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Date of Degree: May 29, 1960

Institution: Oklahoma State University

Location: Stillwater, Oklahoma

Title of Study: A PHYSICAL SCIENCE COURSE OF STUDY FOR THE NINTH GRADE

Pages of Study: 50

Candidate for Degree of Master of Science

Major Field: Natural Science

Nature of Study: The study started from a proposal of the Oklahoma Curriculum Committee for Science. This proposal is for a physical science course to replace the general science which is now being offered in the ninth grade. The situation confronting the study is to find what should be included, and to develop a course of study from the available text books.

Finding and Conclusions: There is not a suitable text on the Oklahoma adopted text list. The course should consist of two-thirds Physics, one-fourth Chemistry and one-tenth Geology. This course of study is developed from a state adopted text and by using several other books as references. The course of study is developed into units. Each unit gives an introduction, points to consider and a list of references with the particular page reference for that unit.

Use of Study: As a guided outline for teaching a physical science class on the ninth grade level.

ADVISOR'S APPROVAL ______________________

A PHYSICAL SCIENCE COURSE OF STUDY

FOR THE NINTH GRADE

By

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Bachelor of Science
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1946

Submitted to the faculty of the Graduate School of
the Oklahoma State University in partial
fulfillment of the requirements
for the degree of
Master of Science
May, 1960

A PHYSICAL SCIENCE COURSE OF STUDY

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ACKNOWLEDGEMENTS

The writer wishes to express his sincere appreciation for the helpful guidance of Dr. James H. Zant, Professor of Mathematics, which has culminated in the presentation of this report.

Grateful acknowledgement is made to my wife, Katherine A. Matthews, for her cooperation and the typing of this report.

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CHAPTER I

STATEMENT OF THE PROBLEM

The purpose of this report is to develop an outline for teaching a Physical Science class in the ninth grade for the Madill, Oklahoma city schools. Since the ninth grade General Science class, as it is taught today, is what the name implies --a general study of all the major sciences (which includes Physics, Chemistry, Astronomy, Meterology, Zoology, Botany and the earth sciences)--this report was selected because of the need of a change in our curriculum. We have too much material that is duplicated over and over. Some of the experiments performed in the sixth grades are being rerun in the ninth grades. Some material that should be covered in the ninth grades is being omitted because of the lack of time.

The Oklahoma Curriculum Committee for Science, in a meeting on February 6, 1960, made the following recommendations: Kindergarten through sixth grades would cover (1) space, (2) weather, (3) matter and energy, (4) living things, (5) earth and (6) man and his environment. Junior High's seventh grades would cover basic Chemistry and Physics (from matter standpoint), earth science and some Astronomy. In the eighth grades, Biological Science would be covered. The ninth grades would be given a fundamental course of Physical Sciences. High School courses of Chemistry Physics, Biology, Geology, etc. being offered as far as possible. This was suggested with the ninth grade Physical Science being required of all students. With this in mind, and there not being any text book on the market at this time to cover the material for the ninth grades, it is the purpose of this report to outline the material that should be covered in the ninth grade Physical Science course.

Your author has made a study of Heath's Elementary Science series to avoid as much duplication as possible. It is in the thinking and planning stage of the curriculum committee that all grades will be standardized as to the subject matter in the science classes. Until this is a reality, other provisions will have to be made.

This report will be limited to a study of the ninth grades. It cannot be over-emphasized that the basic materials that students should have received in his lower grades are essential.

Since there are no text books on the market at this time to cover such a course, and since Oklahoma has the free text book policy, it is expected that some book on the adopted text book list be used. This study, based on Science, A Story of Discovery and Progress, by Davis-Burnett and Gross as the basic text for the course. Of course, the teacher will have to use references and supplementary materials for the course. This report will attempt to be of help to teachers to organize and teach such a course. Other books of science on the adopted text book list could be used just as well. This particular text has been chosen because it is the one which will be used next year.

This report will use the Oklahoma Curriculum Committee's resolution of proposed Physical Science course as its outline as much as possible, keeping in mind the background of the present students. This new proposal by the curriculum committee, can not go into effect all at once because of the background of the lower class students. For example, the ninth grades could not expect to be able to master a very deep course in Physical Sciences without more basic materials in the lower grades. So, until the whole program gets under way, this report should help bridge the gap.

CHAPTER II

BACKGROUND AND REVIEW OF LITERATURE

The Madill city schools are in the process of revising their science program to fit the needs of the students. That is, to prepare the students for college, and to better equip those who will not be going on to college. The elementary school is being strengthened by including science laboratories in their new building. This will enable the elementary students to have a complete, planned science program included in their curriculum.

The seventh and eighth grades will adopt the Curriculum Committee's proposed program. Of course, it will take a few years to make the complete change, because of time required in coordinating the program between grades, getting the outlines for each of the grades, and finding suitable reference materials. This is a start of an organized plan for all the sciences in the Madill city school system. As has been stated before, this report will only cover the Physical Science program for the ninth grades.

Today we are faced with a world that is making many rapid changes. These changes mean progress. We are faced with problems today that make changes necessary. The students of today are not the same type as those of fifty years ago.

> In 1900, only 11% of the nation's population fourteen to seventeen years of age were enrolled in secondary school. A little more than a half century later, over 76% of the nation's youth in this age group are enrolled. In 1900, Science teacher's task was relatively simple. It consisted of preparing this relatively homogeneous group of capable youngsters for college. The task and responsibility of the Science teacher today, are more complicated than those of his predecessors. He is expected to help equip the "dull" and the "bright", the rich and the poor, the college-bound and the laborer-to-be -- all the children -- for personal lives of satisfaction for the fullest possible contribution to the maintenance and advancement of our democratic society.[1]

"The constant problem in Science education is to meet the needs of pupils in terms of their maturity level and interests, and still avoid repetition."[2]

Student enrollment today is quite different from that of 1900. Burnett[3] in his book, Teaching Science in the Secondary School, gives the following percentage of high school enrollment. General Science enrollment went from 18% in 1922 to 21% in 1949. The Biology classes had 1% of the high school students as compared to 18% in 1949. Chemistry dropped from 7.7% in 1900 to 7.6% in 1949, and Physics dropped from 19% in 1900 to 5.4% in 1949.

What is the reason for this increase in Biology and the decrease in Physics and Chemistry? Could it be that the students have the wrong conception of the courses? Is it because

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[1] R. Will Burnett, Teaching Science in the Secondary School, (New York, 1957), p. 6.

[2] Burnett, p. 7.

[3] Burnett, p. 8.

students think Biology is easier? This type of enrollment is overloading the Biology class, and at the same time, the Chemistry and Physics fields are losing some very capable students.

Why not develop a Science program that would give the students a better understanding of the different Sciences? Dr. Roy Jones, in his address to the Second Annual Conference on Recent Developments in Mathematics and the Sciences, makes the following statements about the curriculum changes in the sciences:

> The Committee on Elementary Science, Kindergarten through the sixth grade has suggested that the science training in the elementary grades must be a destinct program recognized by both students and teachers as dealing with the subject matter of Science and concerned with experiments in which the students learn not only about Science, but learn to do things in a scientific manner. It was, in general, considered that probably the kindergarten through the first three grades, what we might call the primary grades, would be concerned with some six areas of Science and that these areas would be introduced in broad generalities and intergrated with other materials in these primary grades. The six areas suggested are as follows: (1) living things, (2) the universe, including inner and outer space, (3) the seasons and weather, (4) matter and energy, (5) the earth, and (6) man and his environment.
>
> The committee, after due deliberation and consideration, agreed upon the following for the seventh and eighth grades: (1) that the seventh grade science course should concern itself with the basic principles of physical sciences, matter and energy, and with the basic principles of earth sciences, physical geography and astronomy. (2) It was felt that the eighth grade science should concern itself primarily with the biological sciences, with emphasis or explanations on the phenomena of reproduction, and on the phenomena necessary to understanding the functions of the human body, especially the function of some six or seven of the body systems. The committee arrived at the conclusion that the next step in the science program should be a course in physical science required of all students in the high school for graduation. This course might be offered at the ninth grade level, and that all of the other high school science courses should

> require this physical science program as a pre-requisite. It was felt that as a result of having had this to provide strong course in "modern" Chemistry, Physics and Biology.[4]

What is this Physical Science that Dr Jones speaks about?

> Physical Science is to be regarded as the name given to a course in which a definite attempt has been made to combine Physics and Chemistry into a definite series of units of subject matter within each of which both matter of Chemistry and Physics are considered and treated in a more or less related manner.[5]

A course of this kind may be taken either as a substitute for chemistry or physics, or as an introduction to them. There is always the possibility that a student who has no apparent interest in Science may develop an enthusiasm for it and will have three more high school years for study. Some schools are offering it only to those students who do not plan to go on into other sciences.

> Austin High School, Austin, Texas, offers it primarily for non-college students; however, if they do go on, the University of Texas will give college entrance credit as a laboratory science.[6]

It is up to the Physical Science instructor, or other persons setting up the course of study, to hold the interest of the students. Too often, because of lack of time or interest on the part of the teacher, the Physical Science course becomes a science course with one-half of the year spent on

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[4] Roy Jones, Oklahoma State University, Curriculum Changes in Science, Feb. 6, 1960.

[5] Vaden W. Miles, Principles and Experiments for Courses of Intergrated Physical Sciences, (Michigan 1950) p. 3.

[6] Frank C. Guffin, "Physical Science Today--A Symposium", The Science Teacher, XVIII (1951), p. 19.

Chemistry and one-half on Physics.

> It appears probable that the majority of these courses have been developed by the classroom teacher who has received no special time allotment for such work; the work has been done at the end of a busy day, during evenings, over weekends, and during vacation times.[7]

The Physical Science course could be the answer to the problem of small schools, where Chemistry one year and Physics the next is taught. The teacher could work year after year improving the course rather than teaching an alternating course every other year. The student would receive instruction in both subjects, rather than choosing one and never getting any enlightenment in the other. In the large school, this would give a good background for students enrolling in Physics or Chemistry.

Present day teachers have received very little training designed to show them how to teach a course in Physical Science. The teacher may be well-informed in the matter of Chemistry and Physics, but would find that he lacked the necessary training to coordinate them into a unified Physical Science course.

> In general, the survey of Physical Science courses in all types of schools seem to have been taught by teachers who originally were trained to teach the separate Physical Sciences or some other form of science rather than the generalized course.[8]

"The big question is -- What should be taught in Physical

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[7] O. A. Nelson, "Physical Science Today -- A Symposium", The Science Teacher, XVIII, p. 21.

[8] Donald R. Watson, "The Training and Experience of Instructors in Survey Courses in Physical Science", Science Education XXV (1941) p. 82.

Science, which now enrolls the majority of our high school youth."[9]

In developing a Physical Science course, you must have an objective which is defined by Uhl as "a value or element which is set up for attainment to meet with plans for appropriate activities of the attainment of that value."[10]

It is important to plan a course of study for the student as he develops. For that reason, the eighth grade would study biology while the students are making their physical change in life. The Physical Science class would start Physics and Chemistry while they were taking Algebra. This way, they could apply this Algebra to their science problems. Hunter states in his Science Teaching

> In making out a plan for Science education that will be continuous through elementary, junior high school, and senior high school, it is necessary to consider first, the mental development of the child, particularly with relation to his native interest and abilities, and second, the fact that the child has to be fitted into a social group as a cooperating member of society as well as an individual. The child's relation to his environment must be considered from a different point of view in his early life from that of later life, because of the difference in his mental development and the accretion of experiences which give him his environmental knowledge.[11]
>
> The particular units of study should be those that truly interest the pupils. Interest not only secures productive attention but is the evidence of attention. To be substantially educated, interest

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[9] Burnett, p. 9.

[10] W. D. Uhl, Secondary School Curriculum, (McMillan, 1927).

[11] George Hunter, Science Teaching, (New York, 1934) p. 114.

must rest upon a sense of value, an evident worthwhileness in the topics considered.[12]

Now comes the task of deciding what should be included in the Physical Science course. Vaden Miles[13] points out that after doing a study on the "important principles which might be included in Physical Science", he found that two-thirds of such principles were in Physics (including Astronomy and Meteorology), one-fourth Chemistry and one-tenth Geology. This emphasizes the fact that there can not be an equal balance among the different fields.

Investigators trying to arrive at an ideal method of teaching science found the following results and were reported by Heiss and Obourn.[14]

I. Conclusions contending that the Laboratory Method is superior.

1. There is slight indication that material was better retained when taught by the individual laboratory method.

2. The order of preference of the methods studied places the individual laboratory method before the demonstration method.

3. In every respect the lecture method is least effective in imparting knowledge in high school students.

4. For permanent learning, the laboratory method is perhaps slightly superior.

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[12]Hunter, p. 126.

[13]Vaden W. Miles, Principles and Experiments for Courses of Integrated Physical Sciences, (Michigan, 1950) p. 190.

[14]Elwood D. Hiess and Ellsworth S. Obourn, Modern Methods and Materials for Teaching Science, (New York, 1940) p. 63.

5. For providing knowledge and method of attack, the laboratory method is superior for the inferior pupil.

II. Conclusion claiming that the demonstration method is superior.

1. Bright pupils are more likely to profit by lecture-demonstration than the others.

2. Dull pupils profit more from demonstration than from individual laboratory work.

3. The lecture-demonstration takes less time and cost less.

4. Lecture demonstration method gives better control over the individual since all are under teacher guidance.

5. For purpose of providing knowledge for both immediate and permanent retention and for the purposes of providing technique or handling new problems, the demonstration method is much to be preferred to the laboratory method in the case of average superior pupils.

III. Conclusion contending that the students achieved equally well by either method.

1. Immediate retention is about equal in both demonstration and individual-laboratory method.

2. There is not as great a difference as is ordinarily supposed in the value of the three methods: lecture, textbook and laboratory, so far as imparting knowledge is concerned.

According to Richardson[15], there is no "best" way or procedure of teaching. What the student retains and achieves will vary with the individual teacher.

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[15]John S. Richardson, Methods and Materials for Teaching General Science, (New York, 1951), p. 14.

Richardson[16] also gives the purposes of demonstration as follows: (1) Motivation, (2) Explanation of a principle or application, (3) Preview of a unit of work, (4) Provision for various phases of teaching for thinking, (5) Provision for particular student needs or interest, (6) Exemplification of a skill or technique, (7) Review and (8) Evaluation.

[16] Richardson, p. 16.

CHAPTER III

PHYSICAL SCIENCE COURSE OF STUDY

This course of study is formulated to correlate Physics, Chemistry, Meteorology and Astronomy into one subject with no effort made to distinguish the different sciences. Although Physics takes the major role of the course, Chemistry, Meteorology and Astronomy are intermingled for the purpose of explaining the forces of nature. To lay a foundation for the forces of nature, matter and energy are studied first, with atomic and molecular phenomena coming very early in the outline.

Science, A Story of Discovery and Progress, by Davis, Burnett and Gross is used as the basic text. Other references, as shown in the outline, are used as supplementary materials. It is intended for the students to study the basic text and the teacher use the supplementary materials to strengthen the basic text.

Each unit is given an introduction to acquaint the student with the material that is to be covered in that unit. The content of each unit is presented in a question form. It is felt that if the students understands each question, the principles of that unit will be easier comprehended.

For convenience, this outline includes the pages covered in both the basic text and in the supplementary references for each unit.

UNIT I

MATERIALS AND FORCES OF NATURE

A. Introduction:

Have you ever thought what it would be like living 10,000 years ago? To whom can you give credit for living in a environment as we live in today? What can you do to make this a better place in which to live? What is your body make of? Did you know that everything on this earth is made up of probably less than 101 different little items we call elements? Let's see how things are composed of these little elements and see how some of them work.

B. Points to Consider:

1. What is matter?
2. What is matter composed of?
3. What is energy?
4. Matter exists in what forms? Explain how these forms may be changed.
5. Where is matter found?
6. What is the difference between organic and inorganic matter?
7. What force attracts matter to the earth?
8. Does matter have weight?
9. How will friction help you get home this afternoon?
10. Show how inertia is of value to you.

11. Explain the difference in potential and kinetic energies.

12. How can these energies be changed?

13. What one new law do we now have about creating and destroying energy or matter?

14. What is atomic energy and some of its uses?

15. What method does the scientist use in solving his problems?

C. Reference:

1. Ira C. Davis, John Burnett and E. Wayne Gross, Science, A Story of Discovery and Progress. Henry Holt and Company, New York. p.3-31

2. William O. Brooks and George R. Tracy, Modern Physical Science. Henry Holt and Company, New York. chapter 2

3. Melton O. Pella and Aubrey G. Wood, Physical Science for Progress. Prentice-Hall Inc., New Jersey. p.124-143

4. Hyman Ruchlis and Harvey B. Lemon, Exploring Physics. Harcourt, Brace and Company, New York. chapter 3

UNIT II

AIR AND AIR PRESSURE

A. <u>Introduction</u>:

Have you ever been up in an airplane? Did you wonder what held it up? As the airplane takes off and lands, you may feel your ears pop. This occurs because the air gets thinner as you go away from the earth.

When the wind blows we are also reminded that we live in air. The air is really an important part of the earth. Without air, the earth would be a barren mass. All the living things we know are found at or near the bottom of the "ocean of air". Living things need air. Air protects the earth. Without air, the earth would undergo extreme changes in temperature.

B. <u>Points to Consider</u>:

1. What is a barometer?
2. Why did Galileo and Torricelli construct the barometer? What was the problem they were trying to solve?
3. In what different ways may the pressure of air be changed?
4. Why are particles of air much too small to be seen under a microscope?
5. What makes a basketball bounce when it hits the ground?
6. Why should you make two holes in an oil can when pouring from it?
7. What is the weight of one cubic foot of air?
8. How does the barometer measure air pressure?
9. What is the pressure of the air in pounds per square inch?
10. What is a vacuum?

11. What is meant by compressed air?

12. How are the pressure and volume of gases related?

13. What causes a balloon to rise in the air? How long will it continue to rise?

14. What effect does heat have on air?

15. What is meant by bouyancy?

16. What is meant by the term of center of gravity?

17. What keeps an airplane in motion and off the ground?

18. Why are modern automobiles and trains streamlined?

19. Explain the operation of a siphon.

C. References:

1. Ira O. Davis, John Burnett and E. Wayne Gross, Science, A Story of Discovery and Progress. Henry Holt and Company, New York. p. 34 - 61.

2. Melton O. Pella and Aubrey G. Wood, Physical Science for Progress. Prentice-Hall Inc., New Jersey. p. 156 - 183.

3. William O. Brooks and George R. Tracy, Modern Physical Science. Henry Holt and Company, New York. chapter 3 and p. 170.

UNIT III

THE NATURE AND USES OF FIRE AND HEAT

A. Introduction:

We have always had fire, because fires in the earliest days were caused by lightening or volcanoes. Our problem was how to make fire and control it. Indians made fires by rubbing two sticks together just as the Boy Scouts do it today. Not too many years ago, the match was made by an Englishman. He used chemicals and started the chemical reaction with friction.

How would you like to live without the use of matches, or some easy way of making a fire? Fires can be dangerous as well as helpful. Their control is up to man.

B. Points to Consider:

1. What are the properties of oxygen?
2. What occurs when a fuel burns?
3. Why is the air called a mixture?
4. What is an element? A compound?
5. How do mixtures differ from compounds?
6. How is the composition of air affected by the burning of a fuel?
7. What three conditions must exist before you can have a fire?
8. What chemical changes occurs during the rusting of iron?
9. What are the products of combustion of the common fuels?
10. Distinguish between physical and chemical changes?
11. What are molecules? What is the molecular theory?

12. What is oxidation? How can it be increased or decreased?

13. What theories are used to explain how coal and petroleum were formed?

14. What are the main causes of destructive fires?

15. What methods are used to put out fires? Including oil fires?

16. What is the most important source of the earth's heat energy?

17. In what three ways is heat produced?

18. What is the effect of a change in temperature on the volume of liquids, solids and gases?

19. What is the meaning of temperature? How is it measured?

20. What two units are used to measure quantities of heat? What is the definition of each unit?

21. In what three ways may heat be distributed?

22. What is the most comfortable temperature and humidity of a classroom?

23. How does the humidity vary with the temperature? Compare the humidity of summer with that of winter.

24. How is the loss of heat prevented in a thermos bottle?

25. Under what condition is carbon monoxide gas formed during combustion?

C. <u>References</u>:

1. Ira C. Davis, John Burnett and E. Wayne Gross, Science, A Story of Discovery and Progress. Henry Holt and Company, New York. p. 63 - 122.

2. Melton O. Pella and Aubrey G. Wood, Physical Science for Progress, Prentice-Hall Inc., New Jersey. p. 431-453.

3. William O. Brooks and George R. Tracy, Modern Physical Science, Henry Holt and Company, New York, chapter 2 and p. 52 - 57.

UNIT IV

THE NATURE AND USES OF CHEMICALS

A. Introduction:

Chemistry is concerned with the properties of matter, changes in matter, and the laws or principles which describe these changes.

All of us daily observe many transformations or changes in matter taking place: water may be frozen into ice or converted into steam, gasoline burned, wood rots, tools rust or corrode. The chemist is interested in all of these changes and many more.

B. Points to Consider:

1. What is an element, compound and mixture?
2. What is meant by chemical changes?
3. What is meant by physical changes?
4. Why was progress in chemistry slow during the revival of learning that occurred in the 15th and 16th centuries?
5. What event began the period of modern chemistry?
6. What was the greatest scientific achievement that was made during the 1940's?
7. What are some of the differences between metals and nonmetals?
8. What three kinds of particles make up the atom of all elements?
9. Has man actually created new elements that do not occur in nature?
10. Why do the elements silver and iron have symbols that do not begin with the first letter of their names?
11. How many elements have we discovered?

12. What is an important difference between physical properties and chemical properties that help us to classify such properties? Is it possible to have a chemical change without having physical change?

13. What is the activity series?

14. Why did we weigh out the iron filings and the sulfur when we made a compound of these two elements?

15. How do you know that a molecule of sugar has something still smaller in it?

16. What two things do all chemical formulas tell us?

17. If a farmer's land is too acid, how can he correct the trouble?

18. Explain the difference in acid, base and salts.

19. What is produced when an acid neutralizes a base?

20. How is crude salt separated from impurities to make a pure product?

21. Why don't we use hydrochloric acid as the acid substance in baking powder?

22. What is used to make lustrous glass for fine table glassware?

23. How has man imitated, and also improved upon, the silkworm in making new textile fibers?

24. What are the raw materials used in making the new textile fibers?

C. References:

1. Ira C. Davis, John Burnett and E. Wayne Gross, Science, A Story of Discovery and Progress, Henry Holt and Company, New York, p. 393 - 418.

2. Melton O. Pella and Aubrey G. Wood, Physical Science for Progress, Prentice-Hall Inc., New Jersey p. 200 - 211 and 455 - 475.

3. William O. Brooks and George R. Tracy, Modern Physical Science, Henry Holt and Company, New York, chapter 2 and chapter 18.

UNIT V

NATURE AND KINDS OF ENERGY

A. Introduction:

You use energy to work and play. You feel tired after work or play, because you have used your supply of energy. You wash with water warmed by energy. You put on clothes washed and ironed with energy.

You use many kinds of energy. Machines help you work and play. Machines change energy from one form to another. Many machines use electrical energy. Power tools that are run with electrical energy help us do work. What are these different kinds of energies?

B. Points to Consider:

1. What happens to energy when we use it?
2. What is the main source of energy for the earth?
3. What forms of energy can be changed to heat energy: Mechanical energy? Sound energy? Electrical energy? Magnetic energy? Chemical energy? Radiant energy?
4. In what forms are potential energy found?
5. In what forms are kinetic energy found?
6. How is kinetic energy like potential energy? How are they different?
7. What two units are used to measure work?
8. What is the original source of the energy in a flowing river?
9. Prepare a chart to show the changes that could take place to change sunlight into electrical energy.
10. Label each of the following as potential or kinetic energy:

a. Water behind a dam?

b. Car on a hill with brakes set?

c. Lump of coal?

d. Water falling over a dam?

e. A motor running?

f. A brick set on top of a building?

g. A brick falling through the air?

h. A plate of food?

11. What is atomic energy?

12. What parts of the atom gives it most of its weight?

13. What part of the atom moves around?

14. How does the number of electrons and protons in an atom compare?

15. What determines the combining power of an element?

16. How are atomic weights of the elements determined?

17. How is nuclear energy released from uranium?

18. What is the graphite in the reactor used for?

19. How is nuclear energy harnessed for use?

C. Reference:

1. Melton O. Pella and Aubrey G. Wood, Physical Science for Progress, Prentice-Hall Inc., New Jersey, p. 243 - 253.

UNIT VI

THE NATURE AND USES OF LIGHT

A. <u>Introduction</u>:

The use of our sense of seeing helps us to grasp many facts. We learn a great deal about the world through sight. We see color. We see stars. Probably best of all, we escape many dangers because we can see.

Light is necessary for sight. We know of two forms of light--artificial and natural. Natural light comes from the sun. We can use this only during the day time. Because we were not satisfied with the daylight hours, we have found artificial sources of light. Light is a form of energy, so we use light in many ways and will probably use the sun light energy more and more as the years go by.

B. <u>Points to Consider</u>:

1. What is the nature of light?
2. What makes objects visible?
3. Explain polarized light.
4. How are transparent, translucent and opaque materials different?
5. What is a shadow? What are the parts of a shadow?
6. How does light enter a window on the north side of a house?
7. What kinds of surfaces make good reflectors?
8. What kinds of surfaces are used to diffuse light?
9. What are the differences between real and virtual images?

10. Under what conditions is an eclipse of the moon produced? An eclipse of the sun?

11. How is light refracted?

12. If you were shooting obliquely at an object under water, where should you aim to hit it?

13. What causes a rainbow?

14. What is white light? What does black mean?

15. Why is the inside of a camera painted black?

16. Compare the human eye and the camera. In what ways are they the same? In what ways are they different?

17. Why is white clothing preferred for summer?

18. What is a convex lens?

19. Under what conditions does a convex lens form a real image? A virtual image?

20. What is a concave lens?

21. What makes objects have color?

22. How is nearsightedness corrected?

23. How is farsightedness corrected?

24. What makes movies appear to move?

25. What methods are used to produce light in the home?

26. What three methods are used to distribute light in the home?

27. How is the intensity of light affected by increasing the distance from the source?

28. Why are motion pictures usually taken more rapidly than they are projected on the screen?

29. What are the three primary colors? How are they mixed to produce a white color? A green color?

30. What are the three primary pigments? What combination of pigments is needed to produce black?

31. What gives any object its color?

32. What different kinds of radiant energy are given off by the sun?

33. What are the colors in the sun's spectrum as formed by a prism?

C. References:

1. Ira C. Davis, John Burnett and E. Wayne Gross, Science, A Story of Discovery and Progress, Henry Holt and Company, New York, p. 229 - 258.

2. Melton O. Pella and Aubrey G. Wood, Physical Science for Progress, Prentice-Hall Inc., New Jersey, p. 370 - 397.

3. William O. Brooks and George R. Tracy, Modern Physical Science, Henry Holt and Company, New York, chapter 35-36-37.

UNIT VII

NATURE OF SOUND AND MUSIC

A. <u>Introduction</u>:

Sound comes from vibrating objects. Our ear picks up this vibration and causes us to hear a sound. Examine a string or tuning fork as it vibrates to produce sound, and you will notice the blurred appearance of the rapid vibration. The sound of a knock on the door is caused by the vibration of the wood of the door when it is struck. If you stop the vibration, the sound stops. Without vibration, there can be no sound. No exception to this rule has ever been discovered.

B. <u>Points to Consider</u>:

1. How is sound produced?
2. What is meant by compression and rarefraction?
3. How are sound waves carried from one place to another? What is the speed of sound? Is it the same under all conditions?
4. What is meant by frequency of a wave?
5. What is the difference between a noise and a musical sound?
6. What are the upper and lower limits of hearing? What is the rate of vibration for each?
7. How is the air around a vibrating body set in vibration?
8. How does a phonograph reproduce sound? When and by whom was the phonograph invented?
9. What is meant by wave lengths?
10. What do we mean by the pitch of a sound? By the loudness of a sound?
11. What is the purpose of sound amplifiers? Upon what principle do they operate?

12. What is the principle of the megaphone?

13. What are the parts of the ear? What is the function of each part?

14. Why do you see the flash of a distant gun before you hear the sound of explosion?

15. If the sound of thunder is heard five seconds after you saw the flash of lightning which caused it, how far away was the lightning?

16. What are echoes? Under what conditions are they produced? How may they be prevented in a room?

17. What are the three characteristics of a musical sound?

18. What determines the quality of sound?

19. Why are the pipes of some organs kept in rooms in which the temperature is controlled?

20. In what three ways may the wires of stringed instruments be set in vibration?

21. In what different ways may air columns be set in vibration?

22. What arrangements are used in stringed instruments to get sounds of different pitch? To increase the loudness? To produce overtones?

23. Why is it difficult to reproduce sound mechanically?

24. How is the fundamental tone produced in a wire? The first overtone? The second?

25. How do musical instruments get out of tune? How are they tuned?

26. What are the causes of echoes in auditoriums? How can they be prevented?

27. What use do doctors make of the stethoscope?

28. Why may a stringed instrument which is in tune in a warm room be out of tune when taken into a cold room? Will the pitch be raised or lowered?

29. How does the human voice produce sounds of different pitches?

30. Why are the members of an orchestra or choir placed as near together as possible and in a semi-circle?

C. References:

1. Ira C. Davis, John Burnett and E. Wayne Gross, Science, A Story of Discovery and Progress, Henry Holt and Company, New York, p. 259-279.

2. Melton O. Pella and Aubrey G. Wood, Physical Science for Progress, Prentice-Hall Inc., New Jersey, p. 333-349.

3. Hyman Rushlis and Harvey B. Lemon, Exploring Physics, Harcourt, Brace and Company, New York, p. 274-312.

UNIT VIII

MAGNETISM AND ELECTRICITY

A. Introduction:

Oersted accidentally observed that a wire got magnetic properties when a current of electricity was sent through it. This discovery of a connection between magnetism and electricity eventually made possible such useful devices as the electromagnet, dynamo, electric bell, electric motor, telegraph, telephone, television and radio.

You are entertained by television, radio and movies. Electrical energy does the work. You take electrical energy for granted. It is an important part of your daily life. You put in a plug or flip a switch to get electrical energy. How has this energy been harnessed? Where does it come from?

B. Points to Consider:

1. What materials are attracted to magnets?
2. Where is a magnet the strongest?
3. Why does a magnet that is free to move come to rest in a north-south direction?
4. What materials stop the passage of magnetic lines of force?
5. How can we find which end of a magnet is a north pole?
6. What discoveries did the following men make in electricity: Volta, Oersted, Henry and Faraday?
7. How is static electricity produced?
8. How is a dry cell constructed?
9. What is an electric current?
10. What are the properties of magnets?

11. What is the shape of the magnetic field around a bar magnet? A horseshoe magnet?

12. How is an electromagnet made? What factors affect its strength?

13. How may the nature of magnetism be explained by the molecular theory?

14. Why are electric wires insulated? Do the magnetic lines of force pass through the insulation?

15. How are cells connected in series? In parallel? When should cells be connected in series? When in parallel?

16. What is electrolysis? How is water separated into hydrogen and oxygen?

17. How are metals plated?

18. What materials are used to make a storage battery? How is the battery charged?

19. What advantages does a storage battery have over a dry cell?

20. What units are used to measure the pressure, resistance and quantity of current flowing in an electric circuit? What is the relationship between these units?

21. Under what conditions does an electric current produce heat?

22. What is a watt? A watt hour? A kilowatt hour?

23. How is the cost of electrical energy calculated?

24. What causes the armature of a motor to rotate?

25. How can the direction of rotation of a motor be reversed?

C. <u>References</u>:

1. Ira C. Davis, John Burnett and E. Wayne Gross, <u>Science, A Story of Discovery and Progress</u>, Henry Holt and Company, New York, p.281-315.

2. William O. Brooks and George R. Tracy, <u>Modern Physical</u> Science, Henry Holt and Company, New York, p. 418-463.

3. Melton O. Pella and Aubrey G. Wood, <u>Physical Science</u>

for Progress, Prentice-Hall Inc., New Jersey, p. 229-269

4. Hyman Ruchlis and Harvey B. Lemon, *Exploring Physics*, Harcourt, Brace and Company, New York, p. 370-427.

UNIT IX

COMMUNICATION WITH MATTER AND ENERGY

A. Introduction:

In the early days, how were messages sent from place to place? Did you know that fighting in the War of 1812 continued for some time after the peace treaty had been signed in Paris? Today this would not happen. Radio, telephone or telegraph would bring the news almost instantly to all corners of the earth. It is hard for us to realize what it was like to live only a hundred years ago when telephone, telegraph and radio were unknown.

The telegraph was once a very common nethod of communication. The telephone is the most common method of direct communication today. Radio and television are common methods of communication. Distance and weather are no great problems to radio. With television, we see a picture as well as hear a sound.

B. Points to Consider:

1. What discovery probably lead to the invention of the telegraph?

2. Sketch a simple telegraph circuit and explain its operation.

3. What are the difficulities of sending sounds as sounds for long distances?

4. Under what conditions can signalling by light be used?

5. What is the history of the telegraph?

6. What is the history of the development of the telephone?

7. How does a telegraph sounder differ from an electric bell?

8. What men have worked on and contributed to, wireless telegraph and radio?

9. How are signals sent over a telegraph wire? How are telegrams sent long distances?

10. What is the Morse Code? The continental Code?

11. What are the essential parts of a generator? How is a current produced in a generator?

12. What is the purpose of a commutator on a generator?

13. Sketch a simple telephone curcuit and explain its operation.

14. Compare the velocities of light, sound and an electric current.

15. How are signals sent by wireless telegraphy?

16. How are messages sent and received by radio?

17. What is the meaning of frequency of a wave? What is the meaning of audio frequency? What is the meaning of radio frequency?

18. Why is it necessary to have broadcasting stations on different frequencies?

19. Explain how a radio receiver changes electrical waves into sound waves.

20. What is the amplitude of a wave? What are sound amplifiers?

21. Sketch the parts of an image orthicon tube.

22. Sketch and label a T.V. receiver tube. Explain its operation.

23. Why is it so hard to get a large picture on the receiving screen of a television set?

24. What are the advantages of television broadcasting over radio and motion pictures?

25. What are radar waves? How is an object located by radar? How is the distance of an object from the radar set measured?

26. Why is it necessary to use high frequency waves in sending messages by radio?

27. What is the advantage of having high radio towers? Consider the curvature of the earth.

C. References:

1. Ira C. Davis, John Burnett and E. Wayne Gross, Science, A Story of Discovery and Progress, Henry Holt and Company, New York, p. 317 - 340.

2. Melton O. Pella and Aubrey G. Wood, Physical Science for Progress, Prentice-Hall Inc., New Jersey, p. 350 - 368.

3. William O. Brooks and George R. Tracy, Modern Physical Science, Henry Holt and Company, New York, p. 466 - 486.

UNIT X

MACHINES

A. Introduction:

Today we use machines to help us do most of our work. There are many machines around your home. Some of these are automatic. We have come a long way since the first tools or machines were used. The first tools man used were probably used for defense, which was probably a club. This is a lever type of a machine. Since then, man has developed other types of tools which he puts to use in doing his work. At first, man applied his own energy from other sources supply the energy for the machines. So today we have compound machines that are automatic.

B. Points to Consider:

1. What is a machine?
2. What types of simple machines are there?
3. Why was the invention of the wheel important?
4. What is work? In what units is work measured?
5. What is a force?
6. How is a force measured?
7. What is energy? What are the two kinds of energy? Give two examples of each.
8. What is power? In what units is power measured?
9. What are the three classes of levers?
10. What is the position of the fulcrum, force and resistance in each class?
11. How is the principle of work applied in each class of lever?

12. Draw sketches to show how a lever of the first class can be used to gain: (a) direction, (b) speed and (c) force.

13. What is the law of mements of forces?

14. How may a pulley be used to gain speed?

15. What is a wheel and axle? Under what condition is a wheel and axle used?

16. Explain how the principle of work is applied in the wedge, screw and inclined plane. What is gained with the use of each?

17. In using a wheelbarrow:

    a. Where is the resistance?

    b. Where do you apply the force?

    c. In what directions do the force and resistance move?

    d. What distance does the force move compared to the resistance?

    e. What is gained in the operation of this machine? What is lost?

18. In rowing a boat:

    a. Where is the fulcrum?

    b. What is the resistance?

    c. Where is the force applied by the person rowing the boat?

    d. Where is the force applied to the resistance?

    e. What class lever is used?

    f. In what direction does the force move? In what direction does the resistance move?

    g. Is the force larger or smaller than the resistance?

    h. What is gained in the operation of this machine?

19. What methods are used to decrease friction?

20. In what ways may force be transferred from one wheel to another wheel? Why is it done?

21. What is a compound machine?

22. What is friction?

23. What are the two kinds of friction?

24. In what ways does friction hinder us in the use of machines?

25. In what ways does friction help us?

26. How is mechanical advantage determined?

27. Sketch a system of ropes and pulleys with a mechanical advantage of five.

28. What is the difference between work and power?

29. How large is a horsepower?

30. What is the formula for finding power?

31. State and explain Pascal's Law.

32. Explain the operation of the hydraulic press.

33. What is the difference between efficiency and mechanical advantage?

34. How is the mechanical advantage of a hydraulic press determined?

35. How can the efficiency of a machine be increased?

C. References:

1. Ira C. Davis, John Burnett and E. Wayne Gross, Science, A Story of Discovery and Progress, Henry Holt and Company, New York, p. 341 - 368.

2. Melton O. Pella and Aubrey G. Wood, Physical Science for Progress, Prentice-Hall Inc., New Jersey, p. 291 - 326.

3. William O. Brooks and George R. Tracy, Modern Physical Science, Henry Holt and Company, New York, p. 160 - 210.

UNIT XI

METALS AND MACHINES FOR POWER

A. Introduction:

You have learned we live on the earth's crust. Most of the materials we use come from this crust. The cars you ride in, the clothes you wear, and the food you eat are made of materials taken from the earth's crust. Have you seen these materials? They are all there, even if you do not recognize them. Energy is used to make things from the earth's crust. The subject of this unit is about how some of these materials are changed over to useful products.

B. Points to Consider:

1. What is an ore?
2. What is metallurgy?
3. What is meant by oxidation and reduction?
4. In what two ways can we extract metals from their ores?
5. How is iron taken from its ore?
6. What materials make up the charge in a blast furnace?
7. How is solder made?
8. What is an alloy? Name three alloys.
9. How are metals welded together?
10. How is power obtained in a steam engine? How is this power changed into circular motion?
11. Why are flywheels used on steam engines and gas engines?
12. How are gasoline and air mixed in a carburetor?
13. Why does gasoline vapor mixed with air explode in a gas engine but burn quietly in a gas stove?

14. What do we mean by a rich mixture? A lean mixture?

15. How is power developed in the gas engine?

16. Why does a four-cylinder engine produce a more even power than a one-cylinder engine?

17. How is the electric spark produced in a gas engine?

18. What are the raw materials for making cement?

19. How are high temperatures produced in blast furnaces and in gas burners?

20. What materials are used in making glass?

21. How is rubber extracted from latex?

22. What is synthetic rubber made from?

C. Reference:

1. Ira C. Davis, John Burnett and E. Wayne Gross, Science, A Story of Discovery and Progress, Henry Holt and Company, New York, p. 369-389.

2. Melton O. Pella and Aubrey G. Wood, Physical Science for Progress, Prentice-Hall Inc., New Jersey, p. 269-289.

3. William O. Brooks and George R. Tracy, Modern Physical Science, Henry Holt and Company, New York, p. 261-302.

4. Charles E. Dull, William O. Brooks and H. Clark Metcalfe, Modern Chemistry, Henry Holt and Company, New York, p. 438-449 and 461-471

UNIT XII

NATURE OF WATER AND THE FORCES OF LIQUIDS

A. Introduction:

Water is the most common liquid on the earth. It is plentiful on most parts of the earth, but there are some places where water is scarce. We find it is very difficult to live where there is no water. Water would have to be moved in for human life to exist.

Water, like other liquids, has certain properties. Some people are able to float, others are not. When we go deep into water, we have to wear a special suit. Deep sea fish brought to the surface may burst. By a study of water and its forces, we may see how this can happen.

B. Points to Consider:

1. What are the physical and chemical properties of water?
2. What is a solution? What factors effect solubility?
3. How can the freezing and boiling points of water be changed?
4. What is the difference between quantity of heat and temperature?
5. How is a centigrade temperature changed to Farenheit? From Farenheit to centigrade?
6. What laws were stated by Archimedes and Pascal? When were these laws stated?
7. Why was the invention of the water wheel important?
8. What is the relation between depth and pressure in water?
9. What do we mean by a ship's displacement?
10. How much water will a block of wood weighing two pounds

displace? How much kerosene will this same block of wood displace if it floats?

11. What is the weight of a cubic foot of water? What is the pressure per square inch in water that is one foot deep?

12. How can metals be made to float?

13. How does inertia help in moving boats through water?

14. How is force developed with water wheels?

15. What is the upward pressure in water called?

16. What determines the pressure that can be developed by the dam?

17. How are submarines and boats alike? How are they unlike?

18. Why do divers have difficulty in going to very great depths in water?

19. Why can automobiles travel at higher speeds than boats with a motor of the same power?

20. How does a swimmer move through water? How does he keep himself from sinking?

C. References:

1. Ira. C. Davis, John Burnett and E. Wayne Gross, Science, A Story of Discovery and Progress, Henry Holt and Company, New York, p. 177 - 196.

2. Melton O. Pella and Aubrey G. Wood, Physical Science for Progress, Prentice-Hall Inc., New Jersey, p. 221 - 226.

3. Hyman Ruchlis and Harvey B. Lemon, Exploring Physics, Harcourt, Brace and Company, New York, p. 146 - 156.

4. William O. Brooks and George R. Tracy, Modern Physical Science, Henry Holt and Company, New York, p. 91 - 101.

UNIT XIII

THE SOIL AND WHAT KEEPS IT FERTILE

A. Introduction:

Either directly or indirectly, all human food comes from the soil. The soil's formation is started from the breaking down of the different rocks of the earth. The actual soil that we use to produce crops has gone through a series of developments, which we will study in this unit. The forming of soil by nature's method is a slow process, so care must be taken not to destroy what nature has put here. With man and nature working hand in hand, the soil can be kept fertile for years to come.

B. Points to Consider:

1. In what three ways may rocks be formed?
2. What are the names of the three classes of rocks?
3. In what ways may rocks be changed into soil?
4. In what kind of rocks would you expect to find fossils?
5. Why do not all rocks contain fossil remains?
6. What is soil? How is it formed?
7. What are the various kinds of soil? What are the properties of each kind?
8. How do chemical changes cause rocks to break up into smaller pieces?
9. How does weathering break up rocks?
10. What is erosion?
11. In what ways may loss of soil by erosion be prevented?
12. What is strip cropping? How does it prevent erosion?
13. How does terracing help prevent erosion?

14. What methods can you suggest for the prevention of dust storms?

15. In what ways are trees helpful to man?

16. What materials does a fertile soil contain?

17. What methods should be used to improve the fertility of the soil?

18. What is the test for an acid soil? How can you correct soil acidity?

19. What are the minerals in soils that plants need for growth?

20. What kind of soil holds moisture best? What kind holds moisture least?

21. What effect does decreased soil fertility have on the chemical composition of crops which are grown on poor soil?

22. How do plants of the bean and pea family help in keeping soils fertile?

23. How does cultivation help to improve the fertility of the soils?

24. What methods are used to conserve moisture during dry weather?

25. Under what conditions is it advisable to build large irrigation projects?

26. How is water distributed over soils by irrigation?

27. How does water seep through the soil?

28. Of what advantage is contour farming?

29. In what different ways is humus added to the soil?

30. What is capillary action? In what kind of soils does water rise the highest by capillary action?

C. Reference:

1. Ira C. Davis, John Burnett and E. Wayne Gross, Science, A Story of Discovery and Progress, Henry Holt and Company, New York, p. 422 - 443.

UNIT XIV

THE CAUSES OF CHANGES IN WEATHER AND CLIMATE

A. Introduction:

Have you ever gone to a picnic and been caught in the rain? Did you check the weather prediction before you went? If you are making a trip, do you see what weather is expected? The weather is important to all of us when we make plans. We like to know what road conditions will be met if we drive. Airplane pilots must know what weather conditions they will fly through. A farmer decides on harvesting and planting time in terms of weather.

B. Points to Consider:

1. What is the meaning of the words "weather" and "climate"
2. What causes changes in weather and differences in climate?
3. What two instruments have helped in the study of weathwe and climate?
4. Compare the amounts of moisture that may be held by warm and cold air?
5. What effect do mountains have on rainfall?
6. On what three factors does the rate of evaporation depend?
7. What caused moisture to condense?
8. What is the dew point?
9. Under what conditions is frost formed?
10. Why are frosts less likely on cloudy nights?
11. What are the different clouds and how are they formed?
12. How is relative humidity measured?

13. What is the cause of winds?

14. What are the characteristics of highs and lows?

15. How is a weather map made?

16. What is a storm?

17. Describe and give the characteristics of the different kinds of storms?

C. References:

1. Ira C. Davis, John Burnett and E. Wayne Gross, Science, A Story of Discovery and Progress, Henry Holt and Company, New York, p. 123 - 146.

2. Melton O. Pella and Aubrey G. Wood, Physical Science for Progress, Prentice-Hall, New Jersey, p. 399 - 419.

UNIT XV

OUR SOLAR SYSTEM AND HOW TO TELL TIME AND DIRECTION

A. Introduction:

The earth and eight other known planets circling about the sun make up our solar system. The sun, the center of our solar system, is one of billions of stars.

The belief in the round earth was not accepted by most people for a long time. The stars appear to move, but it is really the earth that is moving.

The cause of an eclipse of the sun cannot be seen with the naked eye. Neither can the cause of an eclipse of the moon. Can we see the cause of seasons? We can only see the results. To learn the causes we must study the universe more carefully.

B. Points to Consider:

1. What evidence exist to prove that the earth is round and that it is rotating?
2. What forces keep the moon moving around the earth?
3. What are the conditions of the moon?
4. What causes the phases of the moon?
5. What is a galaxy?
6. Why is the invention of the compass considered so important?
7. When was the earth first known to be a magnet with north and south magnetic poles?
8. Why do we say the sun is the center of our solar system?
9. What are the heavenly bodies in the solar system?
10. What causes the seasons?

11. What causes night and day?

12. Explain the eclipse of sun and eclipse of the moon?

13. What is a constillation?

14. What is meant by a star of the first magnitude?

15. What is a light year?

16. How is a compass made and why does it not point true north?

17. Compare the location of the earth's magnetic and geographic poles.

18. What is latitude?

19. What is longitude?

20. What is the width of a time belt in degrees?

21. What is a chronometer?

22. Why does the United States have different time belts?

23. What is the different times in the different time belts across the United States?

24. What is the cause of tides?

C. Reference:

1. Ira C. Davis, John Burnett and E. Wayne Gross, Science, A Story of Discovery and Progress, Henry Holt and Company, New York, p. 200 - 227.

2. William O. Brooks and George R. Tracy, Modern Physical Science, Henry Holt and Company, New York, p. 532 - 555.

3. Melton O. Pella and Aubrey G. Wood, Physical Science for Progress, Prentice-Hall Inc., New York, p. 30 - 65.

BIBLIOGRAPHY

Brooks, William O. and George R. Tracy, Modern Physical Science. New York: Henry Holt and Company, 1952.
A book for the general education student who needs a course that is simple and interesting but which, at the same time, gives him some knowledge of the consumer aspect of science.

Burnett, R. Will. Teaching Science in The Secondary School. New York: Rhinehart and Company, 1957.
A presentation of theory and practice of science teaching on the secomdary level in an integrated fashion.

Davis, Ira C., John Burnett and E. Wayne Gross. Science, A Story of Discovery and Progress. New York: Henry Holt and Company 1952.
A science text book for junior high school students covering general science, used as a basic text by several junior high general science classes.

Dull, Charles., William O. Brooks and H. Clark Metcalfe. Modern Chemistry. New York: Henry Holt and Company, 1953.
A high school chemistry book.

Guffin, Frank C., "Physical Science Today--A Symposium", The Science Teacher, XVIII (February, 1951).
A symposium on present practices and prePlexing problems in the area of modified courses in the physical sciences at the senior high school level.

Heiss, Elwood D., and Ellsworth S. Obourn. Modern Science Teaching. New York: The MacMillan Company, 1950.
An analysis of the principles of science teaching at any level and the present trends in the teaching of science.

Hunter, George W. Science Teaching at Junior and Senior High Levels. New York: American Book Company, 1934.
A report of the recent findings in education as they apply to science teaching in the secondary school.

Jones, Roy W. Curriculum Changes in Science. Oklahoma State University. February, 1960.
A report of recommended changes in the science program, given to the Oklahoma State Curriculum Committee at Stillwater, Oklahoma.

Miles, Vaden W. Principles and Experiments for Courses of Integrated Physical Science. Ann Arbor, Michigan: Edward

Brothers, Inc., 1950. p. 3.
The results of surveys of physical science courses, in which the definition of Physical Science is given.

Nelson, O. A. "Physical Science Today--A Symposium", The Science Teacher, XVIII (February, 1951).
A symposium on present practices and perplexing problems in the area of modified courses in the physical sciences at the senior high school level.

Pella, Melton O. and Aubrey G. Wood. Physical Science for Progress. New Jersey: Prentice-Hall, Inc., 1959.
A book developed around basic principles of physics, chemistry, astronomy and physical geography.

Richardson, John S. and G. P. Cahoon. Methods and Materials for Teaching General and Physical Sciences. New York: McGraw-Hill Book Company, 1951.
A book dealing with the procedures of teaching.

Ruchlis, Hyman and Harvey B. Lemon. Exploring Physics. New York: Harcourt, Brace and Company, 1952.
High school text book used for reference.

Uhl, W. D., Secondary School Curriculum. New York: McMillan Publishing Company, 1927.
An article giving the objectives of a physical science course.

Watson, Donald R., "The Training and Experience of Instructors in Survey Courses in Physical Science." Science Education, XXV (February, 1941).
A survey of physical science courses with the kind of teachers that taught the courses.

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