1	33
9. Chemistry							2	2	3	3/4	10.5	347
10. Psychology										1	1	33
11. Foreign language					4	4	3	3	3	3	20	660
12. Physical education	2	2	2	2	2	2		2	2	2	20	660
13. Drawing	1	1	1	1	1	1					6	198
14. Technical drawing							1	1	1	1	4	132
15. Singing	1	1	1	1	1	1					6	198
16. Work and practical exercises	1	1	1	1	2	2	2				10	330
17. Practice in agriculture with agricultural machinery and in electrotechnology												
18. Excursions								2	2	2	6	198
												188
Total	24	24	24	26	32	32	32	33	33	33	293	9,857

[1] In grades 1, 2, 3, and 10, the school year is 33 weeks; in grades 4–9, 34 weeks. Six school days in each year are devoted to excursions.

[2] From the general number of hours, given over in grades 1–3 to the Russian language, 2 hours a week are allotted for teaching penmanship in grade 1, and 1 hour a week in grades 2 and 3.

[3] The course in the Constitution of the U.S.S.R. was not taught in the 1957–58 school year to grade 10, since the students in grade 10 had already had the course in grade 7; in this way 1 hour a week in grade 10 was released in the 1957–58 school year for the improvement of the knowledge of those studying in the Russian language or other courses—at the discretion of the pedagogical council of the school.

SOURCE.—E. N. Medynskii. *Prosveshchenie v SSSR. (Education in the U.S.S.R.)* Moscow, 1955, p. 84.

Table B.—Curriculum for 10-year schools, to be implemented by 25 percent of the schools during school year 1957-58, and by 50 percent during 1958-59

Subjects	Number of hours a week in each grade [1] [Two figures for one grade in a column indicate number of hours for each semester]										Total hours		In addition to yearly hours in schools		Total year's hours in schools	
	1	2	3	4	5	6	7	8	9	10 [2]	By the week	By the year	Urban	Rural	Urban	Rural
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Russian language and literature [3]	13	13	13	9	9	6	6	5	4	4	84	2,856	----	----	2,856	2,856
2. Mathematics	6	6	6	6	6	6	6	6	6	6/5	59.5	2,023	----	----	2,023	2,023
3. History	----	----	----	2	2	2	2	4/3	3/4	4/5	19.5	663	----	----	663	663
4. Geography	----	----	----	2	3	2	2	2/3	3	----	14.5	493	----	----	493	493
5. Biology	----	----	----	2	2	2	3	2	1	----	12	408	----	----	408	408
6. Physics	----	----	----	----	----	2	3	3	4/3	4	15.5	527	----	----	527	527
7. Astronomy	----	----	----	----	----	----	----	----	----	1	1	34	----	----	34	34
8. Chemistry	----	----	----	----	----	----	2	2	2	4	10	340	----	----	340	340
9. Foreign language	----	----	----	----	4	4	3	3	3	3	20	680	----	----	680	680
10. Physical culture	2	2	2	2	2	2	2	3	3	3	23	782	----	----	782	782
11. Drawing	1	1	1	1	1	1	----	----	----	----	6	204	----	----	204	204
12. Technical drawing	----	----	----	----	----	----	1	1	1	1	4	136	----	----	136	136
13. Singing	1	1	1	1	1	1	----	----	----	----	6	204	----	----	204	204
14. Work (classes 1–4) and practical exercises in school workshops (classes 5–7)	1	1	2	2	2	2	2	----	----	----	12	408	----	----	408	408
Autumn and spring work in the school's practice area in classes 5–7 and educationally productive practice upon the termination of the school exercises in classes 5–6 [4]	----	----	----	----	----	----	----	----	----	----	----	----	102	138	102	138
15. Fundamentals of production	----	----	----	----	----	----	----	3	4	4	11	374	----	----	374	374
Educationally productive practice upon the termination of school exercises in classes 8–9 [5]	----	----	----	----	----	----	----	----	----	----	----	----	192	192	192	192
Excursions	----	----	----	----	----	----	----	----	----	----	----	----	191	191	191	191
Total	24	24	25	27	32	32	32	34	34	34	298	10,132	485	521	10,617	10,653
Optional (at the choice of those learning) practical courses	----	----	----	----	----	----	----	1	2	2	5	170	----	----	170	170

[1] In grades 1, 2, 3, and 10 the number of school weeks in the year is 34, and in grades 4 through 9, 35; of the total in grades 4 through 9, 1 week—6 school days in the year—is allotted to making excursions.

[2] The course on the Constitution of the U.S.S.R. usually required in grade 10 was not conducted in 1957–58 since students in this school year in grade 10

(CONTINUED ON NEXT PAGE)

Table C.—Experimental curriculum for grades 9, 10, and 11 of urban schools (1957-58)[1]

Subjects	Number of hours a week in each grade			Total hours	
	9	10	11	By the week	By the year
1	2	3	4	5	6
1. Literature	2	3	3	8	297
2. Mathematics	4	4	4	12	448
3. History	3	4	3	10	375
4. U.S.S.R. Constitution			1	1	34
5. Economic geography	3			3	117
6. Physics	4	3	2	9	341
7. Astronomy		2/0		1	39
8. Chemistry	2	3	2	7	262
9. Biology	1			1	39
10. Foreign language	3	3	2	8	302
11. Technical drawing	2			2	78
12. Physical education	2	2	1	5	190
13. Principles of industrial production	2	0/2		3	117
Total	28	24	18	70	2,640
14. Production (theoretical and practical) training and production work	6	12	18	36	1,314
Total	34	36	36	106	3,954
Extracurricular activities (sport, various types of art, etc.)	3	3	3	9	336

NOTE.—(1) Academic year in grades 9–10 is 39 weeks, and in grade 11 is 34 weeks. (2) From the total number of hours which are provided in production training and production work, for theoretical study there are allocated 2 hours per week in grade 9, 4 hours in grade 10, and 2 hours in grade 11.

SOURCE.—S. G. Shapovalenko, *ed. Soedinenie obuchenila s proizvoditel'nym trudom uchashchikhsia.* (Combining instruction with production work of pupils. An experience of fifty schools in the R.S.F.S.R.) Moscow, R.S.F.S.R. Academy of Pedagogical Sciences, 1958. P. 198.

FOOTNOTES FOR TABLE B

(Continued from Page 219)

had already had the course in grade 7. Therefore, from the 5 hours a week, devoted in the second half year in grade 10 to the history of the U.S.S.R., 1 hour was used at the discretion of the director of the school.

[3] Out of the total hours devoted to the Russian language, 2 hours per week is allocated to penmanship in grade 1, and in grades 2 and 3, 1 hour a week is usually required.

[4] In grades 5, 6, and 7, 22 hours a week is allotted in each for fall and spring work at the school practice area.

[5] In addition to practical exercises and educationally productive practice, conducted in grades 5–7 and 8–10 during the school year, there is provided for:

a. Educationally productive practice in urban schools—at the school's practice area—at the transition from grade 5 to 6—6 working days, and from grades 6 to 7—6 working days, at the rate of 3 hours a day; in the rural schools, the school's plot on a collective farm, on the transition from grade 5 to 7—12 working days at the rate of 3 hours a day.

b. Educationally productive practice in agriculture upon the transition from grade 8 to 9 for pupils in the urban and rural schools for 24 working days at 4 hours a day.

c. At the transition from grade 9 to 10, educational productive practice in agriculture for pupils in rural schools—24 working days, and in industrial establishments for pupils in urban schools for 24 working days at 4 hours a day.

SOURCE.—U. S. Department of Health, Education, and Welfare, Office of Education. *Soviet Commitment to Education.* (Bulletin 1959, No. 16.) Report of the First Official U. S. Education Mission to the U.S.S.R. Washington, U. S. Government Printing Office, 1959, pp. 40–41.

NOTE.—For teaching pupils in grade 10 practical driving of a motor car (tractor) there is devoted 10 school hours for each pupil.

Table D. — Experimental curriculum for grades 9, 10, and 11 of rural schools (1958-59)[1]

Subjects	Number of hours a week in each grade			Total hours	
	9	10	11	By the week	By the year
1	2	3	4	5	6
1. Literature	4	4	4	12	368
2. Mathematics	5	5	5	15	460
3. History	3	4	5	12	370
4. Constitution of the U.S.S.R. (Civics)			0/2	1	32
5. Economic geography	2	2		4	120
6. Physics	4	3	4	11	338
7. Astronomy			2/0	1	32
8. Chemistry	2	3	3	8	246
9. Biology	2			2	60
10. Foreign language	3	3	3	9	276
11. Physical education	2	2	2	6	184
12. Technical drawing	1	2		3	90
Total	28	28	28	84	2,576
13. Principles of agricultural production, and production training (theoretical and practical)	8	8	8	24	736
Total	36	36	36	108	3,312
14. Productive labor (6 hours per day)	54 days	54 days	18 days	126 days	756
Extracurricula activities: (sport, various types of art, etc.)	3	3	3	9	276

[1] This curriculum was tried out in a number of different schools.
NOTE.—Academic year in grades 9–10 is 30 weeks, and in grade 11 is 32 weeks.
SOURCE.—S. G. Shapovalenko, *ed., op. cit.*, p. 201.

APPENDIX II

Curriculums for Labor-Polytechnic Schools of General Education

Table E.—Study plan for 8-year school

Subjects	Number of hours a week in each grade								Total hours	
	1	2	3	4	5	6	7	8	By the week	By the year
1	2	3	4	5	6	7	8	9	10	11
1. Russian language	12	12	12	10	6	5	3	2	62	2,184
2. Literature					2	3	2	3	10	357
3. Mathematics	6	6	6	6	6	6	6	5	47	1,663
4. History. Constitution of U.S.S.R.				2	2	2	2	3	11	391
5. Nature study				3					3	105
6. Geography					2	2	2	2	8	286
7. Biology					2	2	2	2	8	286
8. Physics						2	2	3	7	249
9. Chemistry							2	2	4	142
10. Technical drawing							1	1	2	71
11. Foreign language					4	3	3	3	13	465
Total	18	18	18	21	24	25	25	26	175	6,199
12. Drawing	1	1	1	1	1	1	1		7	248
13. Music and singing	1	1	1	1	1	1	1	1	8	283
14. Physical education	2	2	2	2	2	2	2	2	16	566
Total	4	4	4	4	4	4	4	3	31	1,097
15. Labor instruction	2	2	2	2	3	3	3	3	20	709
16. Socially-useful work			2	2	2	2	2	2	12	426
17. Socially-productive practice in grades 5–8, 2 weeks each year at the end of the school year.[1]										180
Total	2	2	4	4	5	5	5	5	32	1,315
Grand Total	24	24	26	29	33	34	34	34	238	8,611

[1] Examples of practice are: Tending public parks, raising poultry and rabbits at collective farms, performing simple shop operations in industry, etc. See E. Afanasenko, "The Soviet School System Reorganized," in *USSR*, No. 10 (37), 1959, Washington, Embassy of the U.S.S.R. in the U.S.A. P. 47.

NOTE.—The school year will begin on September 1, and terminate 1) for grades 1 to 4, on May 31; 2) for grades 5 to 7, on June 19; and 3) for grade 8, on June 25 (including examination period).

The year is divided into 4 quarters; a vacation period follows each quarter as follows: November 5–9 (5 days); December 30–January 10 (12 days); March 24–31 (8 days); and summer vacation after school closes.

The length of the school year for the various grades is as follows: Grades 1 to 4, 35 weeks; grades 5 to 7, 38 weeks (including 2 weeks for socially-productive practices); and grade 8, 39 weeks (including 2 weeks for socially-productive practice and 2 weeks for preparing for and taking the final examinations).

SOURCES.—*Uchitel'skaia gazeta*, August 29, 1959; and *Narodnoe obrazovanie*, No. 11 (November), 1959, pp. 9 ff.

Table F.—Study plan for urban secondary school with production training (planned after 1963)

Subjects	Number of hours a week in each grade			Total hours	
	9	10	11	By the week	By the year
1	2	3	4	5	6
1. Literature	3	3	3	9	339
2. Mathematics	4	4	4	12	452
3. History	2	3	4	9	335
4. Constitution of U.S.S.R.			2	2	70
5. Economic geography		2	2	4	148
6. Physics	4	4	2	10	382
7. Astronomy		1		1	39
8. Chemistry	2	3	2	7	265
9. Biology	3			3	117
10. Technical drawing	2			2	78
11. Foreign language	2	2	3	7	261
12. Physical education	2	2	2	6	226
Total	24	24	24	72	2,712
13. General technical subjects, production (theoretical and practical) instruction, and productive labor	12	12	12	36	1,356
Grand Total	36	36	36	108	4,068
14. Optional activities [1]	2	2	2	6	226

[1] Indications of kinds of optional activities offered are not available to us.

NOTE.—The school year will begin on September 1 and end on June 25 (including 4 weeks for preparing and taking final examinations. The year is divided into two parts, from September 1 to December 29, and from January 11 to the end of the school year. Each grade will have a school year of 39 weeks.

SOURCES.—Same as cited in footnote to table E.

Table G.—Study plan for rural secondary school with production training (planned after 1963)

Subjects	Number of hours a week in each grade			Total hours	
	9	10	11	By the week	By the year
1	2	3	4	5	6
1. Literature	4	3	4	11	333
2. Mathematics	5	4/5	5	14.5	445
3. History	3	4	4	11	338
4. Constitution of U.S.S.R.	----	----	2	2	64
5. Economic geography	----	3/2	2/3	5	155
6. Physics	5	5	3/2	12.5	380
7. Astronomy	----	1	----	1	30
8. Chemistry	2/3	3	3	8.5	261
9. Biology	4	----	----	4	120
10. Technical drawing	3/2	----	----	2.5	75
11. Foreign language	3	3	3	9	276
12. Physical education	2	2	3	7	216
Total	31	28	29	88	2,698
13. Fundamentals of agricultural production and production (theoretical and practical) instruction	5	8	7	20	614
Total	36	36	36	108	3,312
14. Productive labor according to seasons: days	(54)	(54)	(18)	----	(126)
hours	324	324	108	----	756
Grand Total	----	----	----	----	4,068
15. Optional activities [1]	2	2	2	6	184

[1] No indication of the specific kinds of optional activities to be offered is now available.

NOTE.—See remarks under *Note* in table F.

SOURCE.—*Narodnoe obrazovanie.* (Public Education), No. 11 (November), 1959, pp. 12–18.

Table H. — Study plan for evening (shift, seasonal) secondary general educational school (planned after 1963)

Subjects	Number of hours a week in each grade			Total hours by the week
	9	10	11	
1	2	3	4	5
1. Literature	2	2	2	6
2. Mathematics	3	3	3	9
3. History	1	2/1	2	4.5
4. Constitution of U.S.S.R.	----	----	1	1
5. Economic geography	----	2/1	1/2	3
6. Physics	3	3	2	8
7. Astronomy	----	0/1	----	0.5
8. Chemistry	1/2	2	2/1	5
9. Biology	2/1	----	----	1.5
10. Technical drawing	1/2	----	----	1.5
11. Foreign language	2/1	1/2	2	5
Total	15	15	15	45
12. Optional activities for raising pupils' vocational qualifications	2	2	2	6
13. Consultations	3	3	3	9
Grand Total	20	20	20	60

NOTE.—For evening shift schools, the school year will be 36 weeks; and for evening seasonal schools, 26 weeks. In the eleventh grade of the evening shift school, 3 weeks are to be taken for final examinations.

The school year starts on September 1 for evening shift schools, and it is divided into two parts, with a vacation of 10 days (January 1–10) separating them.

Correspondence lessons are to be organized for those persons who cannot for various reasons follow the regularly established program.

SOURCE.—*Narodnoe obrazovanie* (Public Education), No. 11 (November), 1959, pp. 11, 13.

APPENDIX III

Experimental Schools in R.S.F.S.R. (1957-58)

Table I.—Urban schools

Number and location of school	Number of pupils in experimental classes	Number of specialties offered	Number and location of school	Number of pupils in experimental classes	Number of specialties offered
1	2	3	4	5	6
1. 475 Moscow	65	15	21. 23 Rostov-on-Don	58	13
2. 381 Moscow	64	6	22. 28 Taganrog	63	4
3. 204 Moscow	46	14	23. 55 Ivanovo	58	5
4. 607 Moscow	46	7	24. 1 Stalingrad	41	3
5. 287 Moscow	52	10	25. 4 Stalingrad	45	3
6. 503 Moscow	55	10	26. 6 Nevinnomysk	66	13
7. 16 Moscow	45	3	27. 47 Krasnodar	125	9
8. 529 Moscow	28	13	28. 17 Sverdlovsk	52	4
9. 441 Moscow	55	8	29. 27 Sverdlovsk	57	7
10. 155 Moscow	52	7	30. 10 Novosibirsk	48	11
11. 3 Orekhovo-Zuevo (Moscow Oblast')	53	5	31. 47 Novosibirsk	51	9
12. 38 Leningrad	62	8	32. 99 Novosibirsk	44	11
13. 118 Leningrad	58	12	33. 17 Cheliabinsk	55	8
14. 139 Leningrad	52	12	34. 91 Cheliabinsk	57	8
15. 366 Leningrad	53	11	35. 2 Morshansk	59	5
16. 4 Leningrad	41	8	36. 10 Ufa	65	7
20. 4 Gatchina (Leningrad Oblast')	55	7	37. 9 Nishnii Tagil	60	2
17. 133 Gor'kii	111	9	38. 26 Kazan'	.....	.....
18. 13 Dzerzhinsk	57	7	39. 53 Krasnodar	.....	.....
19. 22 Tula	50	16	40. 281 Leningrad	.....	.....
			41. 20 Rostov-on-Don	.....	.....
			42. 20 Kamensk-Ural'sk	.....	.....

SOURCE.—S. G. Shapovalenko, *ed., op. cit.*, p. 203. The reader is advised that this list of experimental school is by no means exhaustive. We have evidence that a number of other schools in the Russian Federation, not to mention other Soviet Republics, have significant experimental programs.

Table J.—Rural schools

Name of School	*Location of School*
1. Starominskii Secondary, No. 8	Krasnodar Krai, R.S.F.S.R.
2. Elizavetenskii Secondary	Leningrad Oblast', R.S.F.S.R.
3. Siverskii Secondary	Leningrad Oblast', R.S.F.S.R.
4. School in Memory of Lenin	Moscow Oblast', R.S.F.S.R.
5. Erminshinskii Secondary	Riazan' Oblast', R.S.F.S.R.
6. Pokrovskii Secondary	Rostov Oblast', R.S.F.S.R.
7. Olginskii Secondary	Stavropolskii Krai, R.S.F.S.R.

APPENDIX IV

Course Outline for Polytechnic Instruction (Grades 8 through 10)

Fundamentals of production (grades 8 through 10 in urban schools)

Program	Class hours	Excursions	Practical work	Total hours
1	2	3	4	5
I. Machine Study (Grade 8) [1]	40	6	56	102
A. Introduction	2	0	0	2
B. Elements of the Technology of Metals:				
Topic 1. Machine-Building Materials	4	2	0	6
Topic 2. Processing of Metals by Cutting	6	0	12	18
Topic 3. Assembly and Finishing of Items	4	0	12	16
C. Basic Information about the Mechanisms and Machines:				
Topic 1. Parts of Machines and Their Junctures	4	0	4	8
Topic 2. Construction and Work of the Mechanisms	14	0	14	28
Topic 3. Construction and Work of Machines	6	4	14	24
II. Fundamentals of Industrial Production in the Form of a Specific Enterprise (Grade 9)	30–50	0	202–182	[4] 232
A. General Acquaintance with Industrial Enterprise. (Study of production branch, production of enterprise, raw materials of enterprise and auxiliary materials, technology and techniques of production, and supply of power and water for enterprise).	30–50	0	0	30–50
B. Industrial Practice:				
1. During study year	0	0	106–86	106–86
2. During summer period (Work in main shops, auxiliary shops, and plant laboratory and on testing finished products, and individual tasks at work-benches.)	0	0	96	96
III. Automobiles (Grade 10) [5]	40	0	38	78
A. Introduction	2	0	0	2
Topic 1. Automobile Engine	4	0	0	4
Topic 2. Crankgear and Gas-Distributing Mechanisms	2	0	6	8
Topic 3. Cooling System	2	0	2	4
Topic 4. System of Oiling Engine	2	0	2	4
Topic 5. Feeding of Engine	4	0	4	8
Topic 6. Ignition System	2	0	2	4
Topic 7. Power Transmission of Automobile	4	0	6	10
Topic 8. Running Part of Automobile	2	0	2	4
Topic 9. Steering Mechanism	4	0	4	8
Topic 10. Electrical Equipment of Automobile	4	0	2	6
Topic 11. Principles of Driving of Automobile and Technical Servicing	4	0	0	4
Topic 12. Manufacture and Repair of Automobiles	2	0	0	2
B. Automobile driving				
(a) Preliminary Acquaintance	2	0	0	2
(b) Exercise in Driving Automobile	0	0	8	8
IV. Electrotechnics (Grade 10) [6]	36	0	32	68
A. Introduction	2	0	0	2
B. Basic Electro-Technical Materials	4	0	0	4
C. Technical Electric Measuring Instruments	6	0	8	14
D. Electrical Machines				
1. Basic Information about Magnetic Materials and Understanding of Magnetic Chain	2	0	0	2
2. Single-Phase and Three- Phase Currents	10	0	8	18
3. Direct Current Machine and Semiconductor Rectifiers	4	0	8	12
E. Production and Utilization of Electric Power	8	0	8	16
V. Summer Agricultural Practice for Students of Urban Schools (24 days when passing from grade 8 to 9).				

See footnotes at end of appendix IV.

Fundamentals of agricultural production (grades 8 to 10 in rural schools)[7]

Program	Class hours	Excursions	Practical work hours	Total hours
1	2	3	4	5
I. Fundamentals of Plant Growing (Grade 8)	29	4	35	68
A. Introduction	1	0	0	1
B. Conditions of Growth and Development of Plants	2	0	3	5
C. The Soil, Its agronomic Properties and the Role of Mineral Feeding of Plants	4	2	2	8
D. Working of Soil	3	2	0	5
E. Fertilisers	4	0	4	8
F. The Principal Field Crops and Agrotechnical Bases for Rotation Crops	2	0	4	6
G. Determining the Quality of the Sowing and Planting Material and Its Processing Prior to Sowing	2	0	2	4
H. The Sowing and Planting of the Principal Field Crops	4	0	[8] 10	14
I. Care of the Principal Field Crops and the Harvest	4	0	[8] 6	10
J. Organisation of Production and Labor in a Kolkhos, or Sovkhos [9]	3	0	4	7
K. Summer Training-Production Practice Between Grades 8 and 9: First Period: Care of Crops (12 days). Second Period (during Harvest): Harvesting and the Sowing of Winter Crops (12 days).				
II. Agricultural Machinery	32	0	38	70
A. Grade 8	12	0	22	34
1. Introduction	1	0	0	1
2. Basic Information about Machine Parts and Mechanisms	2	0	6	8
3. Plows	2	0	4	6
4. Harrows and Cultivators	2	0	4	6
5. Grain-Cleaning Machines	1	0	2	3
6. Sowing Machine (Drills)	4	0	6	10
B. Grade 9 (Study of (a) grain combines, (b) potato-harvesting combines, (c) flax-harvesting combines, and (d) corn-harvesting combines.)	20	0	16	36
III. Fundamentals of Animal Husbandry (Grade 9)	22	5	41	68
A. Introduction	1	3	0	4
B. Physical Build of Horned Cattle and Its Type of Productivity (Meat, Milk or Both)	1	0	3	4
C. The Keeping of Agricultural Animals and Their Care	4	2	6	12
D. Feed and Feed Base for Agricultural Animals	4	0	6	10
E. The Feeding and Fattening of Animals, Mechanization of Feed Preparation	4	0	10	14
F. The Milking of Cows and Calculation of Yield	4	0	6	10
G. The Breeding of Animals and the Raising of Young Stock	4	0	4	8
H. Work on Kolkhos or Sovkhos Dairy	0	0	6	6
I. Summer Training-Production Practice in Passing from Grade 9 to 10: Care of Crops: 12 days upon completion of studies. Gathering of Harvest: 12 days during harvesting.				

Program	Class hours	Excursions	Practical work hours	Total hours
IV. Agricultural Machinery	55	2	43	100
A. Grade 9	20	2	10	32
1. Introduction	1	0	0	1
2. Classification and General Construction of Tractors	2	0	0	2
3. Classification and General Construction of Tractor Engines	2	0	0	2
4. The Principle of the Work of Tractor Engines	2	2	0	4
5. Mechanisms and Systems of Tractor Engines Crankgear Mechanism	2	0	0	2
6. Distribution Mechanism	2	0	2	4
7. Fuel System	6	0	6	12
8. Cooling System	3	0	2	5
B. Grade 10	35		33	68
1. Lubricating System	2	0	4	6
2. Starter Arrangement on Diesel Engines	2	0	2	4
3. Electrical Equipment of Tractor	7	0	4	11
4. Transmission of Tractors:				
a. Coupling Clutch and Intermediate Connection of Coupling Clutch with Transmission Box	2	0	2	4
b. Transmission Box	2	0	2	4
c. Rear Bridge and Steering Mechanism of Tractor	6	0	0	6
5. Framework and Running Part of Tractor. Arrangement for Additional Utilization of Power of Tractor Engine:				
a. Framework and Running Part of Tractor	4	0	0	4
b. Arrangement for Additional Utilization of Power of Tractor Engine	4	0	6	10
6. Driving of Tractor:				
a. Safety Techniques while Working with Tractor	4	0	0	4
b. Rules for Driving Tractor	2	0	13	15

[1] Ministry of Education of RSFSR, *Programmy srednei shkoly na 1958/59 uchebnyi god (Programs for Secondary School for Academic Year 1958–1959)*, Moscow, 1958, p. 54–74.

[2] Practical work for processing of metals by cutting is done on a lathe (turning) or milling machine.

[3] Practical work on parts of machines and their junctures consists of making bolts, screws, nuts, etc.

[4] See topical outline in text for a machine building plant, p. 122.

[5] Ministry of Education of RSFSR, *op. cit.*, p. 150–159.

[6] *Ibid.*, p. 159–167 (Electrotechnics is also taught in rural schools, second semester, grade 10).

[7] *Ibid.*, p. 169–203.

[8] Practical work is performed on a *kolkhoz* (collective farm) and *sovkhoz* (State farm).

APPENDIX V

Study Plan for Training Turners[1]

Showing the hours per week devoted to each class during the four years of training in special vocational schools

FIRST YEAR

Classes	First quarter (9 weeks)	Second quarter [2] (8 weeks)	Third quarter (13 weeks)	Fourth quarter [3]		Total hours
				10 weeks	8 weeks	
1	2	3	4	5	6	7
I. General studies cycle						
1. Georgian language for the Georgian group	3	3	3	3		121
2. Georgian language for the Russian group	2	2	1	1		55
3. Russian language and literature for the Georgian group	3	3	3	3		121
4. Russian language and literature for the Russian group	4	4	4	4		160
5. Mathematics	4	4	4	4		160
6. History	2	2	2	2		80
7. Geography	2	2	2	2		80
8. Biology	2	2	2	2		80
9. Physics						
10. Chemistry						
11. Foreign language	2	2	2	2		80
12. Political education						
II. Production and technological cycle						
1. Production training	12	12	12	12	24	[4] 544
2. Special technology	2	2	2	2		[4] 88
3. General technology of metals	2	2	2	2		80
4. Mechanical drawing	2	2	2	2		80
5. Principles of mechanics						
6. Principles of electrical technics						
7. Economics and production organisation						
III. Physical education	2	2	2	2		80

See footnotes at end of table.

SECOND YEAR

Classes	First quarter (9 weeks)	Second quarter [2] (8 weeks)	Third quarter (13 weeks)	Fourth quarter [3]		Total hours
				10 weeks	3 weeks	
1	2	3	4	5	6	7
I. General studies cycle:						
1. Georgian language for the Georgian group	3	3	3	3		121
2. Georgian language for the Russian group	2	2	1	1		55
3. Russian language and literature for the Georgian group	3	3	3	3		121
4. Russian language and literature for the Russian group	3	3	4	4		143
5. Mathematics	3	3	4	4		143
6. History	2	2	1	1		57
7. Geography	2	2	1	1		57
8. Biology	2	2	2	2		80
9. Physics	2	2	2	2		80
10. Chemistry						
11. Foreign language	2	2	2	2		80
12. Political education						
II. Production and technological cycle:						
1. Production training	12	12	12	12	[4] 24	[4] 540
2. Special technology	2	2	2	2		80
3. General technology of metals	2	2	2	2		80
4. Mechanical drawing	2	2	2	2		80
5. Principles of mechanics						
6. Principles of electrical technics						
7. Economics and production organisation						
III. Physical education	2	2	2	2		80

See footnotes at end of table.

THIRD YEAR

Classes	First quarter (9 weeks)	Second quarter [2] (8 weeks)	Third quarter (13 weeks)	Fourth quarter [6]		Total hours
				8 weeks	2 weeks	
1	2	3	4	5	6	7
I. General studies cycle:						
1. Georgian language for the Georgian group	3	3	3	3	------	121
2. Georgian language for the Russian group	2	2	1	1	------	55
3. Russian language and literature for the Georgian group	3	3	3	3	------	121
4. Russian language and literature for the Russian group	5	5	4	3	------	161
5. Mathematics	4	4	5	6	------	181
6. History	------	------	------	------	------	------
7. Geography	------	------	------	------	------	------
8. Biology	------	------	------	------	------	------
9. Physics	2	2	2	2	------	76
10. Chemistry	2	2	2	2	------	76
11. Foreign language	2	2	2	2	------	76
12. Political education	2	2	2	2	------	76
II. Production and technological cycle:						
1. Production training	12	12	12	12	24	528
2. Special technology	2	2	2	2	------	76
3. General technology of metals	------	------	------	------	------	------
4. Mechanical drawing	1	1	1	1	------	38
5. Principles of mechanics	2	2	2	2	------	76
6. Principles of electrical technics	------	------	------	------	------	------
7. Economics and production organisation	------	------	------	------	------	------
III. Physical education	2	2	2	2	------	76

See footnotes at end of table.

FOURTH YEAR

Classes	First quarter (9 weeks)	Second quarter [2] (8 weeks)	Third quarter (11 weeks)	Fourth quarter [7] 18 weeks	Fourth quarter [7] 1 week	Total hours for the fourth year [8]	Total hours for all four years
1	2	3	4	5	6	7	8
I. General studies cycle:							
1. Georgian language for the Georgian group							464
2. Georgian language for the Russian group							484
3. Russian language and literature for the Georgian group							137
4. Russian language and literature for the Russian group							137
5. Mathematics							160
6. History							156
7. Geography							76
8. Biology							236
9. Physics	2	2	2			56	132
II. Production and technological cycle:							
1. Production training	20	20	27	[9] 41	41	1,211	2,823
2. Special technology	5	4	2	[10] 2		125	369
3. General technology of metals							160
4. Mechanical drawing							198
5. Principles of mechanics	4	4	2			90	166
6. Principles of electrical technics	5	4	2			99	99
7. Economics and production organization		2	2			38	38
III. Physical education	2	2	2			56	292

[1] *Uchebnyi plan.* (Curriculum.) Approved by Main Administration of Labor Reserves attached to U.S.S.R. Council of Ministers (June 20, 1957). Curriculum used in Vocational School #5, Tbilisi, Georgian S.S.R.

[2] Followed by 1 week and 5 days of vacation.

[3] Followed by 6 weeks and 5 days of vacation.

[4] Study of the principle of personal hygiene and industrial sanitation has been transferred from production training to special technology.

[5] Three days are allocated for taking examinations in the course on the general technology of metals.

[6] The fourth quarter of the third year is followed by 2 weeks of examinations.

[7] Followed by 3 weeks of examinations and 6 weeks and 5 days of vacation.

[8] The total hours for the fourth year when calculated by multiplying the hours per week by the number of weeks, do not always coincide with the total given in column 7; nevertheless they are shown on the original Russian document given to us in Tbilisi.

[9] Students who have not reached 18 years of age in the last year of the study program will receive only 36 hours per week in production training.

[10] Two hours per day are devoted to consultation dealing with final performance work.

APPENDIX VI

Inventory of Equipment for School Workshops (Grades 5 through 7)[1]

I. *Machine Tool Equipment*

Name of Equipment, Instruments, and Devices	*Quantity*
Screw-cutting lathe with attachments	2
Drill (table mounted) with bits for drilling holes, diameter of 12 mm.	4
Woodturning lathe with attachments	2
Combined joiner machine with circular saw (disk)	1
Grinder	1
Wet grinder with mechanical power-driven motor	1

II. *The Equipment, Instruments, and Devices for Metal Work*

A. For General Use	
Checking (surface) plate—small	1
Marking gage for mechanic (height gage)	1
Micrometer (from 0 to 25 mm.)	2
Angle gage	1
Spiral drills, various types	120
Steel plates, 300 x 400 mm. (or anvil on table)	2
Vise with jaws, 120–240 mm.	1
Hand clamp vise	5
Hammer for mechanic, 500 g.	3
Sledge hammer, 1 kg.	1
Metal shears	1
Hand drill	1
Tap wrench	2
Die plate	2
Screw taps	20
Cutter die and thread chaser	40
Thread gage	2
Electric soldering iron	6
Simple soldering iron	2
Blowpipe torch	1
Various types of wrenches for nuts	20
Monkey wrenches	2
Files, various types	50
Needle files	100
Various cutter bits (face cutters, cutoff cutters, etc.)	30
Countersink reamers, various types	7
Broach bits, various types	10
Groove chisel	8
Combination cutting and twisting pliers	10
Mandrels and holder for riveting	15
Handles for tools	100
Brushes for cleaning files	5
B. For Individual Use	
Workbench (combination)	20
Steel plates for table	20
Vises for mechanics with 100 mm. jaws	20
Hammers for mechanics	20
Electric solders (hammer type)	20
Steel scale ruler 300 mm.	20
Sliding calipers	20
Compass marker	20
Outside calipers	20
Scriber (marking tool)	20
Center punch	20
Squares	20

[1] A. G. Dubov, *Prakticheskie zaniatiia v uchebnykh masterskikh (Practical Studies in the School Workshops)*, Moscow, R.S.F.S.R. Academy of Pedagogical Sciences, 1957, p. 199–202.

Name of Equipment, Instruments, and Devices	Quantity
Chisels for metal	60
Hand hacksaw	20
Snippers for cutting metal by hand	20
Bastard and smoother files, various cross sections and sizes	100
Flat pliers	20
Round nose pliers	20
Cutting pliers	20
Screwdrivers	20
Wooden mallet for working with sheet metal	20
Drawing set	20

III. *Equipment, Instruments, and Devices for Work with Wood*

A. General Use	
Marking compass	10
Bevel square	4
Protractors	4
Pincers	10
Clamps (metal and wooden)	20
Frame saw, various types	6
Saw, rounding (keyhole)	2
Handsaw for joiners, wide and narrow	4
Coping saw	10
Tables for coping saw	10
Planes	2
Channel molding plane	2
Grooving plane	1
Wood chisels, various widths	15
Wood chisel semicircle (round nose)	10
Gouge, various	10
Bits and brace	3
Flat drills, various designs and sizes	30
Gimlet, various sizes	5
Awl for woodwork	20
Bastard files of various sizes and cross sections	20
Rasp, flat and semicircle	10
Scrapers	5
Light axe	8
Circular cutter, hand	2
Grinding stone	10
Honing stone for sharpening tools	10
Blades for coping saw	200
B. For Individual Use	
Workbenches (combination)	20
Folding meter (folding rule)	20
Steel rule for scaling 500 mm.	20
Marking squares	20
Surface gage (simple)	20
Light hammers for carpentry	20
Hacksaw blades with raker tooth	20
Flat chisels, 10 and 15 mm.	40
Butt chisels	20
Mallet	20
Rough plane	20
Planes	20
Smoothing planes	20
Screwdrivers	20
Glue pot, volume .5–1 liter	2
Handles for the tools	100

IV. *Various Equipment, Instruments, and Devices*

Saw blade clamps	1
Saw set	1
Device for sharpening plane iron, chisels	1
Electric plates	2
Glass cutter	1
Drawing set	1
The set of drawing instruments (drawing board, rule, squares, irregular curves)	1
Oiler (oil can)	2
Spatula	5
Brushes for glue	20
Brushes for various painting purposes	20

V. *Visual Aids, Charts, and Literature*

Name of Equipment, Instruments, and Devices	*Quantity*
Collection of samples of wood	1
Collection of samples of metals and alloys	1
Collection of samples which could be extracted from wood	1
Study chart on treatment of woodwork	1
Study chart on metalwork	1
Chart on safety engineering	1
Chart on individual types of joiner work, mechanic, and electric assembly work	1
Library pertaining to method and technology of joiner work, mechanics, electric and assembly work, and various types of reference material	1

VI. *Furniture and Inventory*

Table for teacher	2
Chair for teacher	2
Stools for students	40
Blackboard	2
Blackboard, movable	6
Lockers for keeping tools	2
Lockers for books	2
First-aid kit	2
Wastebasket	2
Brushes	20
Brushes for clothes	20
Towel (to be used only by the leaders)	5
Shop coat for leaders	2
Hanger for the shop coat	1
Brushes for the floor	6
Table for assembly work, chopping, etc.	2

APPENDIX VII

Inventory of Basic Materials Which are Necessary for Studying and for Working Outside of Class Assignments in the Shop[1]

(Quantity indicated according to calculation for work of six 5 to 7 grades during the academic year)

Name of Material	*Size*	*Quantity*
Pine boards (from 13 to 35 mm.), first grade	cu. m.	2.25
Pine boards already cut to thickness (from 40 to 50 mm.), first grade	"	2
Birch boards 25 mm., first grade	"	.5
Linden boards, thin, first and second grades	"	.5
Plywood birch 3-4 mm., first and second grades	"	.5
Glue for carpenters	kg.	4
Wire nails for construction from 10 to 50 mm.	"	20
Screws, semicircle and flat sinking heads (round and flat heads)	"	5
Sheet metal steel (also iron for roofing)	"	100
The black sheet metal, polished, Nos. 25, 28, and 50	"	20
Sheet metal wide, thickness .24 to .48 mm.	"	20
Round steel, diameter 10, 20, and 50 mm., manufacture ST-3	"	75
Strip steel 4 x 12 mm., manufacture ST-3	"	25
Galvanized sheet metal	"	50
Cold rolled steel strips .5 mm.	kg.	5
Steel wire, round, thickness .1-2 mm.	"	15
Aluminum sheet metal, thickness .5-3 mm.	"	40
Aluminum, round (rod type), diameter 8-10 mm.	"	20
Aluminum wire, thickness 2-3 mm.	"	3
Aluminum pipes from 10 x 8 to 25 x 20 mm.	"	10
Brass sheet metal, thickness .5-.8 mm.	"	4
Brass wire, thickness 1-2 mm.	"	3
Coiling copper wire, type PESHO and PEBO	"	3
Coiling copper wire, type PE or PEL	"	3
Copper wire for assemblying, naked (plain)	"	2
Cord for electric wiring, insulated with cotton fabric, type PR or PRO	meters, linear	120
Solder, tin-lead (type POS-60 or others)	kg.	3
Tin	"	2
Screws, diameter 3, 4, or 5 mm., various lengths, type M3-M4	"	4
Nuts, M3-M5	"	3
Washer with screws M3-M5	"	1
Glass, ordinary and colored, 2-5 mm.	"	10

[1] A. G. Dubov, *Prakticheskie zaniatiia v uchebnykh masterskikh (Practical Studies in the School Workshops)*, Moscow, R.S.F.S.R. Academy of Pedagogical Sciences, 1957, p. 203-204.

Ebonite sheets, thickness 3–4 mm	"	5
Textolite sheet, thickness 2–4 mm	"	5
Porcelain pulley	pieces	200
Porcelain tubes	"	50
Tape for insulation	kg.	1
Various types of electric fixtures, such as fuses, receptacles, light switches, cutting-in safeguard (circuit breaker), lamp socket, etc.	sets	50
Alcohol lac light	kg.	5
Oil lac light (No. 1, 2, 3, or 6)	"	2
Lacquer of various colors	"	3
Sealer	"	5
Enamel	"	3
Thinner	"	4
Turpentine	"	5
Sandpaper, Nos. 1 to 8	sq. meter	20
Emery paper (from No. 20 to No. 30)	linear meter	30

APPENDIX VIII

Curriculums for Pedagogical Institutes[1]

Table K.—Specialty: Russian language, literature, and history

Subjects	Hours per week by school year and by semester									Number of hours			
	1		2		3		4		5				
	1 (10 weeks)	2 (16 weeks)	3 (19 weeks)	4 (16 weeks)	5 (19 weeks)	6 (13 weeks)	7 (10 weeks)	8 (16 weeks)	9–10 (21 weeks)	Total	Lectures	Laboratory	Practical work or seminar
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. History of C.P.S.U.	3/R	4/E	3/R	4/E						224	120	104	
2. Political economy					2/R	3/E	2/R	3/E		140	98	42	
3. Dialectical and historical materialism							3/R	3/E	3/E	140	80	60	
4. Logic					4/E					70	44	26	
5. Psychology	2	3/E								84	50	34	
6. Pedagogy			3	4/R,E						120	70	50	
7. History of pedagogy					4/E					72	54	18	
8. School hygiene						1	/R			36	18	18	
9. Foreign language	2/R	2/R	2/E	2/R	-/R	-/R	-/R	-/R		140		140	
10. Introduction to linguistics	3	2/E								80	54	26	
11. Russian language:													
a. Old-Slavonic	3/R	2/R								80	40	40	
b. Study of dialects		2/R								32	16	16	
c. Historical grammar			3/R	4/E						121	60	61	
d. Contemporary Russian			5/R	4/R	4/E	4/R	4/R	5/E		416	162	254	
e. History of literary Russian									2/E	42	22	20	
Total	3	4	8	8	4	4	4	5	2	700	300	400	
12. Introduction to the study of literature	3/E									60	40	20	

See footnotes at end of table.

For meaning of R and E symbols, see note on page 217.

Subjects	Hours per week by school year and by semester									Number of hours			
	1		2		3		4		5				
	1 (10 weeks)	2 (16 weeks)	3 (19 weeks)	4 (16 weeks)	5 (19 weeks)	6 (13 weeks)	7 (10 weeks)	8 (16 weeks)	9–10 (21 weeks)	Total	Lectures	Laboratory	Practical work or seminar
1	2	3	4	5	6	7	8	9	10	11	12	13	14
13. Russian literature.													
a. Spoken folk-literature	3/E									57	45	12	
b. Ancient Russian literature		3/R								48	36	12	
c. Literature of the 18th century			3/E							57	45	12	
d. Literature of the 19th century				4/R	3/R	4/E				173	113	60	
e. Literature of the 20th century							3/E			30	30		
f. Soviet literature										95	75	20	
Total	3	3	3	4	3	4	3	2 2	3/E 3	460	344	116	
14. Foreign literature:													
a. Ancient literature		2/R								32	32		
b. Literature of Renaissance, Middle Ages, and 17th century			2/E							38	38		
c. Literature of the 18th century				2/R						32	32		
d. Literature of the 19th century					2	3/E				82	82		
e. Literature of recent times						2	4/E			66	66		
Total		2	2	2	2	5	4			250	250		
15. History of the ancient world	5/R	4/E								160	106	54	
16. History of the Middle Ages			6/R	4/E						178	108	70	
17. History of Modern Times					5	5/E	4/R	4/E		264	174	90	
18. Modern history of the East									5/E	106	86	20	
19. History of the U.S.S.R.	5/R	4/E	5/R	4/E	4/R	3/E				430	290	140	
20. Methods of teaching Russian				2	2	2/R	3/E			100	52	48	
21. Methods of teaching literature						3/R	3/E			70	38	32	
22. Methods of teaching history					2/R	2/R				64	32	32	
23. Special courses (Russian language, literature, history)							2	3/E	3/E	130	130		
24. Special seminars (Russian language, literature, history)							2	4/R	4/R	168		168	
25. Special training	1	2/R								48		48	
26. Physical education	2/R	2/R	2/R	2/R						140		140	
Total hours	32	32	34	34	32	32	30	24	20	4,434	2,538	1,896	

Item	Number of exams, reports, and projects by semester								
	1		2		3		4		5
	1	2	3	4	5	6	7	8	9–10
I	2	3	4	5	6	7	8	9	10
Exams (37)	2	5	3	5	3	5	4	5	5
Reports (44)	6	7	6	6	5	5	6	2	1
Projects (4)				1		1		1	1

TEACHER TRAINING (19 wks)

1. In Pioneer camps (3 wks in the 6th semester)
2. In schools (8 wks in the 7th semester and 8 wks in the 9th and 10th semesters)

Optional courses (fakul'tativnye distsipliny)

1. Practical training in conducting extracurricular and out-of-school activities (100 hrs.)
2. Latin language (68 hrs.)
3. A modern Slavonic language (60 hrs.)
4. Literature of the People's Democracies (60 hrs.)
5. Museum science (40 hrs.)
6. History of culture (60 hrs.)
7. Practical training in expressive reading (60 hrs.)
8. Practical training in construction of visual aids (40 hrs.)
9. Improving sports skills (420 hrs.)
10. Foreign language (in years 3 and 4, 140 hrs.)
11. Music and singing (250 hrs.)
12. Individual instruction in playing musical instruments (250 hrs.)

[1] *Uchebnye plany pedagogicheskikh institutov, (Curriculums for pedagogical institutes.)* Moscow, 1957, 31 p.

For meaning of R and E symbols, see note on page 217.

Table L.—Specialty: Russian language, literature, foreign language

Subjects	Hours per week by school year and by semester									Number of hours			
	1		2		3		4		5	Total	Lectures	Laboratory	Practical work or seminar
	1 (19 weeks)	2 (16 weeks)	3 (19 weeks)	4 (16 weeks)	5 (19 weeks)	6 (13 weeks)	7 (10 weeks)	8 (16 weeks)	9–10 (21 weeks)				
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. History of C.P.S.U.	3/R	4/E	3/R	4/E						224	120	104	
2. Political economy					2/R	3/E	2/R	3/E		140	98	42	
3. Dialectical and historical materialism							3/R	3/E	3/E	140	80	60	
4. Psychology	2	3/E								81	50	31	
5. Pedagogy			3	4/RE						120	70	50	
6. History of pedagogy					4/E					72	54	18	
7. School hygiene						2	-/R			36	18	18	
8. Introduction to linguistics	3	2/E								80	54	26	
9. Russian language:													
a. Old Slavonic	3/R	2/E								89	40	49	
b. Study of dialects		2/R								32	16	16	
c. Historical grammar			3/R	4/E						121	60	61	
d. Contemporary Russian			5/R	4/E	4/R	4/E	4/R	5/E		416	162	254	
e. History of literary Russian									2/E	42	22	20	
Total	3	4	8	8	4	4	4	5	2	700	300	400	
10. Introduction to the study of literature	3/E									60	40	20	

11. Russian literature:													
a. Spoken folk-literature	3/E									57	45	12	
b. Ancient Russian literature		3/R								48	36	12	
c. Literature of the 18th century			3/E							57	45	12	
d. Literature of the 19th century				4/R	3/R	4/E				173	113	60	
e. Literature of the 20th century							3/E			30	30		
f. Soviet literature								2	3/E	95	75	20	
Total	3	3	3	4	3	4	3	2	3	460	344	116	
12. Foreign literature:													
a. Ancient literature		2/R								32	32		
b. Literature of the Renaissance, Middle Ages, and 17th century			2/E							38	38		
c. Literature of the 18th century				2/R						32	32		
d. Literature of the 19th century					3	2/E				80	80		
e. Literature of recent times							2	3/E		68	68		
Total		2	2	2	3	2	2	3		250	250		
13. Foreign language	12/E	10/E	12/E	10/E	12/RE	10/RE	10/E	10/RE	3/E	1,562		1,562	
14. Latin language	2	2/R								60		60	
15. Methods of teaching Russian					2	2/R	3/E			100	52	48	
16. Methods of teaching literature					2/R	2/R				70	38	32	
17. Methods of teaching foreign language						3/R	3/E			70	40	30	
18. Special courses (Russian language or literature)									4/E	84	84		
19. Special seminars (Russian language or literature)								2/R	2/R	74		74	
20. Special training	1	2/R								48		48	
21. Physical education	2/R	2/R	2/R	2/R						140		140	
Total hours	34	34	33	34	32	32	30	28	22	4,574	1,692	2,882	

For meaning of R and E symbols, see note on page 217.

Item	Number of exams, reports, and projects by semester									
	1		2		3		4		5	
	1	2	3	4	5	6	7	8	9–10	
1	2	3	4	5	6	7	8	9	10	
Exams (36)	3	5	3	4	2	5	4	5	5	
Reports (33)	3	6	4	4	5	4	4	2	1	
Projects (3)						1		1	1	

TEACHER TRAINING (19 wks.)

1. In Pioneer camps (3 wks. in the 6th semester)
2. In schools (8 wks. in the 7th semester and 8 wks. in the 9th semester)

OPTIONAL COURSES (*fakul'tativnye distsipliny*)

1. Logic (70 hrs.)
2. Practical training in conducting extracurricular and out-of-school activities (100 hrs.)
3. A modern Slavonic language (60 hrs.)
4. Literature of the People's Democracies (60 hrs.)
5. Practical training in expressive reading (60 hrs.)
6. Improving sports skills (420 hrs.)
7. Choral singing (250 hrs.)
8. Individual instruction in playing musical instruments (250 hrs.)

Table M. — Specialty: Foreign languages

Subjects	Hours per week by school year and by semester										Number of hours			
	1		2		3		4		5		Total	Lectures	Laboratory	Practical work or seminar
	1 (19 weeks)	2 (16 weeks)	3 (19 weeks)	4 (16 weeks)	5 (19 weeks)	6 (13 weeks)	7 (13 weeks)	8 (16 weeks)	9 (19 weeks)	10				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. History of the C.P.S.U.	3/R	4/E	3/R	4/E							224	120	104	
2. Political economy					2/R	3/E	2/R	3/E			140	98	42	
3. Dialectical and historical materialism							2/R	3/E	4/E	4	140	80	60	
4. Psychology	2	3/E									84	50	34	
5. Pedagogy			4	3/RE							120	70	50	
6. History of pedagogy					2	3/E					72	54	18	
7. School hygiene							2/R				36	18	18	
8. Introduction to linguistics	2	2/E									80	80		
9. Latin language	2	1/R									60		60	
10. Methods of teaching foreign languages					2	2/R	2	2/R	-/E		120	50	70	
11. Phonetics of foreign languages	6/E	6/R	4/E	4/R	2/E	2/R	2/E				438	20	418	
12. Grammar of foreign language	6/R	6/E	6/R	6/E	4/R	2/R	2/R	2/E			578	60	518	

For meaning of R and E symbols, see note on page 217.

13. Practical training in spoken (foreign) language	7/RE	6/RE	4/RE	4/RE	6/RE	6/RE	5	5	8	8	854		854	
14. Analysis of texts and written practice	4	4	4	4	4	2	2/R	2/RE	2/RE	2	476		476	
15. Translation								2/R	2/R	2	70		70	
16. Lexicology					2/R	2/E					64	34	30	
17. History of language							2	3/RE			72	52	20	
18. Literature in the foreign language studied				2	2/R	2/E					96	96		
19. Second foreign language			4/R	5/E	6/E	8/R	8/E	8/R	10/RE	10	800		800	
20. Recent history of the country speaking the language studied							3/R				36	36		
21. Special training			3/R								48		48	
22. Physical education	-/R	2/R	-2/R	2/R							140		140	
23. Practical training in audio-visual techniques									4/R	4	76	30	46	
Total hours	34	34	34	34	32	32	32	30	30	30	4,824	948	3,876	

For meaning of R and E symbols, see note on page 217.

Item	Number of exams, reports, and projects by semester									
	1		2		3		4		5	
	1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10	11
Exams (33)	2	5	2	5	3	5	2	5	4	-----
Reports (43)	4	4	6	4	5	5	6	5	4	-----
Projects (3)	-----	-----	-----	-----	-----	-----	1	1	1	-----

TEACHER TRAINING (19 wks.)

1. In Pioneer camps (3 wks. in the 6th semester)
2. In schools (6 wks. in the 7th semester and 10 wks. in the 9th semester)

OPTIONAL COURSES *(fakul'tativnye distsipliny)*

1. Practical training in extracurricular and out-of-school activities (100 hrs.)
2. History of the country speaking the language studied (20 hrs.)
3. History of the culture of the country speaking the language studied (40 hrs.)
4. Geography of the country speaking the language studied (40 hrs.)
5. Russian language (120 hrs.)
6. Literary style (40 hrs.)
7. Special course in philology (120 hrs.)
8. Special seminar in philology (120 hrs.)
9. Foreign literature (40 hrs.)
10. Improving sports skills (420 hrs.)
11. Logic (70 hrs.)
12. Choral singing (250 hrs.)
13. Individual instruction in playing musical instruments (250 hrs.)

Table N.—Specialty: Mathematics and physics

Subjects	Hours per week by school year and by semester										Number of hours			
	1		2		3		4		5					
	1 (18 weeks)	2 (16 weeks)	3 (18 weeks)	4 (16 weeks)	5 (18 weeks)	6 (16 weeks)	7 (12 weeks)	8 (16 weeks)	9 (18 weeks)	10	Total	Lectures	Laboratory	Practical work or seminar
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. History of the C.P.S.U.	4/R	3/E	3/R	4/E							224	120		104
2. Political economy					2/R	3/E	2/R	3/E			140	98		42
3. Dialectical and historical materialism							2/R	3/E	4/E	4	140	80		60
4. Psychology	3	2/E									81	50		34
5. Pedagogy			4	3/RE							120	70		50
6. School hygiene						1/R					36	18		18
7. History of pedagogy					2	3/E					72	54		18
8. Mathematical analysis	6/RE	6/RE	6/RE	6/RE							408	204		204
9. Analytical geometry	6/RE	4/E									172	83		86
10. Projective and descriptive geometry					4/E	3/R					110	78		32
11. Foundations of geometry									4/E	4	64	54		10
12. Higher algebra	4/RE	3/R	4/E								192	104		88
13. Theory of numbers						3/E					48	36		12
14. Foundations of arithmetic							3/E				36	36		
15. Theory of functions of a real variable						3/E					50	50		

16. Theory of functions of a complex variable					3/E						54	54			
17. Special seminar in mathematics or special practical training in physics								3/R	2/R	2	84			84	
18. Elementary mathematics	4	2/RE	4/R	4/E	4/R	3/R	3/E				400	180	16	204	
19. Methods of teaching mathematics						5/R	4/E	2/R	2/R	2	194	92		102	
20. Special practical training (mathematical models, surveying, calculation)							2/R	2/R	2/R	2	92		92		
21. Mechanical drawing	3/R	2/R									86	18	68		
22. General physics		8/RE	9/RE	9/RE	9/RE						620	272	201	144	
23. Theoretical mechanics							4/R	4/E			112	56		56	
24. Astronomy									4/E	4	72	54	18		
25. Methods of teaching physics						6/R	3/R	2/E	2/R	2	210	60	100	6	
26. Practical training in school work-shops with elements of technology of materials				4/R	3/R	4/R					188	32	150	6	
27. Electrical and radio engineering							4/R	5/R			140	48	80	12	
28. Machine technology with practical training in auto-tractor technology								6/R	5/R	5	190	54	130	6	
29. Educational movies							2/R				36		36		
30. Special course (elective)									3/R	3	54	54			
31. Foreign language	2/R	2/R	2/E	2/R							140			140	
32. Physical education	2/R	2/R	2/R	2/R							140			140	
33. Special Training					3/R						48			48	
34. Pedagogical practice in extracurricular activity					4/R						60			60	
Total hours	34	34	34	34	34	34	30	30	28	28	4,818	2,114	1,810	894	

For meaning of R and E symbols, see note on page 217.

Item	Number of exams, reports, and projects by semester									
	1		2		3		4		5	
1	1	2	3	4	5	6	7	8	9	10
	2	3	4	5	6	7	8	9	10	11
Exams (35)	4	5	4	5	3	4	3	4	3	----
Reports (55)	7	7	5	6	6	6	7	5	6	----
Projects (4)	----	----	----	1	----	1	----	1	1	----

TEACHER TRAINING (18 wks.)

1. In the school (6 wks. in the 7th semester and 10 wks. in the 10th semester)
2. Industrial (2 wks. in the 10th semester)

OPTIONAL COURSES *(fakul'tativnye distsipliny)*

1. Practical training in extracurricular and out-of-school activity (100 hrs.)
2. Methods of mathematical physics (40 hrs.)
3. Differential geometry (40 hrs.)
4. Theory of probability (40 hrs.)
5. Methods of approximate calculation (40 hrs.)
6. Algorithms and computing machines (40 hrs.)
7. Modern algebra (40 hrs.)
8. Nuclear physics (40 hrs.)
9. Physics of semiconductors and dielectrics (40 hrs.)
10. Aerodynamics (40 hrs.)
11. History of physics (40 hrs.)
12. History of mathematics (40 hrs.)
13. Selected topics in elementary mathematics (40 hrs.)
14. Special topics in the methodology of physics (40 hrs.)
15. Improving sports skills (420 hrs.)
16. Foreign language (in years 3 and 4, 140 hrs.)
17. Choral singing (250 hrs.)
18. Individual instruction in playing musical instruments (250 hrs.)

Table O. — Specialty: Mathematics and mechanical drawing

Subject	Hours per week by school year and by semester										Number of hours			
	1		2		3		4		5		Total	Lectures	Laboratory	Practical work or seminar
	1 (18 weeks)	2 (16 weeks)	3 (18 weeks)	4 (16 weeks)	5 (18 weeks)	6 (13 weeks)	7 (13 weeks)	8 (16 weeks)	9 (18 weeks)	10				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. History of the C.P.S.U.	3/R	4/E	3/R	4/E							224	120	104	
2. Political economy					2/R	3/E	2/R	3/E			140	98	42	
3. Dialectical and historical materialism							2/R	3/E	4/E	4	140	80	60	
4. Psychology	2	3/E									84	50	34	
5. Pedagogy			3	4/RE							120	70	50	
6. History of pedagogy					2	3/E					72	54	18	
7. School hygiene						1/R					36	18	18	
8. General physics			5/R	5/RE	6/R	6/RE					356	160	66	130
9. Astronomy									4/E	4	72	54		18
10. Theoretical mechanics							4/R	4/E			112	56	56	
11. Mathematical analysis	6/RE	7/RE	6/RE	6/RE							424	204	220	
12. Theory of functions of a complex variable					4/E						72	54	18	
13. Theory of functions of a real variable							2	2/E			50	50		
14. Analytical geometry	6/RE	4/RE									172	86	86	
15. Differential geometry					4/E						64	50	14	
16. Projective and descriptive geometry					4/E	3/R					110	78	32	

For meaning of R and E symbols, see note on page 217.

17. Foundations of geometry									4/E	4	64	54	10		
18. Higher algebra	4/R	4/E	4/RE								208	104	104		
19. Foundations of arithmetic						3/E					38	38			
20. Theory of numbers					4/E						60	36			
21. Special courses (elective)								3/R	2/R	2	84	84			
22. Special seminar in mathematics or methods of mathematics						2/R	2	2/R	2/R	2	118		118		
23. Algorithms and computing machines									3/R	3	50	50			
24. Elementary mathematics	4/E	3/R	4/R	4/E	4/R	3/R	3/E				402	180	206	16	
25. Methods of teaching mathematics						6/R	4/E	2/R	2/R	2	194	92	102		
26. History of mathematics								3/E			48	48			
27. Special practical training (surveying, mathematical models, calculation)							3/R	2/R	3/R	3	116			116	
28. Projective and technical drawing with methods of teaching	3/R	2/R	2/R	2/R	2/R	2/E					216	48		168	
29. Fundamentals of machine technology	2	2/R									80	34	12	34	
30. Educational movies							3/R				36			36	
31. Foreign language	2/R	2/R	2/E	2/R							140		140		
32. Physical education	2/R	2/R	2/R	2/R							140		140		
33. Special training				3/R							48		48		
Total hours	34	33	31	32	32	32	26	24	24	24	4,290	2,050	1,722	518	

For meaning of R and E symbols, see note on page 217.

Item	Number of exams, reports, and projects by semester									
	1		2		3		4		5	
	1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10	11
Exams (35)	3	5	3	5	4	5	2	5	3	------
Reports (52)	7	7	7	7	4	6	5	4	5	------
Projects (4)	------	------	------	1	------	1	------	1	1	------

TEACHER TRAINING (21 wks.)

1. In Pioneer camps (3 wks. in the 6th semester)
2. In school (6 wks. in the 7th semester and 10 wks. in 10th semester)
3. Industrial (2 wks. in the 10th semester)

OPTIONAL COURSES *(fakul'tativnye distsipliny)*

1. Practical training in extracurricular and out-of-school activities (100 hrs.)
2. Foundations of modern algebra (40 hrs.)
3. Topology (40 hrs.)
4. Analysis of functions (40 hrs.)
5. Calculation of variations (40 hrs.)
6. Vector and tensor analysis (40 hrs.)
7. Methods of mathematical physics (40 hrs.)
8. Methods of approximate calculations (40 hrs.)
9. Nomography (40 hrs.)
10. Theory of surfaces (40 hrs.)
11. Theory of probability (40 hrs.)
12. Mathematical statistics (40 hrs.)
13. Mathematical logic (40 hrs.)
14. History of modern mathematics (40 hrs.)
15. Selected topics in elementary mathematics (40 hrs.)
16. Foreign language (in years 3 and 4, 140 hrs.)
17. Improving sports skills (420 hrs.)
18. Choral singing (250 hrs.)
19. Individual instructions in playing musical instruments (250 hrs.)

Table P.—Specialty: Physics and the fundamentals of production

Subject	Hours per week by school year and by semester										Number of hours			
	1		2		3		4		5					
	1 (19 weeks)	2 (16 weeks)	3 (19 weeks)	4 (16 weeks)	5 (19 weeks)	6 (13 weeks)	7 (13 weeks)	8 (16 weeks)	9	10 (18 weeks)	Total	Lectures	Laboratory	Practical work or seminar
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. History of the C.P.S.U.	3/R	4/E	3/R	4/E							224	120	104	
2. Political economy					2/R	3/E	2/R	3/E			140	98	42	
3. Dialectical and historical materialism							2/R	3/E	4/E	4	140	80	60	
4. Psychology	2	3/E									84	50	34	
5. School hygiene						1/R					36	18	18	
6. Pedagogy			3	4/RE							120	70	50	
7. History of pedagogy					2	3/E					72	54	18	
8. Foreign language	2/R	2/R	2/R	2/E							140		140	
9. Physical education	2/R	2/R	2/R	2/R							140		140	
10. Analytic geometry	5/E	4/RE									158	88	70	
11. Mathematical analysis	7/RE	5/E	7/RE	4/E							410	232	178	
12. Methods of mathematical physics					4/E						76	56	20	
13. Mechanical drawing	3/R	2/R									86	18		68
14. General physics		9/RE	9/RE	9/RE	9/RE						636	272	160	204
15. Theoretical physics						5/E	6/E	6/E	6/E	6	334	218	116	
16. Theoretical mechanics					4/R	4/E					128	64	64	

17. Special practical training in physics								4/R	4/R	4	136			136
18. Special course in physics (elective)									3/E	3	54	54		
19. Astronomy with methods of teaching					6/R	4/E					160	100		60
20. Methods of teaching physics						6/R	5/E	2/R	2/R	2	210	60	50	100
21. Methods of teaching courses on the bases of production							1	2	1/R	1	70	12	26	32
22. Educational movies				3/R							48			48
23. Technology of metals and materials with practical training in school shops	5/R	2/R	6/R	4/R							310	56	6	248
24. Technical mechanics							3	3/E			86	48	6	32
25. Machine technology with practical training in autotractor technology							5	4/R	4/E	4	190	54	6	130
26. Electrical engineering					3/R	4/R					114	38	6	70
27. Radio engineering							6/R	3/R			120	44	6	70
28. Pedagogical practice in extracurricular activities					2	2/R					60		60	
29. Special training	3/R										48		48	
Total hours	32	33	32	32	32	32	30	30	24	24	4,530	1,904	1,428	1,198

For meaning of R and E symbols, see note on page 217.

Item	Number of exams, reports, and projects by semester									
	1		2		3		4		5	
	1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10	11
Exams (31)	2	5	2	5	2	5	2	4	4	.....
Reports (43)	7	6	6	5	5	4	3	4	3	.....
Projects (4)	.....	.....	.....	1	.....	1	.....	1	1	.....

TEACHER TRAINING (23 wks.)

1. In the school (8 wks. in the 7th semester and 8 wks. in the 10th semester)
2. Industrial training in repair workshops, factories and electric plants, and at machine-tractor stations (3 wks. in the 6th semester and 4 wks. in the 10th semester)

OPTIONAL COURSES *(fakul'tativnye distsipliny)*

1. Practical training in extracurricular and out-of-school activities (100 hrs.)
2. Improving driving skills (automobile or tractor) (80 hrs.)
3. Nuclear physics (40 hrs.)
4. Physics of semiconductors and dielectrics (40 hrs.)
5. Physics of electronic phenomena (40 hrs.)
6. Special course in optics (40 hrs.)
7. Hydrodynamics and aerodynamics (40 hrs.)
8. Geophysics (40 hrs.)
9. History of physics (40 hrs.)
10. Special topics in the methodology of physics (40 hrs.)
11. Selected chapters of general chemistry (80 hrs.)
12. Improving sports skills (420 hrs.)
13. Foreign language (140 hrs.)
14. Choral singing (250 hrs.)
15. Individual instruction in playing musical instruments (250 hrs.)

Table Q. — Specialty: Biology, chemistry, and the fundamentals of agriculture

Subject	Hours per week by school year and by semester										Number of hours			
	1		2		3		4		5					
	1 (18 weeks)	2 (12 weeks)	3 (18 weeks)	4 (12 weeks)	5 (18 weeks)	6 (12 weeks)	7 (13 weeks)	8 (12 weeks)	9 (16 weeks)	10	Total	Lectures	Laboratory	Practical work or seminar
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. History of the C.P.S.U.	3/R	5/E	4/R	3/E							224	120	104	
2. Political economy					3/R	2/E	3/R	2/E			140	98	42	
3. Dialectical and historical materialism							3/R	3/E	4/E	4	140	80	60	
4. Psychology	2	4/E									84	50	34	
5. Pedagogy			4	4/RE							120	70	50	
6. History of pedagogy					2	3/E					72	54	18	
7. School hygiene						2/R					36	18	18	
8. Inorganic chemistry	7/RE	9/RE									234	120		114
9. Analytic chemistry			5/R	5/R							150	18		132
10. Organic and biochemistry				6/RE	6/RE						180	84		96
11. Foundations of physical and colloidal chemistry					4/R	6/RE					142	78		64
12. Fundamentals of chemical technology								2	4/RE	4	88	56		32
13. Botany	5/R	4/RE	4/E	5/RE							270	140		130
14. Physiology of plants				5	2	4/R	4/RE				140	80		60

For meaning of R and E symbols, see note on page 217.

15. Bases of agriculture					4/E	5/R	3/E	4/RE			220	110		110
16. Mechanisation of agriculture					2	2/R	2	3/R			120	24		96
17. Zoology	5/E	4/RE	4/R	5/RE							270	140		130
18. Histology w. embryology	4/RE										72	36		36
19. Anatomy of man					5/RE						90	38		52
20. Physiology of man and animals							4/R	4/RE	5/RE	5	180	100		80
21. Darwinism							3	3/RE			70	50		20
22. Geology	4/E	4	2/RE								160	110		50
23. Methods of teaching chemistry						4	4/E	2	2/RE	2	156	50		106
24. Methods of teaching natural science and fundamentals of agriculture						4	4/R	3/R	2/RE	2	168	62		106
25. Special practical training (elective)								4	4/R	4	112			112
26. Special course (elective)									3/R	3	48	48		
27. Foreign language	2/R	2/R	2/E	2/R							140		140	
28. Physical education	2/R	2/R	2/R	2/R							140		140	
29. Special training			3/R								48		48	
30. Pedagogical practice in extra curricular activities					4/R						60		60	
31. Educational movies			2/R								36		36	
Total hours	34	34	32	32	32	32	30	30	24	24	4,110	1,834	750	1,526

For meaning of R and E symbols, see note on page 217.

Item	Number of exams, reports, and projects by semester									
	1		2		3		4		5	
	1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10	11
Exams (35)	4	5	3	5	3	3	3	5	4	
Reports (52)	6	5	7	7	5	6	5	5	6	
Projects (4)				1		1		1	1	

TEACHER TRAINING (45 wks.)

1. In the school (6 wks. in the 7th semester and 10 wks. in the 10th semester)
2. Fieldwork (6 wks. in the 2nd semester, 6 in the 4th and 7 in the 6th)
3. Working experience with the bases of agriculture and methods of teaching natural science and the fundamentals of agriculture (8 wks. in the 8th semester)
4. Workshop experience in chemical technology (2 wks. in the 10th semester)

OPTIONAL COURSES *(fakul'tativnye distsipliny)*

1. Practical training in extracurricular and out-of-school activities (100 hrs.)
2. Geography of plant-life with fundamentals of ecology (40 hrs.)
3. Geography of animal-life with fundamentals of ecology (40 hrs.)
4. Genetics and breeding of agricultural animals and plants (40 hrs.)
5. Agricultural entomology (40 hrs.)
6. Agricultural microbiology (40 hrs.)
7. Apiculture (40 hrs.)
8. Mineral resources (40 hrs.)
9. Chemistry of complex compounds (30 hrs.)
10. Selected chapters in the technology of inorganic substances (30 hrs.)
11. Practical training in construction of visual aids (60 hrs.)
12. Improving sports skills (420 hrs.)
13. Foreign language (in years 3 and 4, 140 hrs.)
14. Choral singing (250 hrs.)
15. Individual instruction in playing musical instruments (250 hrs.)

Table R.—Specialty: Geography and biology

Subject	Hours per week by school year and by semester										Number of hours			
	1		2		3		4		5					
	1 (19 weeks)	2 (18 weeks)	3 (18 weeks)	4 (13 weeks)	5 (19 weeks)	6 (13 weeks)	7 (19 weeks)	8 (17 weeks)	9 (11 weeks)	10 (19 weeks)	Total	Lectures	Laboratory	Practical work or seminar
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. History of the C.P.S.U.	4/R	3/E	4/R	3/E							224	120	104	
2. Political economy			2/R	3/E	2/R	2/E					140	98	42	
3. Dialectical and historical materialism							3/R	3/E	3/R	4/E	140	80	60	
4. Psychology	3	2/E									84	50	34	
5. Pedagogy			3	5/RE							120	70	50	
6. History of pedagogy					2	3/E					72	54	18	
7. School hygiene							1/R				36	18	18	
8. Fundamentals of topography and cartography		5/RE	4/R								136	68		68
9. Fundamentals of general earth science	3/E	3/R	6/E								204	136		68
10. Physical geography of the U.S.S.R.					4/R	5/E	3/R	3/E			220	148	26	46
11. Physical geography of the parts of the world					4/E	5/R	3/E				198	134	26	38
12. Economic geography of the U.S.S.R.						6/R	3/E	3/R	3	3/E	216	144	27	45
13. Economic and political geography of foreign countries							4/R	5/E	4/R	5/E	200	138	30	32
14. Practical training in the study of regions								4/R	3/R		64			64
15. Methods of teaching														

15. Methods of teaching geography							4/R	4/E			104	52		52
16. Chemistry	5/RE	6/RE									180	96		84
17. Botany	4/R	4/E	4/E	5/E							270	140		130
18. Zoology	4/R	4/E	4/R	5/E							270	140		130
19. Physiology of plants					4	3					116	64		52
20. Physiology of man and animals							5/RE	4/R	3/R	3/E	180	100		80
21. Human anatomy					4/RE						76	38		38
22. Darwinism									3	4/E	70	50		20
23. Methods of teaching natural science							4/R	4/E			104	44		60
24. Fundamentals of agriculture					4/R	3/RE					116	52		64
25. Geology	4/E	3/R	3/E								170	120		50
26. Elements of soil culture				6/R							78	39		39
27. Geography of animal life					2/R						38	38		
28. Geography of plant life					2/R						38	38		
29. Educational movies				3/R							36			36
30. Astronomy	3/R										56	38		18
31. Special course in geography or biology (elective)									2	2/R	40	40		
32. Special practical training and special seminars in geography or biology (elective)									5	5/R	100			100
33. Pedagogical practice in extracurricular and extra-school activities					2	2/R					60		60	
34. Foreign language	2/R	2/R	2/E	2/R							140		140	
35. Physical education	2/R	2/R	2/R	-/R							140		140	
36. Special training					2	1/R					48		48	
Total hours	34	34	34	32	32	30	30	30	26	26	4,484	2,347	823	1,314

For meaning of R and E symbols, see note on page 217.

Item	Number of exams, reports, and projects by semester									
	1		2		3		4		5	
	1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10	11
Exams (38)	3	5	5	5	2	5	3	5		5
Reports (51)	7	6	5	5	6	6	7	3	4	2
Projects (4)			1		1		1			1

TEACHER TRAINING (43 wks.)

1. In the school (6 wks. in the 8th semester, and 10 wks. in the 9th)
2. Summer fieldwork (7 wks. in the 2d semester, 7 wks. in the 4th, 6 wks. in the 6th, and 7 wks. in the 8th)

OPTIONAL COURSES (*fakul'tativnye distsipliny*)

1. Practical training in extracurricular and out-of-school activities (100 hrs.)
2. History of geographical discoveries (40 hrs.)
3. Geography of population (40 hrs.)
4. Economic cartography (38 hrs.)
5. Methods of geographical field observation (40 hrs.)
6. History of the National Economy of the U.S.S.R. (80 hrs.)
7. Ecology of plants (40 hrs.)
8. Ecology of animals (40 hrs.)
9. Apiculture (40 hrs.)
10. Sketching (40 hrs.)
11. Construction of visual aids (60 hrs.)
12. Practical study of agricultural machinery (60 hrs.)
13. Improving sports skills (420 hrs.)
14. Foreign language (in years 3 and 4, 140 hrs.)
15. Choral singing (250 hrs.)
16. Individual instruction in playing musical instruments (250 hrs.)

Table S.—Specialty: Physical education

Subjects	Hours per week by school year and by semester										Number of hours			
	1		2		3		4		5					
	1 (19 weeks)	2 (11 weeks)	3 (19 weeks)	4 (11 weeks)	5 (19 weeks)	6 (8 weeks)	7 (11 weeks)	8 (9 weeks)	9	10	Total	Lectures	Laboratory	Practical work or seminar
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. History of the C.P.S.U.	4/R	3/E	4/R	3/E							224	120	104	
2. Political economy			2/R	3/E	2/R	4/E					140	98	42	
3. Dialectical and historical materialism					2	4/E	3/R	4/E			140	80	60	
4. Psychology (including psychology of sports)	8	2/E						3/R			100	50	50	
5. Pedagogy			4	4/RE							120	70	50	
6. History of pedagogy					2	4/E					72	54	18	
7. Foreign language	2/R	2/R	2/E	2/R							140		140	
8. Chemistry	3/RE	4/E									104	54		50
9. Human anatomy	6/RE	6/RE									180	60		120
10. Human physiology			4/R	6/RE	6/RE						256	150		106
11. Methods of teaching human anatomy and physiology					2	2/R					54	20	14	20
12. General biology with fundamentals of Darwinism	4	3/E									112	66		46
13. Hygiene, general and of physical exercises					4/R	6/E					124	60	24	40

For meaning of R and E symbols, see note on page 217.

14. Physical therapy, medical supervision, athletic massage						3/R	6/R	6/RE			150	60		90
15. Organization and history of physical culture							5/R	4/E			96	70	26	
16. Theory and methods of physical education				4/R	4/R	3/E					142	60	82	
17. Gymnastics (fundamental, sports, and acrobatics) with methods of teaching	4	4/R	2	4/R	2	4/R	6/E	6/R			400	30	370	
18. Light athletics with methods of teaching:														
a. In the course of theoretical instruction	4/R		5/RE		4/RE									
b. During summer study camp		10/(R) (4 wks.)		10/(R) (4 wks.)							248	30	218	
19. Athletic games with methods of teaching											(80)	(10)	(70)	
a. In the course of theoretical instruction	2/R	2	2	2	4/R	2/R	4/E	2/R						
b. During summer study camp		8/(R) (4 wks.)		6/(R) (4 wks.)							274	30	244	
20. Skiing with methods of teaching											(56)	(10)	(46)	
a. In the course of theoretical instruction					2/RE						38	20	18	

b. During winter study camp		34/(R) (3 wks.)		34/(R) (3 wks.)								(204)	(10)	(194)	
21. Ice-skating with methods of teaching		2	2/RE									60	8	52	
22. Active games with methods of teaching															
a. In the course of theoretical instruction			2	2/R								60	14	46	
b. During summer study camp				4/(R) (4 wks.)								(16)	(4)	(12)	
23. Swimming and diving with methods of teaching															
a. In the course of theoretical instruction		2	2	2								82	10	72	
b. During summer study camp		12/(R) (4 wks.)		10/(RE) (4 wks.)								(88)	(10)	(78)	
24. Musical and rhythmic training	2	4/R										82		82	
25. Excursion training (*turizm*)															
a. During summer study camp		4 (4 wks.)		6/(R) (4 wks.)								(120)	(22)	(18)	
b. Summer excursion (*letnii turistskii pokhod*)				X/(R)								(80)		(80)	
c. Winter excursion (*zimnii turistskii pokhod*) (optional) (48 hrs.)					X										
26. Special training			3/R									48		48	
Total hours	34	34	34	32	34	32	24	25				3,446 (564)	1,214 (66)	1,760 (498)	472

For meaning of R and E symbols, see note on page 217.

Item	Number of exams, reports, and projects by semester									
	1		2		3		4		5	
	1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10	11
Exams [27 (1)]	2	5	3	4 (1)	3	2	5	3	.....	.....
Reports [40 (10)]	6	4 (4)	7	5 (6)	7	4	3	4	.....	.....
Projects (3)	.....	.....	.....	.....	1	1	1	.....	.....	.....

TEACHER TRAINING

1. Pedagogical practice in physical education in schools with suspension of course attendance (6 wks. in the 6th semester)
2. Pedagogical practice in physical education, anatomy, and physiology in schools with suspension of course attendance (8 wks. in the 8th semester)
3. Winter study camp *(zimnii uchebnolagernyi sbor)* (3 wks. or 102 hrs. in the 2d semester and 3 wks. or 102 hrs. in the 4th semester, for a total of 204 hrs.)
4. Summer study camp *(letnii uchebnolagernyi sbor)* (4 wks. or 136 hrs. in the 2d semester, and 4 wks. or 144 hrs. in the 4th semester, for a total of 280 hrs.)
5. Summer hike *(letnii turistskii pokhod)* (10 days in the 4th semester for a total of 80 hrs.)
6. In the Pioneer camp (3 wks. in the 6th semester)

OPTIONAL COURSES *(fakul'tativnye distsipliny)*

1. Practical training in improving sports skills (600 hrs.) (for 1st-class athletes and masters of sports, 900 hrs.)
2. Automobile racing (100 hrs.)
3. Figure skating (70 hrs.)
4. Rowing (40 hrs.)
5. Bicycle racing (60 hrs.)
6. Shooting (60 hrs.)
7. Fencing (70 hrs.)
8. Mass folk and ballroom dancing (100 hrs.)
9. Athletic equipment (30 hrs.)
10. Practical training in cinema and photography (80 hrs.)
11. Choral singing (250 hrs.)
12. Individual instruction in playing musical instruments (250 hrs.)

APPENDIX IX

Curriculum for University

Specialty: Physics, Moscow State University (1957-58)[1]

Subject	Hours per week by school year and by semester										Number of hours			
	1		2		3		4		5					
	1 (18 weeks)	2 (16 weeks)	3 (18 weeks)	4 (16 weeks)	5 (18 weeks)	6 (16 weeks)	7 (18 weeks)	8 (13 weeks)	9 (13 weeks)	10 (16 weeks)	Total	Lectures	Laboratory	Practical work or seminar
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Foundations of Marxism-Leninism	3/R	3/E	4/R	4/E							224	144	80	80
2. Political economy					2/R	3/E	2/R	2/E			140	100		40
3. Dialectical and historical materialism							2	3/E	5/E		140	80		60
4. History of physics									4/E		52	52		
5. Foreign language	4/R	4/R	4/R	4		R		R			270			270
6. Chemistry	4/E	2/R									102	68	34	
7. Mechanical drawing	2	2/R									68		68	
8. Teaching workshop	2	2/R									68		68	
9. Higher mathematics	10/ER	10/ER	10/ER	6/ER							616[2]	360		236

For meaning of R and E symbols, see note on page 217.

10. Methods of mathematical physics					8/ER	7/ER					256	170		86
11. Mathematical practicum					1	1/R					34		34	
12. General physics	4/ER	6/ER	6/ER	6/ER							372	236		186
13. Atomic physics					3/R	2/E					86	68		18
14. Nuclear physics						3/R	3/E				102	68		34
15. Theoretical mechanics and mechanics of continuous media				3/R	5/E						154	102		52
16. Thermodynamics and statistical physics						2/R	4/E				104	68		36
17. Electrodynamics					4/R	4/E					136	102		34
18. Quantum mechanics							4/R	4/E			124	93		31
19. Electronics fundamentals					3/E						54	54		
20. General physics practicum	5/R	5/R	6/R	6/R							374		374	
21. Atomic-nuclear physics and electronics practicum					6/R	6/R	9/R	9/R			483		483	
22. Special course and seminar					4	6/R	6/ER	6/ER	6/ER	6/ER	424	345		79
23. Laboratory in area of specialization								7/LR	14/LR	22/LR	625		625	
24. Gym and sport	2/R	2/R	2/R	2/R							136			136
Total hours	36	36	32	32	32	32	30	31	29	28	5,144	2,110	1,688	1,348

[1] *Uchebnyi plan.* Fizicheskii fakul'tet, Moskovskii Gosudarstvennyi Universitet, (1967). (Curriculum. Department of Physics, Moscow State University, 1967).

See note on symbols on page 217.

I. SUBJECTS—Continued

Total laboratory reports	3
Total examinations	37
Total oral reports	47

II. OPTIONAL COURSES

	Semesters	Hours
Foreign language	5–8	120
Physical education and sport	1–8	420
Astrophysics	6–7	68
Preliminary seminar	1–6	204
Educational photography and film management		

III. EXPERIENCE IN PRODUCTION WORK

Semester 8: 3 weeks (Aug. 10-31)
Semester 9: 5 weeks (Sept. 1–Oct. 5)

IV. TYPICAL COURSES OFFERED FOR AREAS OF SPECIALIZATION

Theoretical & Mathematical Physics

	Hours
1. Theory of continuous media	68
2. Further topics in mathematical physics	34
3. Further topics in statistical physics	34
4. Further topics in electrodynamics	68
5. Quantum electrodynamics	68
6. Theory of relativity	68
7. Quantum chemistry	34
8. Theory of elementary particles	68
9. The atomic nucleus	34
10. Quantum theory of fields	34
11. Theoretical physics seminar	68
12. Qualitative theory of differential equations	34
13. Theory of functions of a real variable	68
14. Integral equations	34
15. Elliptic differential equations	34
16. Hyperbolic differential equations	34
17. Operational calculus	34
18. Analytic theory of differential equations	34
19. Computational techniques	34
20. Special seminar	68
TOTAL HOURS	952

Physics of Solids

	Hours
1. Fundamentals of crystallography and X-rays	68
2. Structure analysis	68
3. Physico-chemical analysis	68
4. Roentgenography of metals	34
5. Special topics in physics of Xrays	34
6. Theory of solids	68
7. Electron theory of metals	34
8. Special topics in crystal chemistry	34
9. Physics of semiconductors	68

10.	Semiconductor devices	34
11.	Elements of high frequency technology	34
12.	Technology of semiconductors	34
13.	Crystallography	68
14.	Growth of crystals	34
15.	Crystal optics	34
16.	Crystal physics	68
17.	Alternating currents	34
18.	Electromagnetic and magnetic measurements	34
19.	Ferromagnetism	68
20.	Physics of metals	68
21.	Magnetic analysis	34
22.	Quantum theory of metals	34
23.	Special topics in quantum statistics	34
24.	Special methods of measurement	34
25.	Theory of transformers (regenerators)	34
26.	Theory of elementary particles	34
27.	Magnetic analysis of structured materials	34
28.	Special seminar	68
	TOTAL HOURS	1292

Optics & Spectroscopy

		Hours
1.	Spectroscopic technique	68
2.	Geometrical optics	34
3.	Spectrum analysis	34
4.	Theoretical optics	68
5.	Atomic spectroscopy	68
6.	Luminescence	34
7.	Theory of oscillations and waves	34
8.	Electronics (radio techniques)	34
9.	Molecular spectroscopy	68
10.	Further topics in nuclear physics	68
11.	Further topics in chemistry	34
	TOTAL HOURS	544

Molecular Physics

		Hours
1.	Further topics in mechanics of continuous media	34
2.	Fundamentals of theory of heat and mass transfer	34
3.	Molecular-kinetic basis of theory of condensed matter, I	34
4.	Special topics in thermodynamic and statistical physics	34
5.	Gas dynamics	34
6.	Independent student project	34
7.	Special seminar	68
8.	Molecular-kinetic basis of theory of condensed matter, II	34
9.	Physics of burning processes	68
10.	Method of (radioactive) indicator atoms	34
	TOTAL HOURS	408

Physics of Low Temperatures

		Hours
1.	Low temperature techniques	68
2.	Special topics in low temperature physics (experiments)	68

3.	Special topics in low temperature physics (theory)	102
4.	Special seminar	68
	TOTAL HOURS	340

Radio-Physics

		Hours
1.	Acoustics	34
2.	Theory of oscillations	102
3.	Electronics (radio techniques)	64
4.	Fundamentals of radiolocation	34
5.	Theory of waves	34
6.	Impulsive systems	34
7.	Special course	34
8.	" "	34
9.	" "	34
10.	" "	34
11.	" "	34
12.	Special seminar	68
	TOTAL HOURS	540

Geophysics

		Hours
1.	Geophysics	68
2.	Hydrodynamics	68
3.	Theory of turbulence	34
4.	Hydrometeorological measurements	34
5.	Thermodynamics of the sea	68
6.	Dynamics of the sea	68
7.	Hydrometry	34
8.	Physics of ground waters	34
9.	Physics of the atmosphere	102
10.	Oceanography	102
11.	Hydrochemistry	34
12.	Dynamics of river flow	34
13.	Optics of the sea	34
14.	Acoustics	34
15.	Molecular physics of the sea	34
16.	Seismology	34
17.	Seismometry	34
18.	Earth magnetism	34
19.	Gravimetrics	34
20.	Physical geology	34
21.	Thermodynamics and dynamics of the atmosphere	68
22.	Economics of the sea	68
23.	Theory of prognoses	68
24.	Synoptical meteorology	68
25.	Physics of the upper atmosphere	102
	TOTAL HOURS	1326

APPENDIX X

Topical Outlines of Required Courses in Education at Pedagogical Institutes

PEDAGOGY (120 hrs.)

A. Lectures (70 hrs.)
   1. General Theory of Education
      a. The subject and its methods (2 hrs.)
      b. Aim and tasks of Communist education (4 hrs.)
      c. Development and upbringing of children at various ages (2 hrs.)
      d. The system of public education in the U.S.S.R. (2 hrs.)
   2. Principles of Instruction and Didactics
      a. Nature of the teaching process (4 hrs.)
      b. Principles of didactics (4 hrs.)
      c. Contents of instruction (4 hrs.)
      d. The lesson (4 hrs.)
      e. Methods of teaching (6 hrs.)
      f. Theory of upbringing (2 hrs.)
      g. Tests and measurements[1]
   3. Moral and Aesthetic Education
      a. Principles of character education (6 hrs.)
      b. Education in Soviet patriotism and proletarian internationalism (2 hrs.)
      c. Education in Communist attitude toward work and public property (2 hrs.)
      d. Education in conscious discipline (2 hrs.)
      e. Aesthetic education (2 hrs.)
      f. Physical education (2 hrs.)
      g. Role of pupil groups (Pioneer and Komsomol organizations, and class groups) (8 hrs.)
      h. Extra-curricular activities (2 hrs.)
   4. School Management and Home Relations
      a. The teacher and the class leader (4 hrs.)
      b. Upbringing at home (2 hrs.)
      c. School administration (faculty council, control, etc.) (2 hrs.)

B. Practical exercises (50 hrs.)[2]
   1. Introduction (1 hr.)
   2. General acquaintance with the school (2 hrs.)
   3. The lesson (10 hrs.)
   4. Polytechnic education (8 hrs.)
   5. Work of the class leader (4 hrs.)
   6. Komsomol organizations (3 hrs.)
   7. Pioneer organizations (8 hrs.)
   8. Preparing pupils for summer pioneer camp (14 hrs.)
   9. Extra-curricular and other school-related activities (13 hrs.)

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[1] Although the official syllabus *(pedagogika)* published by the R.S.F.S.R. Ministry of Education in 1957 did not include this topic, Soviet educators told us that in fact it is covered in this course.

[2] The topics form a program of active field and practical experiences whereby actual school operations are studied.

HISTORY OF PEDAGOGY

Outline of textbook in history of pedagogy for pedagogical institutes[8]

Part 1. *Short Survey of the history of foreign education* (32.2 percent of text)

Education in primitive society.

Education, the school, and the origin of pedagogical theory in slave-holding society.

Education and the school in feudal society.

Pedagogical theory of Jan Amos Komensky (Comenius).

Pedagogical views of John Locke,

Pedagogical theory of Jean-Jacques Rousseau.

Pedagogical views of the French materialists of the 18th century (Helvetius, Diderot).

Pedagogical thought and the school during the period of the French bourgeois revolution of the 18th century.

Pedagogical theory of Johann Heinrich Pestalozzi.

Pedagogical theory of Johann Herbart.

Pedagogical activity and views of Adolph Diesterweg.

Pedagogical activity and views of Robert Owen.

Teaching of K. Marx and F. Engels on education.

Pedagogical thought at the end of the 19th century and the first half of the 20th century in Western Europe and the USA.

Part II. *History of Russian education* (39 percent of text)

Short survey of education and pedagogical thought in Russia from the 10th to the 17th century inclusive.

Enlightenment, schooling, and pedagogical thought in the 18th century.

School and pedagogy in the first half of the 19th century.

Pedagogical theory of Russian revolutionary democrats V.G. Belinskii and A.I. Hertsen.

Social-educational movement of the 1860's; the pedagogical views and activity of N.I. Pirogov.

The great Russian pedagog K.D. Ushinskii.

Revolutionary-democratic pedagogical theory of N.G. Chernyshevskii and N.A. Dobroliubov.

Pedagogical activity and views of L.N. Tolstoi.

School reforms of the 1860's.

School and pedagogical thought in the period of government reaction in the 1870's and 1880's.

Education, school, and pedagogical thought at the end of the 19th century

[8] N. A. Konstantinov, E. N. Medynskii, *and* M. F. Shabaeva. *Istoriia pedagogiki.* (History of Pedagogy.) Moscow, Gos. uch.-ped. izdat., 1959. 497 p.

and beginning of the 20th century, and during the first Russian people's revolution of 1905-1907. The struggle of the Bolshevik Party for education and school at that time.

Public education and pedagogical thought in Russia during 1908-1917 (up to the Great October Socialist Revolution). The struggle of the Bolshevik Party for public education at that time.

Part III. *History of the Soviet school pedagogy* (26.2 percent of text)

V.I. Lenin on Communist up-bringing, education, and school.

The Great October Socialist Revolution and basic reforms in the field of education and up-bringing (1917-1920).

Soviet school and pedagogy (1921-1929).

Soviet school and pedagogy (1930-1941).

Soviet school and pedagogy in the years of the Great Patriotic War (1941-1945).

Soviet school and pedagogy during 1946-1958.

N.K. Krupskaia—life, pedagogical activity, and pedagogical views.

The outstanding Soviet pedagog A.S. Makarenko.

The outstanding Soviet State leader, M.I. Kalinin, on Communist education.

Part IV. *School and education in countries of the people's democracies* (2.5 percent of text)

APPENDIX XI

Sample State Examinations in Pedagogical Institutes

AT THE END of the 5-year program in pedagogical institutes students are required to pass what are called "State Examinations" in the specialties which they studied. The examination questions are prepared locally at the institutes by examining committees from a list of topics published by the Ministry of Education in each of the Republics. This list of examination topics is made available to the students in advance of their examinations. They are expected to be able to answer questions relating to these topics. On the manner of conducting the state examinations, see the text, page 184.

In the following pages are reproduced two examples of these examinations, one in physics and one in mathematics. These requirements have been in effect since 1957, when teacher education for secondary schools was increased to 5 years.

The State Examination in Physics in Pedagogical Institutes[1]

(Topics from which examining committees will prepare examination questions)

PROGRAM

Introduction

Matter and motion—Space and time. Marxian and Lenin philosophy as a basis of studying physical phenomena. Objective character of laws of nature. Interrelation of physics with engineering. Role of Russian and Soviet science in development of physics.

I. *Mechanics*

1. *Dynamics of rigid bodies.*—Understanding of force and mass. Newton's Laws. Inertial systems and the force of inertia. Centrifugal force and its meaning in technology. The motion of a rigid body. The center of mass. The motion of center of mass. Rotation of a rigid body around an axis. The moment of inertia. The moment of force. Momentum. The basic equations of dynamics in rotating motion.

2. *The law of conservation of energy.*—The law of conservation of momentum. Work, energy, and power. Kinetic and potential energy. Kinetic energy of a rotating body. The law of conservation of energy in mechanics. Application of law of conservation of energy.

3. *Oscillations and waves.*—Harmonic oscillations. Natural oscillations. Pendulum. Damped oscillations. Amount of dampening. Forced oscillations. Resonance and its meaning in technology. Diffusion of waves in elastic media. Transverse and longitudinal waves. Monochromatic plane wave equation. Interference of waves. Moving and standing waves.

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[1] Ministry of Education, R.S.F.S.R., *Programmy pedagogicheskikh institutov. Programma, gosudarstvennykh ekzamenov po fizike.* (Syllabuses of Pedagogical Institutes, Program for State Final Examination in Physics.) Moscow, Uchpedgiz. 7 p.

4. *Hydrodynamics and aerodynamics.*—Stationary movement of an ideal liquid. Bernoulli's equation and technical applications. Laminar and turbulent flow of liquids. Motion of a body in viscous media. Head resistance. Resistance of media (Stokes' Law). Streamlining. Lifting capacity of an aeroplane wing. Understanding of treatise of Zhukovsky.

II. *Molecular Physics and Thermodynamics*

1. *The principle of kinetic theory of gases.*—Equation of state of an ideal gas. Lomonosov's idea. Derivation of equation of gas pressure from molecular-kinetic motion. Maxwell's distribution law concerning the speeds of molecules. Experimental definition of speed of the gas molecule. Mean free path of a molecule. Brownian motion. Definition of Avogadro's number.

2. *Thermal capacity.*—Theory of equal distribution of energy according to degrees of freedom. The classical theory of thermal capacity of gases and solid bodies, and its drawback. Quantum theory interpretation of thermal capacity.

3. *The real gases.*—Van der Waal's equation. Isotherms of Van der Waal. The works of Mendeleev, Andrews, and others. Internal energy of real gases. Joule-Thomson effect. Liquefaction of gases. How to obtain low temperature.

4. *Thermodynamics.*—The law of conservation and transformation of energy. Equivalence of heat and its performance. Mechanical equivalent of heat. The first law of thermodynamics. Isothermal, isobaric, isochoric, and adiabatic processes. Reversible and irreversible processes. Formulation of second law of thermodynamics. Circular process. Carnot's cycle. Entropy. Heat engines (steam engines, engines of internal combustion, and turbines) and their efficiency. Statistical interpretation of second law of thermodynamics. Interrelation between entropy and probability. Criticism of idealistic distortion in interpretation of second law of thermodynamics.

III. *Electricity*

1. *Electric field.*—Electric charge. Coulomb's Law. Intensity of an electric field in a vacuum and dielectric induction in the electric field. Flow of intensity. Flux. The theorem of Ostrogragsky-Gauss. Potentials. Interrelation between variation and intensity. Capacitance. Parallel plate capacitor. Energy of electric field. Electric field as a special type of matter. Electric apparatus: electroscopes, electrometers, and capacitors.

2. *Electron.*—Determination of the charge of an electron according to the method of Millikan. Movement of electrons in electric fields. Specific charge and mass of an electron.

3. *Direct current.*—Applied voltage. Electromotive force. Ohm's Law. Resistance of conductors. Kirchoff's Laws. Lenz-Joule Law and its application. Performance and power of current. Apparatus and methods of determining the power of current. Voltage and resistance.

4. *Electric current in electric lights and gases.*—Electrical dissociation. Electrical conductivity. Faraday's Law. Application of electricity in technology. Mechanism of conductivity of gases. Ionization of gases. Saturation currents. Cathode rays. Thermoelectric emission. The electron tube and its application.

5. *Magnetic field of a current.*—Laws of Biot-Savart and Laplace. Mag-

netic field near a straight wire and a circular coil. Ampere's Law. Movement of conductor with current in a magnetic field. Lorentz force. Determination of the specific charge of an electron.

6. *Electromagnetic induction.*—Discovery of the phenomenon. Lenz' Law. Derivation of law of induction based on law of conservation and transformation of energy. Self-induction. Energy in the magnetic field of a current. Energy density of a magnetic field. Practical application of electromagnetic induction.

7. *Alternating current.*—Methods of production and applications. Resistance, inductance, and capacitance in alternating current circuits. Ohm's Law for alternating current. Performance and power of alternating current. Three-phase current. Electrical measuring apparatus.

8. *Electric machines.*—Direct and alternating current, generators, and motors. Transformers. Rectifiers of alternating current. Applications of direct and alternating current. Electrification of the U.S.S.R. and the role played by Lenin in electrification of U.S.S.R.

9. *Electromagnetic oscillations.*—Thompson's formula. Damped and undamped oscillations. Excitation of undamped oscillations with the aid of an electron tube.

10. *Electromagnetic fields.*—Displacement current. Hypotheses of Maxwell. Equations of Maxwell. The speed of propagation of electromagnetic waves. Reception and detection of electromagnetic waves. Invention of radio by Popov. Broadcasting and reception of radio signals. Fundamental elements of radio apparatus.

IV. *Optics*

1. *Geometric optics.*—Reflection and refraction of light at the boundary between two dielectrics. Thin lens. Formulas of the thin lens. Magnification. Formation of an image by a thin lens. Optical apparatus: Photo apparatus, projectors, magnifying glasses, microscopes, astronomical telescopes. Focusing properties of these instruments and magnification.

2. *Interference of light.*—Coherent sources of light. Experimental proof of interference of light. The color of thin plates. Interference fringes of equal thickness and of equal inclination. Interferometers and their applications.

3. *Diffraction of light.*—Principles. Huyghen's principle. Fresnel. Diffraction of parallel light; the case of single or double slits. Diffractional gratings (screen or mesh as a method of production). Application of the diffraction grating.

4. *Speed of light.*—Astronomical and laboratory methods of determining speed of light. Phase and group speed.

5. *Optics of moving systems.*—Experiments of Fizeau and Michelson. The principle of special theory of relativity. Formulas of the Lorentz transformation (without conclusion) and conclusions from them. Interdependence of mass and speed. Interrelation between mass and energy.

6. *Quantum characteristics of light.*—Photo effect. Works of Stoletov. The fundamental laws of photo effect. Photons, their energy and momentum.

Einstein equation and its experimental confirmation. Photo elements and their applications. Pressure of light and its experimental proof by Lebedev.

7. *X-rays.*—Discovery of x-rays. Their characteristics. Diffraction of x-rays. The principle of structural analysis by means of x-rays. Spectra of x-rays. Compton effect. Production of x-rays and their application in medicine and technology.

V. *Nuclear Physics*

1. *Structure of atom.*—Nuclear model of the atom. Experimental proof of the existence of the nuclear atom. Postulate of Bohr. Electronic levels and shells. Experiments of Frank and Herz. The origin of spectra.

2. *Natural radioactivity.*—Discovery of radioactivity. Radioactive emission. Statistical law of decomposition. Radioactive series. The displacement law. Isotopes. Alpha disintegrations. Beta disintegrations.

3. *Elementary particles.*—Electron, proton, neutron, positron, and meson. Their discoveries. The methods of observation (spinthariscope, Geiger counter, Wilson chamber, and thin layer photo cells). Accelerators of particles (cyclotron and betatron).

4. *Wave-like characteristics of particles.*—Waves of de Broglie. Diffraction of electrons and its experimental realization. Principles of operation of the electron microscope, and its use for solution of problems.

5. *Atomic nuclei.*—Principal characteristics of the atomic nucleus: mass, charge, radius. Proton-neutron model of the nucleus according to Ibanenko. Periodic system of Mendeleev. Error in the metaphysical explanation about atoms as unchangeable particles. V. I. Lenin's theory on inexhaustible particles.

6. *Nuclear reactions.*—Mass defect. Energy relations in atomic nuclei. Splitting of nuclei. Some examples of nuclear reactions. Energy of reactions. Artificial radioactivity.

7. *Division of heavy nuclei.*—Fission of uranium under action of neutrons. Spontaneous fission. Chain reaction. Delayed neutrons. Reactors. Use of atomic energy for national economy in the U.S.S.R.

Explanatory Notes.—The purpose of the examination is to examine the preparation of graduates of pedagogical institutes for teaching physics in the secondary school. Each student will be examined in regard to the following.

1. Extent of the theoretical knowledge absorbed by the student during the course in physics.
2. Ability to apply this knowledge to problems in technology and in polytechnic education.
3. Knowledge of physical apparatus and measuring instruments and how to use them.

It is recommended that this entire program be broken up into a number of tickets (*bilety*) so that there be at least two questions taken from different subdivisions of the program.

The State Examination in Mathematics in Pedagogical Institutes[1]

(Topics from which examining committees will prepare examination questions)

PROGRAM

I. *Arithmetic*

1. Axiomatic structure of natural numbers. Principles of complete mathematical induction and its meaning for the secondary school course. Arithmetic processes.
2. Problems of understanding numbers (analysis of one of the following problems):
   a. Construction of whole numbers
   b. Construction of rational numbers
   c. Construction of complex numbers
3. Division of whole numbers. Common multiples and least common multiples of two or several numbers. Fundamental theorem concerning the factoring of natural numbers into primes. Presentation of the contemporary view on the problem concerning the distribution of prime numbers.
4. Basic characteristics of comparison. Complete and reduced systems of substraction. Theorems of Euler and Fermat. Arithmetic theory of the application of comparison.
5. Structure of real numbers. Decimal forms of real numbers.
6. Elements of approximation. Simple means of precise and approximate calculation.

II. *Algebra*

1. Investigation and solution of systems of n linear equations with n unknowns. Elementary methods of solving linear systems. Systems of linear equations with 2 and 3 unknowns and their geometric interpretations.

   General criteria for consistency of arbitrary systems of linear equations.
2. Equivalency of algebraic equations and systems of equations.
3. Solutions of algebraic inequalities and their geometric interpretations.
4. Number rings and fields. General theory of divisibility of polynomials into a product of irreducible factors.
5. Solution of second degree equations. Existence of roots of polynomials in in the field of complex numbers. Reduction of polynomials into linear factors. Integral and rational roots of polynomials.

III. *Geometry*

1. Relations between lines and planes in space. Study of this problem by the methods of elementary and analytic geometry.
2. Study of space curves by methods of differential geometry.

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[1] Ministry of Education, R.S.F.S.R., *Programmy pedagogicheskikh institutov. Gosudarstvennye ekzameny po matematike.* (Syllabuses of Pedagogical Institutes. Program for State Final Examination in Mathematics.) Moscow, Uchpedgiz, 1958. 6 p.

3. Projective invariance of elements of the first degree. Projective limitations of a curve of the second degree. Problem of constructing a curve of the second degree, using five points (lines). Theorems of Pascal, Brianchon.

4. Geometry and groups of transformations. All collinear groups in a plane and the most important subgroups. Characteristics of various branches of the geometry of invariant groups.

5. Basic understanding of geometry as a postulate system. The system of axioms of elementary geometry. The axiomatic method of construction in geometry (derivation of some theory).

6. Concept about consistency and independence of the axiom system. Analytical interpretation of the axiom system of Euclid's plane geometry.

7. Independence of the axiom of parallelism from other axioms. Interpretation of geometry of Lobachevskii.

8. Problems based on plane constructions. The system of postulates on construction with aid of compass and ruler. Survey of basic methods of solving the problems. Criteria of solution of problems based on construction with compass and ruler.

IV. *Mathematical Analysis and Theory of Functions*

1. Sets and operations. Countable sets and their basic properties. Noncountability of the continuum of real numbers.

2. Sets of real numbers and their basic properties. Existence of upper and lower bounds of bounded sets. Limit points of sets of numbers. Theorem of Bolzano and Weierstrass.

3. Numerical sequences. Concept of the limit of a number sequence and its properties. Existence of limits of monotone sequences. Necessary and sufficient conditions for convergence of sequences.

4. Concept of functional dependence. Determination of limits of function. Functions continuous at a point and classification of points of discontinuity. Properties of continuous functions on closed and bounded sets.

5. Derivatives and differentials of functions of one variable and their geometric and physical interpretations. Differentiability of functions of two variables. Conditions for differentiability.

6. Applications of differential calculus in the study of functions of one variable.

7. Definite integrals. The theorem of existence of the definite integral. Plane area and the length of a curve, and their calculation with aid of definite integrals.

8. Numerical series. Concept of convergence. Conditions for convergence. Absolute and conditional convergence. Power series and their basic properties.

9. Exponential and logarithmic functions and their basic properties.

10. Functions of a complex variable. Power series in the complex domain. Concept of analytic continuation and the uniqueness theorem. Definition of basic elementary functions with aid of power series.

11. Ordinary differential equations, their solution and integral curves. Initial conditions. Linear equations of second order with constant coefficients and their applications in oscillation theory.

Explanatory notes.—The purpose of the State examination in mathematics is to give a thorough check on the preparedness of graduates of pedagogical institutes who are to teach mathematics in secondary schools, particularly:

1. The extent of their theoretical knowledge.
2. Their ability to apply mathematical methods in the solution of problems in the natural sciences and engineering.
3. Their ability to solve problems in elementary mathematics which require knowledge of methods and ideas of higher mathematics.

In conducting State examinations it is recommended that the program should be divided up into tickets (*bilety*) so that each ticket should contain 2 or 3 questions taken from different subdivisions of the program. After student has answered the assigned questions, it is recommended that additional questions be given from subdivisions not included on the ticket. The answer of the student to each question should include example or interrelated proof of his understanding of the question.

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