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Scope and Method of Study: A survey of general science course content was made based upon several school curriculum guides and courses of study. The topics covered in both eighth and tenth grade levels of science were studied in order to formulate subject matter in the ninth grade course. A study was made of the areas of science that were most important for the ninth grader at his own interest and maturation level. Studies of the science interest of junior high school students were used in determining the choices of topics to be presented. Courses of study and units of work from school systems within the locality and from other selected areas were reviewed as sources of information in making up this course.

Findings and Conclusions: A well rounded course of study in general science was developed consisting of units covering the biological and physical science areas. This course of study coordinated and complemented the science course offered at both the upper elementary and high school levels.

ADVISER'S APPROVAL James H. Zant

A GENERAL SCIENCE COURSE OF STUDY

FOR LINCOLN HIGH SCHOOL

By

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A GENERAL SCIENCE COURSE OF STUDY

FOR LINCOLN HIGH SCHOOL

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GENERAL SCIENCE COURSE OF STUDY

PART I

THE PROBLEM AND REVIEW OF LITERATURE

CHAPTER I

THE PROBLEM

An important need in science instruction today is a more efficient organization of the course of study with a view to its socialization and practical application. The subject matter selected is not restricted to the fields of the specialized sciences, but it includes information and principles formerly belonging to each of them. Of utmost importance to modern living are the understanding of scientific principles and a facility in the use of scientific method.

The teacher must be instrumental in making the material important and interesting enough to inspire the students to become interested and appreciative of science and to develop scientific attitudes. The teacher should always keep in mind that children form attitudes more from examples than from abstract precepts. Students must be encouraged to obtain an interest in the present trends in science and especially in scientific discoveries. Students need to realize that scientific discoveries and inventions are cooperative achievements made possible because the scientific discoveries of many investigations are pyramided one upon another.

Statement of the problem. The purpose of this study is to formulate a course of study to be used in teaching ninth grade science in the high school. This course of study is intended to coordinate and complement the science course offered at both the upper elementary and high school levels in the school. Often when science courses are presented year after

year in the curriculum, they become repetitious in their presentation. This has ill effects upon the appreciation of the importance of science in the minds of the students who are required to repeat subject matter at each grade level.

Importance of the problem. Many science educators feel that courses in science should be offered or required at all grade levels. This course of study has been designed to fulfill a specific need for a course in science for a nonth grade class in the author's school. The only science program offered now is a full year of eighth grade science with nothing provided at the seventh or ninth grade levels. In order to maintain and develop a science consciousness and interest, a continuous program is needed from the eighth through the tenth grade.

A lack of interest and motivation in science has been noted at the tenth grade level in high school, because a course in general science has not been provided at the ninth grade level. This course of study is designed to present a functional and intriguing general science course to be introduced into the ninth grade on either an elective or required basis.

Method of procedure. The following steps were taken in formulating the course of study:

1. Surveyed general science content based upon school curriculum guides and courses of study.
2. Surveyed the areas of science that were most important for the ninth grader at his own interest and maturation level.
3. Formulated the course of study.

Each of the above steps were accomplished by a review of literature, experience with students, help of experienced teachers and by the use of other courses of study and handbooks in the field of general science. An

analysis comprised an examination of the current science program at the eighth and tenth grade levels.

A very definite effort was made to use some of the latest and most authoritative curriculum practices in setting up the program. Studies of the science interest of junior high school students were used in determining the choices of topics to be presented. Courses of study and units of work from school systems within the locality and from other selected areas were reviewed as sources of information in making up this course.

CHAPTER II

REVIEW OF THE LITERATURE

Many books and articles have been written and many studies have been made on the school curriculum in its many aspects and its many fields. Much has been written about organizing the curriculum. The books and studies that describe the implications of the reorganized curriculum, objectives, and trends in the program of science in the field of secondary curriculum and science teaching were only a few in number.

Objectives of General Science. Many authorities express similar views on the major objectives of general science are mentioned.

Heiss and Obourn have provided a list of the major objectives of general science. These objectives are:

1. To develop interesting, useful and enduring acquaintance with various aspects of science important in the modern world.
2. To develop understandings of important scientific principles, which the pupils may apply in their everyday lives.
3. To provide abundant and guided training in the development of scientific attitudes in the use of the scientific method.
4. To provide and develop scientific interests and knowledge of wide variety that will serve recreational and leisure uses during the study and in later life.[1]

The National Society for the Study of Education in its Forty-Sixth Yearbook gave a very good list of the objectives of science teaching with the growth and development of the student in many ways such as in interests,

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[1]Elwood D. Heiss and Ellsworth S. Obourn, Modern Science Teaching, (New York, 1950), p. 28.

skills and fundamental concepts.[2]

Miller and Blaydes believe that "if there is any one thing that the study of science should do for the student is to produce a scientific attitude toward all problems that arise in his daily life".[3]

Blanc gave the following as the objectives of general science:

1. To develop an appreciation of the natural and physical environment in which children live.
2. To develop appreciation of the part which science plays in children's lives.
3. To develop a scientific method of thinking and attitudes of problem solving.
4. To develop desirable social attitudes in regard to conservation, health, safety and sex.
5. To develop scientific skills and abilities.
6. To widen interests and enrich children's experiences.
7. To help children acquire those science concepts which are necessary to the understanding of scientific principles.[4]

Brooks in his article on science education, also gave a list of the general objectives of science teaching. His objectives were centered around development of interests, attitudes and understanding.[5]

Trends of the Science Curriculum. Trends in the modern school are toward helping all youth in making adjustment to the world in which they live. The trends mentioned apply to our modern school system.

Palmer, in attempting to discuss trends in a modern school system, mentioned the most significant change in secondary education as being the

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[2]The National Society for the Study of Education, "Science Education in American Schools," The Forty-Sixth Yearbook. (Chicago, 1947), p. 142.

[3]Miller, David F. and Glenn W. Blaydes, Methods and Materials for Teaching Biological Sciences. (New York, 1938), p. 26.

[4]Sam S. Blanc, "Review of the General Goals in Science Teaching." Science Education, XXXVI. (1952), p. 49.

[5]Harold B. Brooks, "Science Education in American High Schools," The Bulletin of the National Association of Secondary School Principals, XXXVII. (January, 1953), p. 11.

period from 1900 to 1920. In 1920 general science was introduced as the first subject of the four-year science sequence. It was offered as an exploratory course for the specialized sciences and as a terminal science course for non-college students.[6] His trends are:

1. In a modern school system, the trend is to develop a continuous science program for all youth through the tenth grade and to provide more generalized courses as electives in the eleventh and twelfth grade.
2. The content of science instruction is undergoing a rather thorough reorganization in an effort to develop a more functional understanding of facts, principles, concepts, and growth in the use of the scientific methods and attitudes.
3. Topical outlines are giving way to resource units based upon the utilization of local resources and problems.
4. The shift from teacher-centered to pupil-centered classes makes the roll of the teacher a guider of learning experiences rather than the traditional lecture and lesson hearers.[7]

Hurd listed the mid-century trends in science teaching with reference to a new type of curriculum.[8] He reported these trends:

> Today's objectives are not so much a change in emphasis. Human adjustment is the major goal of science teaching. Science occupies the dominant position in the world of the twentieth century. No fact of human activity escapes its influence.[9]

Burnett believed that in the new concept of science teaching the students assume a high degree of responsibility for planning the areas of content, the organization and procedures of the course. The main idea is to place the student closer to the center of the learning process.[10]

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[6]Elra M. Palmer, "Trends in Science Education," Baltimore Bulletin of Education, XXVIII. (March, 1951), p. 13.

[7]Ibid., pp. 14-15.

[8]Paul D. Hurd, "Mid-Century Trends in Science Teaching," California Journal of Secondary Education, XXVIII. (May, 1953), p. 250.

[9]Ibid., pp. 244-45.

[10]R. Will Burnett, Teaching Science in the Secondary School. (New York, 1957), p. 7.

Content of science curriculum. Content is a very important part of the science curriculum. The textbook is considered by many authorities to be the most influential factor in determining science content.

Heiss and Obourn believed that the textbook is, in the final analysis, the most influential factor in determining what is to be taught in any science. The emphasis placed on functional facts, fundamental concepts, and fundamental principles, would seem to indicate that science instruction on all levels must be directed toward the learning of the larger principles of science rather than the learning of isolated facts.[11]

National Society for the Study of Education in its Forty-Sixth Yearbook stated that the content of the science curriculum should:

1. Be in harmony with the accepted objectives set up for the pupils.
2. Be of direct use to pupils in their daily living.
3. Be appropriate for the ability level of the pupil.
4. Be in harmony with the needs and interests of the pupils.[12]

Hunter gave helpful information on the selection of subject matter. He stated that,

> The particular units of study should be those that truly interest the pupils. Interest not only secures productive attention but is an evidence of attention. To be substantially educated, interest must rest upon a sense of value, an evidence of attention. To be substantially educated, interest must rest upon a sense of value, an evident worth-whileness in the topics considered.[13]

Heiss and Obourn have given criteria in organizing content in science. They stated that the following criteria are used in the organization of content in science. They have been summarized as follows:

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[11]Heiss and Obourn, p. 166.

[12]National Society for the Study of Education, p. 159.

[13]George W. Hunter, Science Teaching at Junior and Senior High School Levels. (New York, 1934), p. 126.

1. Content should be organized into large areas or units, each of which represents some major problem of living, area of human experience, or aspect of environment.
2. The consent of any single area or unit should be broken down into smaller learning problems which have interest, significance and usefulness to the learner.
3. The learning experience in any single problem should be organized to promote functional understanding growth in instrumental skills, growth in the processes of problem-solving and the development of attitudes, appreciations, and interests.
4. Abundant opportunities should be provided both for building and applying concepts and principles.
5. Provision should be made for effective evaluation including self evaluation.
6. The sequence of units should be planned to give recurrent contacts with facts, concepts and principles of service and to provide a spiralling and enlarging pattern of in concepts and principles.
7. Problem situations should provide definite training in one or more of the elements of scientific method.
8. The course in science should be organized to provide frequent opportunity for pupils to participate in planning and to engage in individual and group projects.[14]

Curtis in his book on biology emphasized that material should be of a simple and logical organization.[15]

The High School General Science Committee of the Courses-of-Study Council,[16] of St. Louis, Missouri, Oklahoma State Department of Education,[17] Brookline Public Schools,[18] and New Mexico State Board of Education,[19] printed excellent courses of study for general science.

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[14]Heiss and Obourn, p. 26.

[15]Francis D. Curtis, Everyday Biology, (Boston, 1940), p. 1.

[16]The High School General Science Committee of the Courses-of-Study Council, Course of Study in General Science for High School, St. Louis Public Schools, 1948.

[17]Oklahoma State Department of Education, A Suggested Guide for the Teaching of Science, Oklahoma City, Oklahoma, 1949.

[18]Brookline Public Schools, Course of Study in General Science, Brookline, Massachusetts, 1955.

[19]New Mexico State Board of Education, Science Tentative Guide for High School Teachers, Santa Fe, New Mexico, 1953.

INTRODUCTION

This study is formulated for the purpose of preparing a course of study for use in teaching General Science in the ninth grade. It coordinates and complements the science courses offered at both the upper elementary and high school levels.

A well rounded course of study from which the student might gain a balanced and rather extensive knowledge of the varied aspects of General Science is preferable to one in which he studies only a few units intensively. There are many students in the ninth grade who are on the threshold of a future scientific career so it is important to open new avenues of interest and satisfaction to the pupil and thus stimulate the development of scientific talent.

This course of study is planned to meet the individual needs and abilities of the student and to give the teacher great freedom and creativeness in teaching. Units covering the biological, and physical aspects of General Science are offered in this course of study. These units are outlined into seven parts; introduction, objectives, content, activities, reports, references, and audio-visual aids. Each part is useful to the teacher and student. The teacher introduces the unit to the student and sets up the unit objectives, or goals of the units. These are goals which the teacher wants and helps the student to reach. The content, activities, reports, references and audio-visual aids are used to help obtain the objectives outlined in each unit.

It is hoped that this course of study will benefit teachers and students in improving the science program at the ninth grade level.

CHAPTER III

OUR ENVIRONMENT-PART I.

UNIT I. MATTER, ENERGY AND WORK

A. Introduction:

Have you ever stopped to think that the things or activities you see about you have particular causes for being as they are? The real scientist asks such a question and tries to find the answer.

Matter and energy are important to man, particularly in doing work. An understanding of matter and energy in our environment is necessary to human progress. These factors make up our environment.

B. Unit Objectives:

1. To obtain knowledge of the properties and uses of matter and energy.
2. To develop a consciousness of the importance of matter and energy in the lives of people.

C. Content:

1. What is matter?
2. What are the forms of matter?
3. How is matter measured?
4. What is the relation of work to modern life?
5. What is energy?
6. What are the kinds of energy?
7. What is the relation of matter and energy to modern life?

8. What are elements?

9. What are compounds?

10. What is work and how is it measured?

D. Activities:

1. Prepare a list of gases, liquids and solids.

2. Illustrate the decomposition of a compound.

3. Experiment to illustrate chemical and physical changes.

4. Demonstrate how to overcome resistance.

5. Name four major sources of energy.

6. Demonstrate change of potential energy to kinetic energy.

7. Demonstrate force of gravity.

8. Experiment to show the properties of matter.

9. Experiment to find out whether a substance is inorganic or organic.

10. Make a list of twenty different things which are matter.

E. Reports:

1. Newton's laws of motion.

2. Properties of elements and compounds.

3. Alchemists.

4. Friction.

5. Center of gravity.

F. References:

1. Carroll, Franklin B. Understanding the Universe. John C. Winston Company, Philadelphia.

2. Powers, Samuel R. Using Our World. Ginn and Company, Boston.

3. Smith, Victor. Using Modern Science.

4. Wood, George, Our Environment, How We Use and Control It. Allyn and Bacon, Boston.

5. Van Hooft, Our Environment. Allyn and Bacon, Inc. New York.

G. Visual Aids:

1. Films*

a. Catalysis. Britannica, 10 minutes. Factors which may be responsible for catalysis action.

b. Energy and Transformation. Britannica 11 minutes. Potential, kinetic and radiant energy as manifested in the mechanical, chemical, and thermal form are illustrated and explained.

c. Molecular theory of Matter. Britannica, 11 minutes. Molecular hypothesis illustrated for animation; behavior of molecules under certain conditions; Brownian Movement.

d. Oxidation and Reduction. Britannica, 10 minutes. Processes presented by relatively simply experimental material; methods of investigating chemical problems.

e. Velocity of Chemical Reactions. Britannica, 10 minutes. Effect of the nature and concentration of reacting substances and of the temperature on the rate of chemical reactions.

2. Filmstrips*

a. Density and specific gravity.

b. Specific of solids and liquids.

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*Film titles and filmstrips and annotations were taken from the State of Louisiana Department of Education, "Catalog of Teaching Films for use in Louisiana Schools."

UNIT II. AIR AND ITS WORK

A. Introduction:

Air is one of the most important factors of our environment. From the time of Torricelli's experiments in the seventeenth century to the present day, scientists have been working continually to increase their knowledge of this substance. Now men use the air for a highway and penetrate even to its upper limits. One cannot help being curious about air, a substance which cannot be seen or even felt except when it is in motion. What does air have to do with our hearing and with our health, and how it can be made to work for us have been problems of investigation through the years of experimentation and study. Our story of air will review some familiar facts and disclose some new ideas.

B. Units Objectives:

1. To recognize the scope of the blanket of air surrounding the earth.
2. To become acquainted with the components of air and with some of the ways in which man makes use of them.
3. To learn many everyday and industrial applications of air.

C. Content:

1. Where is air found?
2. How can we identify the substances found in air?
3. What conditions of the air are best for man's health and well being?
4. How can knowledge of the properties of air help us in doing work with air?
5. What is air?
6. What is the effect of heat upon air?
7. What are some uses of air?

D. Activities:

1. Test samples of soil and water for presence of air.
2. Demonstrate that air occupies space and has weight.
3. List the gases found in the air in the order of their abundance.
4. Demonstrate the preparation of oxygen and test.
5. Condense moisture of air on a cold surface.
6. Invert a dampened test tube with iron fillings, in a beaker of water.
7. Construct fire extinguishers of both carbon dioxide and carbon tetrachloride type.
8. Estimate the weight of air in the classroom.
9. Weigh an object before and after it is inflated with air.
10. Prove that an empty bottle is really not empty.

E. Reports:

1. The uses of air pressure.
2. The earth without a supply of air.
3. Best use of electric fans in homes.
4. Air-conditioning.
5. The gas-helium.

F. References:

1. Carroll, Franklin B. Understanding Our Environment. Allyn and Bacon Company, Dallas.
2. Parker, Bertha. The Air About Us. Row, Peterson and Company, Evanston.
3. Powers, S. R. Our World and Science. Ginn and Company, Chicago.
4. Smith, Victor C. General Science. J. B. Lippincott Company, Chicago.
5. Watkins, Ralph K. Science for Human Control. The Manmillan Co., New York.
6. Wood, G. C. Our Environment, How We Use and Control It. Allyn and Bacon, Boston.

G. Audio-Visual Aids:

1. Films*

a. Aerodynamics, Properties of Air. Bray, 8 minutes. Film consists of two parties; first part demonstrates showing that air has enough mass to support certain objects. The second part consists of demonstration of weight of air.

b. Air All About Us. Britannica, 12 minutes. This film introduces basic concepts about the physics of air.

c. Air All Around Us. Young America, 10 minutes. Presents and explains a number of classroom demonstrations, illustrating concepts concerning air pressure, contraction and expansion of air and compressed air.

d. Control of Body Temperature. Britannica, 11 minutes. Animated drawings and special photography; phenomena associated with variations of body temperature in animals and man.

2. Filmstrips*

a. Air.

b. Air and Properties.

c. Atmosphere and Circulation.

d. Barometers and the Weather.

e. How we breathe.

UNIT III. WATER AND ITS WORK

A. Introduction:

The average person can live about four days without more water than his body already carries. When we consider our immediate needs, next to air, water is the most necessary factor of our environment.

Travel in the desert emphasizes the importance of water. Man has always sought easy access to water supply.

Water travels far in its never-ending cycle of rain into rivers, down hill into lakes and oceans, and back into rain clouds again. It comes to us in many forms, from snowflakes to the ice cubes that fill the trays of the electric refrigerator. It is one of our most useful servants.

B. Unit Objectives:

1. To learn importance of water to life.
2. To learn the properties, composition, occurrence and forms of water.

C. Content:

1. What is water?
2. What is the importance of water?
3. What are the properties of water?
4. Where does water occur?
5. In what forms may water exist?
6. What is water pressure?
7. How is water used in our homes?
8. Name many ways in which we use water in our daily lives.
9. What is the work of water?

D. Activities:

1. Experiment to illustrate surface tension; needle floats on water.

2. Heat a bone; weigh before and after to determine the percentage of water.

3. Weigh dry calcium chloride, leave in air, and re-weigh.

4. Examine tiny water animals under microscope.

5. Visit a farm where terracing or contour plowing is being done.

6. Visit a hydroelectric plant.

7. Visit your local city works and make a diagram and explain all processes.

8. Make a poster-diagram of the water cycle.

9. Turn on the cold-water faucet on the second floor of your house. While it is running, have someone open a faucet in the kitchen. Observe the results.

10. During a rain, observe the water flowing along the gutter.

E. Reports:

1. Sewage disposal.

2. Digestion.

3. Excretion-skin-kidneys.

4. Irrigation.

5. Recreation.

6. Water for heating.

7. Purification of water.

F. References:

1. Beauchamp, W. L. Science Problems. Book I. Scotts Foresman and Company., Dallas.

2. Carroll, Franklin B. Understanding Our Environment. John C. Winston Company, Philadelphia.

3. Powers, Samuel R. Exploring Our World. Ginn and Company, Boston.

4. Smith, Victor C. Exploring Science. J. B. Lippincott Company.

5. Wood, George E. Our Environment, How We Use and Control It. Allyn and Bacon, Boston.

G. Visual Aids:

1. Films*

a. City Water Supply. Britannica, 11 minutes. Annimated drawings describe relation between rainfall and life; the sources; waterborne diseases methods of distribution.

b. Tiny Water Animals. Britannica, 10 minutes. Life processes and activities of amoebae and paramecia; reproduction of amoebae; other interesting creatures.

c. Water Cycle. Britannica, 10 minutes. Shows the movements of water from ocean to sky to rain to streams, rivers and back to oceans.

d. Water Power. Britannica, 15 minutes. Development from small mills or colonists to modern projects; transformation of potential energy or water falls into kinetic energy through hydroelectric plants.

e. Water We Drink. Coronet, 10 minutes. The audience learns how water is essential to our bodies and why we should drink only clean pure water. It shows how water is purified.

f. Water Works For Us. Young America, 10 minutes. Explains the basic principle of water pressure and the many ways in which water works for us.

2. Filmstrips.*

a. Water.

b. What makes rain.

c. Water and its work.

d. Why things float.

CHAPTER IV

OUR ENVIRONMENT - PART II.

UNIT IV. SOURCES AND CONTROL OF HEAT

A. Introduction:

Primitive man probably discovered fire by accident, but he soon found that by rubbing sticks of wood together, he was able to produce fire. Fire started man on his journey upward. Today, science has taught man how to make fire easily and how to use and control it. Fire is man's best helper, but he must use it rightly. From fire comes heat and from heat comes energy which is the chief source of power.

Fire, when controlled, is one of the greatest blessings in man's environment, out of control, it is a demon of the worst sort. Our chief aim in the use of fire should be to study and apply correct methods of control, thus making this natural factor a powerful friend rather than a terrible enemy.

B. Unit Objectives:

1. To learn what fire is and the methods used in producing it and the types.
2. To recognize heat as a form of energy, and fire as a means of producing heat.
3. To compare heating methods essential to the comfort and convenience of man.

C. Content:

1. What is heat?

2. How does heat travel?

3. How is heat measured?

4. What is the nature of a fuel?

5. How is artificial heat produced and distributed?

6. How are fuels produced?

7. Why do some garments keep us cool, and some keep us warm?

8. What properties of heat permit its varied use?

D. Activities:

1. Make a common soda-acid type of fire extinguisher.

2. Experiment to determine the kindling temperature of several stbstances.

3. Cover a lighted candle with a bottle.

4. Collect an exhibit of the commonly used fuels and explain the origin of each.

5. List the steps taken to start a fire in a stove at home.

6. Record temperature readings for a week.

7. Compare the melting point and boiling point of numerous materials.

8. Heat coal in tube, and name the many products obtained from coal.

9. Visit several heating plants, including your own school's plant.

10. Experiment to determine how a candle burns.

E. Reports:

1. History of artificial heating.

2. Processes of conduction, convection, and radiation.

3. Dry ice.

4. Insulators.

5. Fire prevention week.

6. History of the match.

F. References:

1. Beauchamp, W. L. Science Problems, Book I. Scott, Foresman Company, Dallas.

2. Carroll, Franklin B. Understanding Our Environment. Allyn and Bacon Company, Dallas.

3. Powers, Samuel, Exploring Our World. Ginn and Company, Dallas.

4. Smith, Victor. Exploring Science. J. B. Lippincott Co. Philadelphia.

5. Wood, G. C. Our Environment, How We Use and Control It. Allyn and Bacon, Boston, Boston.

G. Audio Visual Aids:

1. Films*

   a. Fire. Britannica, 10 minutes. The film concerns itself primarily with the three essentials of combustion-fuel, oxygen and kindling temperature.

   b. Fire Safety. Britannica 15 minutes. This film suggests ways of preventing fires and shows what to do in case of fires.

   c. Fuels and Heat. Britannica, 11 minutes. Explains the role of carbon in fuels, the manufacture and storage of carbohydrates by plants, the way in which coal and oil were produced by nature, and how man extracts them.

   d. Heating and Air Conditioning. Mahnke, 11 minutes. After showing one of the places such as restaurants, hospitals, factories, etc., where air conditioning is used, scenes of equipment being constructed, installed and serviced follow.

2. Filmstrips*

   a. Coal mining.

   b. Distributing best energy.

   c. Fuels and heat.

UNIT V. LIGHT AND HOW WE USE IT

A. Introduction:

We gladly accept the light from the sun. Those of us who live where skies are often overcast are likely to growl about the dull, dark days if the sun stays hidden too long. Perhaps we take the sun so much for granted that we do not realize how important its light is in our daily living. Light, like water or air or heat, is one of the gifts of nature without which men as a race could not exist.

The source of light is the sun. The history of artificial lighting records the development of devices like the incandescent lamp. Light is a form of energy capable of being reflected, refracted, diffracted, dispersed and polarized.

Cost of lighting should be secondary to considerations of eye hygiene. At present, indirect lighting offers the best solution of general service lighting problems.

B. Unit Objectives:

1. To gain an understanding of the source and properties of light.
2. Develop an appreciation for man's ability to use and control light.
3. To gain knowledge of artificial lights and some of their uses in our modern world.
4. To develop an understanding of eye defects and the care of the eyes.

C. Content:

1. What is light?
2. How does light travel?
3. How do we see objects and color?
4. What are some of the properties of light?

5. How should we care for the eye?

6. What is the relation of light to life?

7. How is light reflected and refracted?

8. How are images formed by lenses and mirrors?

9. How do we light our homes?

D. Activities:

1. Use a prism to break light into its spectrum.

2. Put a pencil in a glass of water and explain why it appears to be bent.

3. Use a plane mirror to illustrate the law of reflection.

4. Devise an experiment to show that light travels in straight lines.

5. Demonstrate the light meter.

6. Have students bring cameras.

7. Examine the lighting in your classroom.

8. Develop and print pictures.

9. Take photographs.

E. Reports:

1. Color.

2. The photometer.

3. Edison discovery of the electric light.

4. Eclipse of the moon and sun.

5. History of artificial lighting.

F. References:

1. Beauchamp, W. L., Everyday Problems in Science. Scott Foresman and Company, Chicago.

2. Smith, V. C., Science For Everyday Use. J. P. Lippincott Company, Chicago.

3. Teale, E. W., The Boy's Book of Photography. E. P. Dutton and Company, New York.

4. Weed, N. T., Useful Science For High Schools. The John C. Winston Company, Philadelphia.

5. Wood, G. C., Our Environment, How We Use and Control It.

G. Visual Aids:

1. Films*

a. Behavior of Light. Britannica, 15 minutes. How light is transmitted, reflected, refracted, or absorbed by various media; dispension; color, the rainbow.

b. Eyes and Their Care. Britannica, 11 minutes. Treats in detail the physiology and hygiene of the eye.

c. Light and Shadow. Young America, 10 minutes. Shows the transmission and reflection of light rays, and defines such terms as "transparent", "translucent", and "luminous".

d. Light Waves and Their Uses. Britannica, 11 minutes. Principles of reflection and interference; polar screens, quanum theory.

e. Nature of Light. Coronet, 10 minutes. The study of light as a form of radiant energy closely observation of the principles of reflection and refraction and how these apply to the science of optics.

2. Filmstrips*

a. Color.

b. Light.

UNIT VI. MAGNETISM AND ELECTRICITY

A. Introduction:

Electricity is the chief source of power in our homes. It is used to light our homes, ring bells, run fans, run power tools, and operate many of our household aids. An understanding of the basic principles of how electricity-works and how it can be controlled must be objectives of a study of electricity. Students must learn to be careful in handling electrical lines and equipment. We must appreciate and understand how and where our electricity is produced, how it is measured and how important it is to our way of life. A study of electricity can be presented with many interesting demonstrations and experiments. The use of these experiments can be carried through the whole unit from introductory experiences and through all of the following activities. From a study of this unit, the student should get an understanding of how we have developed from the early stage of civilization to the age when atomic power seems to be only a step away.

B. Unit Objectives:

1. To develop an appreciation of the nature and effects of magnetism.
2. To develop an appreciation of the uses of magnetism and static electricity in our environment.
3. To develop an understanding of the nature and practice applications of current electricity.

C. Content:

1. What is a magnet?
2. What are the important characteristics of magnetism?
3. What properties of electricity are produced by friction?
4. How can electricity be the result of chemical action?

5. How can current electricity be generated by mechanical action?
6. What are some characteristics of electrical currents?
7. How can substances be changed with the aid of electrical currents?
8. What is static electricity?
9. What are some conductors and nonconductors of electricity?
10. What is the relationship of resistance to electricity?
11. How is electricity used?

D. Activities:

1. Separate a mixture of iron filings and sawdust, with a magnet.
2. Produce frictional electricity by rubbing hard rubber rod with silk.
3. Make a magnet from a needle by rubbing it with a permanent magnet.
4. Use a coil and magnet to show how current is included by magnetism.
5. Test solutions to see if they will conduct an electric current.
6. Visit near-by power station.

E. Reports:

1. The automobile battery.
2. Loadstone.
3. Static electricity in industry.
4. Hydro electric power plants of the world.
5. Oersted's discoveries.
6. Telephone and telegraph.
7. Faraday, Volta and watts.

F. References:

1. Beauchamp, W. L., Everday Problems in Science. Scott Foresman and Company, Chicago.
2. Caldwell, O. W., Everyday Science. Ginn and Company, Boston.
3. Collins, A. F., Fun with Electricity. Appleton-Century Crofts, New York.

4. Smith, V. C. and Vance, B. E., Science for Everyday Use. J. B. Lippincott Company, Chicago.

5. Wood, G. C. and Carpenter, H. A., Our Environment, How We Use and Control It. Allyn and Bacon, Boston.

G. Visual Aids:

1. Films*

a. Electrons. Britannica, 11 minutes. The hypothesis that electricity consists of unit elementary changes is supported by observation of phenomena associated with the conduction of electricity in liquids, gases and vaccums.

b. Electrostatics. Britannica, 11 minutes. Deals with static electricity as fundamental to an understanding of the modern theories of electricity.

c. Magnetic Effort of Electricity. Britannica, 11 minutes. Magnetism, electromagnetism, meters, and motors.

d. Magnetism. Coronet, 10 minutes. Shows what magnetism is, how it differs from electricity and how it works.

e. Ohm's Law. Britannica, 6 minutes. This film graphically explains Ohm's Law voltage, electrical resistance, and their interrelationships.

f. Sources of Electricity. Edited Pictures System. 9 minutes. Production of electric phenomena by induction, friction or chemical action; nature of electric currents.

g. Story of Electricity. Knowledge Builders, 11 minutes. Deals with the properties of magnetism; show how discoveries contributed to our modern world.

2. Filmstrips*

a. A. C. and D. C. Generators.

b. A. C. Voltmeters and Ammeters.

c. Electricity at work.

d. Electro-magnets.

e. D. C. Voltmeters and Ammeters.

f. How we get our electricity.

g. Resistance.

h. Static electricity.

i. Transformers.

CHAPTER V

OUR ENVIRONMENT - PART III.

UNIT VII. THE FACTORS OF TRANSPORTATION

A. Introduction:

Most of the transportation in ancient times was on water, because land transportation was too slow and costly. Land transportation had its beginning in the nineteenth century. Today trolley cars, electric locomotives, gasoline coaches, authomobiles and airplanes have sped the expansion of land transportation.

Improvements in the engines and transmission of power have been since the first transatlantic voyages. Today modern ocean liners, disel-engined motor ships are the last word in speed, equipment and conveniences.

Air is the most modern means of transportation. Wars have influenced airplane production. Today, we have swift, high-power airplanes.

B. Unit Objectives:

1. To gain a knowledge of methods of transportation.
2. To comprehend the evolution of transportation which continues to improve living conditions.
3. To become acquainted with the factors that determine time.

C. Content:

1. What are the basic factors of travel on land?
2. How have locomotives been improved to make land travel easier?
3. Why is the automobile so useful in land travel?
4. What are the basic factors of air travel?

5. How is water travel made safe?

6. What are the basic factors of air travel?

7. How do we determine time?

8. Which modern improvements have helped man solve the problem of distance and space?

9. How do we transport goods?

D. Activities:

1. Secure pictures of all major means of transportation.

2. Demonstrate the decrease in friction when wheels are used.

3. Trace the transmission of power from cylinder to rear wheels of an automobile.

4. List the uses of desirable friction in the operation of the automobile.

5. Study road maps to compare Louisiana roads with those of other states.

6. Prepare a pictorial display of types of vehicles used in land travel in other countries.

7. Visit water fronts, airports, and automobile plants.

8. Observe the pull of gravity on various objects.

9. Show how the parachute operates.

10. Locate on a map the Greenwich Meridian.

11. Divide a map of the United States into time zones.

12. Compare time in with that of other states in the union.

13. Arrange a bulletin board display of apparatus used for keeping time.

14. List instruments used in modern navigation.

15. List names and types of planes, noting methods of identification.

E. Reports:

1. Transportation in your community.

2. Bridges.

3. Use of rails.

4. The Submarine.

5. Gliders.

6. How to fly a plane.

7. Guided missiles.

8. History of automobiles.

9. History of steamboats.

10. Dirigible and balloon.

F. References:

1. Burnett, R. W., New World of Science. Silver Burdett Company, New York.

2. Caldwell, Otis W., Everyday Science. Ginn and Company, Boston.

3. Davis, Ira C., Science. Henry Holt and Company, New York.

4. Hunter, George W., Doorways to Science. American Book Co., New York.

5. Powers, Samuel R., Our World and Science. Ginn and Company, Boston.

6. Smith, Victor, Science for Everyday Use. J. B. Lippincott Co., Philadelphia.

7. Wood, George, Our Environment, How We Use and Control It. Allyn and Bacon, Boston.

G. Visual Aids:

1. Films*

a. Air Liner. Bell and Howell, 20 minutes. Operation of airports, duties of employees on airlines.

b. Air Transportation. Mahnke, 11 minutes. Presents the inner workings of a commercial air line, reservations, sales, weather, flight crew, ground servicing, government licensed airport personnel.

c. Arteries of the City. Britannica, 11 minutes. Elements which influence development of city transportation facilities; traffic systems; police regulations.

d. Bus Driver. Britannica, 11 minutes. The work of long distance bus drivers in dramatized story of an eventful cross country bus trip made by a small boy.

e. Freighter in Port. Academy, 14 minutes. Ocean freighter activity in a port.

f. Latitude and Longitude. United World, 10 minutes. Interpretation of latitude and longitude as angular distance from given points, rather than as imaginary lines.

g. Steam Engine. Young America, 10 minutes. An animated film tracing the historical development of the steam engine, both stationary and locomotive.

h. Transportation in the United States. March of Time, 18 minutes. The film points up both the shortcomings and the progress made in rail transportation and how the need for progressive action is being met not only as it applied to freight but also to passenger requirements.

2. Filmstrips*

a. Air Transportation.

b. Automobiles for millions.

c. History of land transportation.

d. History of water transportation.

e. Transportation in the city.

f. Trucks at work.

UNIT VIII. SOUND AND COMMUNICATION

A. Introduction:

Our world of communication is a world of voices, a world of sights and sounds, by which men exchange ideas, feelings, and beliefs. In ancient times a fast runner, a signal fire, or the beat of a tom-tom, was the chief means of communication. The coming of the town crier and the post rider developed along with the printed word and the mail pouch. Progress was slow in communication even though man learned to read and write. The age of electricity had tremendous influence upon the progress in the field of communication. Inventions from the telegraph to today's television have marked rapid progress.

Our world is a world of voices, a world of sights and sounds. Symbols of communication flash here and there and around the world with the speed of light.

B. Unit Objectives:

1. To become familiar with the principles of sound.
2. To understand the methods of communication.

C. Content:

1. How is sound produced and transmitted?
2. How is knowledge of sound applied to musical instruments?
3. What are the methods of communication?
4. What is the principle of the telegraph?
5. What is the principle of the telephone?
6. How does the wireless telegraph work?
7. How does the wireless telephone or radio work?
8. What is a television?

D. Activities:

1. Experiment to show how sound is produced.
2. Experiment to show how sound is carried.
3. Compare the speed of light and sound.
4. Describe the structure of human voice box and explain how we speak.
5. Demonstrate the fundamental tones and overtones of a vibration string.
6. Visit the local telephone exchange.
7. Review the principles of the telegraph, radio, telephone, and television.
8. Visit the local radio station.
9. Visit the local telegraph office.
10. List all the means of communication used in your home.

E. Reports:

1. Early methods of communication.
2. Telegraph codes.
3. Use of relays.
4. Invention of the telegraph by Samuel Morse.
5. Invention of the telephone by Alexander Bell.
6. The dictaphone.
7. Television.
8. Wire recorder.
9. Invention of the radio by Guglielmo Marcondi.
10. Hearing Aids.

F. References:

1. Burnett, R. W., New World of Science. Silver Burdett Co., New York.
2. Caldwell, Otis W., Everyday Science. Ginn and Company, Boston.

3. Davis, Ira C., Science. A Story of Discovery and Progress. Silver Burdett Company. New York.

4. Hunter, George W., Doorways to Science. American Book Company. New York.

5. Powers, Samuel R., Our World and Science. Ginn and Co., Boston.

6. Smith, Victor. Science for Everyday Use. J. B. Lippincott Co. Philadelphia.

7. Wood, George. Our Environment, How We Use and Control It. Allyn and Bacon, Boston.

G. Visual Aids:

1. Films*

a. Development of Communication. Britannica, 11 minutes. Shows the inventions which make possible instantaneous communication.

b. Fundamentals of Acoustics. Britannica, 11 minutes. The phenomenon of hearing and modification of sound between the source and the hearer are emphasized in this film.

c. Radio and Television. Mahnke, 11 minutes. Analysis of radio industry; history of radio; its importance today and importance of allied inventions; jobs in this vocation.

d. Radio Receiver. Principles of Radio Receivers. United World, 17 minutes. Portrays the principles and the working of typical radio receivers including crystals and tube detectors radio and audio frequency amplification, and the superheterodyne circuit.

e. Sound Waves and Their Sources. Britannica, 11 minutes. Demonstrates and explains several types of sound resources.

f. Vacuum Tubes. Britannica, 11 minutes. Three functions of the vacuum tube in radio.

2. Filmstrips*

a. Communication in our country.

b. Motion pictures.

c. Newspapers.

d. Radio.

e. Television.

CHAPTER VI

OUR ENVIRONMENT - PART IV.

UNIT IX. THE EARTH AND ITS HEAVENLY NEIGHBORS

A. Introduction:

The earth and the other eight planets, which revolve about the sun are but small parts of the vast expanse of the star-studded sky. Time seems to link together in our minds and our work all of earth's activities. The earth itself runs on a time schedule that never varies, as summer follows spring and night follows day. Our earth, swinging on its orbit around our heat-and light-giving sun, and turning on its own axis at the same time, sets the great universal time-clock by which we order our lives. As we look through the eyes of science, far out into space, we discover that our solar family is a very tiny part of the celestial world.

B. Unit Objectives:

1. To develop an understanding of the many kinds of heavenly bodies and the position of the earth in relation to them.
2. To develop an appreciation of the importance and magnitude of the solar system.
3. To get knowledge of the history of scientific discovery as it pertains to astronomical phenomena.
4. To develop an appreciation of the laws which control the movement of the celestial bodies.

C. Content:

1. How have we found out about the heavens?

2. What is the solar system?

3. Where does the sun get its energy?

4. Why do the planets keep on their courses?

5. What effects do heavenly bodies have on us?

6. Name some problems astronomers have answered or have tried to answer.

7. How does the earth move around the sun?

D. Activities:

1. Construct a metal planetarium showing the sun, earth and moon.

2. Use the globe or other round object to demonstrate the causes of eclipses.

3. Use a camera on a dark night to make photograph of the sky.

4. Visit an observatory or planetarium if there is one near your community.

5. Construct or diagram a model telescope.

6. Make a study of the calendar, its beginning and early use.

7. Find out why stars don't twinkle.

8. Make map of the time zones of the United States.

9. Demonstrate eclipses of sun and moon by means of a lamp and ball in a darkened room.

10. Make a collection of rocks and stones.

E. Reports:

1. Famous valcanoes of the world.

2. Day and night.

3. Early stories about constellations.

4. Time telling through the ages.

5. Stars.

6. Galileo, Newton, Kepler, and Copernicus.

F. References:

1. Beauchamp, W. L., Everyday Problems in Science. Scott Foresman and Company, Chicago.

2. Caldwell, O. W., Everyday Science. Ginn and Company, Boston.

3. Carroll, F. B., Understanding the Universe. John C. Winston Co. Philadelphia.

4. Rocks and Minerals. Merit Badge Services. Bay Scotts of America, Cat. No. 3357.

5. Sky and Telescope. (Magazine).

6. Telling Time Throughout the Centuries. American Council on Education, Washington.

G. Visual Aids:

1. Films*

a. Earth: Rotation and Revolution. Edited picture system, 9 minutes. Describes the rotation and revolution of the earth and their effects upon our climate. Explains why we have night and day, summer and winter.

b. Earth and Its Seasons. Knowledge Builders, 10 minutes. Explains why we have changes of seasons, vernal and autumnal equinoxes, summer and winter solstices.

c. Earth in Motion. Britannica, 11 minutes. Presents dynamic aspects of the earth as a planet. Proof of the earth's revolution about the sun in respect to start and by the annual parallax of stars.

d. Exploring the Universe. Britannica, 11 minutes. Demonstrates the principles and construction of telescope.

e. Moon. Britannica, 10 minutes. Story of the moon, tides, lunar month, eclipse, rise and set of moon.

f. Our Earth. Britannica, 10 minutes. Survey of physical aspects-oceans, coast lines, rivers, lakes, valleys, mountains influence on people.

g. Solar Family. Britannica, 10 minutes. Evolution of solar system according to planetesimal hypothesis; motion planets.

2. Filmstrips*

a. Solar System.

b. What causes the seasons.

c. Work of astronomers and space travel.

d. Comets and meteors.

e. Constellations.

UNIT X. THE WEATHER ABOUT US

A. Introduction:

Weather is essential to man in planning all of his activities. The understanding of the behavior of the earth's blanket of air has enabled man to predict weather changes and thus attain measurable protection against elements.

Weather is of universal interest and is universally criticized, for it never suits everybody. Weather varies greatly in different parts of our country. Differences in weather affect all people. Weather and climate are powerful factors of our environment; they affect plant life and animal life and man's occupations and health. The science of meteorology-weather, climate, and stmospheric conditions in general has advanced rapidly in recent decades.

B. Unit Objectives:

1. To develop an appreciation of weather and its effect upon all living things.
2. To develop the ability to read weather reports and understand a weather map or weather forecast.
3. To develop a knowledge of the operation and duties of the United States Weather Bureau.
4. To develop a knowledge of weather factors and how they operate to make up our weather.

C. Content:

1. What factors make up weather?
2. What causes winds?
3. What are the duties of the United States Weather Bureau?
4. What is climate?
5. What does weather do to the surface of the earth?
6. What effect does climate have on living things?

7. What cause changes in weather?

8. How is temperature measured?

D. Activities:

1. Make a collection of pictures of cloud forms.

2. Make a study of annual precipitation in your community.

3. Report on the operation of weather bureau.

4. Use a flashlight to show how slanting rays cover more territory than perpendicular, rays.

5. Demonstrate means of measuring air pressure.

6. Learn to read weather maps.

7. Find where the least rainfall is and make a report about that area.

8. Read to determine how hailstones can form in such large sizes.

9. Visit local weather bureau.

10. Make a daily record of the weather.

E. Reports:

1. Famous storms.

2. Regions of least rainfall.

3. The role of weather in warfare.

4. Importance of weather information to farming.

5. Organization and work of United States Weather Bureau.

F. References:

1. Beauchamp, W. L., Everyday Problems in Science. Scott Foresman and Company, Chicago.

2. Carroll, F. B., Understanding the Universe. John C. Winston Co., Philadelphia.

3. Koppe, C. E., Weather and Climate. McKnight Company, Bloomington, Illinois.

4. Wood, G. C. and Carpenter, H. A., Our Environment, How We Use and Control It. Allyn and Bacon, Boston.

G. Visual Aids:

1. Films*

a. Seasons. United World, 10 minutes. Explains the movements of the earth in relations to the sun and the resultant causes of the seasons.

b. Water Cycle. Britannica, 10 minutes. Shows the movements of water from ocean to sky to rain to streams, rivers and back to oceans.

c. Weather. Britannica, 11 minutes. The polar front weather theory; meteorogical instruments; cloud formation; animated drawing curves, and maps; the science of meteology.

d. What Makes Rain. Young American, 10 minutes. Presentation of the water cycle, and the concepts of evaporation and condensation.

2. Filmstrips*

a. Oceans, Winds, and Currents.

b. Barometers and Weather.

c. Climates.

d. Clouds and Weather.

CHAPTER VII

OUR ENVIRONMENT - PART V.

UNIT XI. PLANTS AND ANIMALS

A. Introduction:

Man is completely dependent on plants and animals. He is continually learning new facts about how to conserve and improve them. Our environment is made of plants and animals. It is important that we become familiar with them. It is important to know the general structure and biological processes of plants and animals. They are very important to life.

We can improve plants and animals by controlling their environment and by providing factors that are favorable for their development. Science has taught us how to produce new kinds of plants, how to increase their number, and how to make them resistant to disease. Science has taught us that careful selection of parents will improve the quality of their offsprings.

It is our responsibility to do everything we can to improve ourselves physically, mentally, and spiritually. It is important that human life be concerved. Improvement of the human race will make our world a better place in which to live.

B. Units Objectives:

1. To develop an appreciation for our environment of plants and animals and their interdependence.

2. To understand the general structure and biological processes of plants and animals.

3. To learn methods of improving life.

C. Content:

1. Why are green plants important to us?
2. Which kinds of plants and animals are found in your community?
3. How are the plant and animal worlds interdependent?
4. What are the methods of control for plants and animal pests?
5. What makes life possible?
6. How do the green plants manufacture the world's food supply?
7. What are the methods of improving life on this planet?
8. Why is the conservation of soil essential?
9. How may new varieties of plants and animals be produced?
10. How does heredity work in man to bring improvement?

D. Activities:

1. Microscopic study of slime from underside of lily leaf.
2. Microscopic study of paramecia.
3. Microscopic study of pond water.
4. Field trips to zoo, park, pond, and the woods.
5. Collect insects.
6. Collect leaves of trees.
7. Collect fungi.
8. List food of man which come from plants and animals.
9. Balance an aquarium.
10. Observe onion cell under microscope.
11. Observe the development of tadpoles.
12. Observe fish getting food in an aquarium.
13. Observe the life stages of insects.
14. Experiment showing osmosis and photosynthesis.

15. Experiment showing how plants get water.

E. Reports:

1. Water cycle.
2. Oxygen-carbon dioxide cycle.
3. Nitrogen cycle.
4. Animal and plant pests.
5. Bird migration.
6. Accomplishments of Luther Burbank and Gregor Mendel.
7. Plants and animals of your community.
8. Work of Agricultural Experimental Station.
9. Work of Conservation Commission.
10. Inherited characteristics.

F. References:

1. Beck, Lester F., Human Growth. Harcourt-Brace and Company, Chicago.
2. Caldwell, Otis, Everyday Science. Ginn and Company, Boston.
3. Parker, Bertha, Adaptation to Environment. Row, Peterson and Company, Evanston, Illinois.
4. Smith, Ella T., Exploring Biology. Harcourt-Brace Company, Chicago.
5. Scheinfell, A., You and Heredity. Stokes, New York.
6. United States Department of Agriculture, Yearbooks. Government Printing Office, Washington, D. C.
7. Van Hooft, Our Environment. Allyn and Bacon, Inc., New York.

G. Visual Aids:

1. Films*

a. Animal Life. Britannica, 10 minutes. Review of main types of animals, animal functions.

b. Birds of North America. Heidenkamp, 4 minutes. Presents the habits of a number of species of wild birds.

c. Flowers at Work. Britannica, 11 minutes. Deals mostly with pollination.

d. House - Fly. Britannica, 10 minutes. This film test the complete story of this common, but extremely dangerous pest.

e. Fungus Plants. Britannica, 10 minutes. Emphasis is given to various mushrooms whose growth and reproduction are illustrated by time-lapse photography and animation.

f. Life in a Pond. Coronet, 10 minutes. Pond life is presented "in action here", showing microscopic animals, food chains, and a wealth of plant and animal life that provide examples of important principles of natural science.

g. Life in an Aquarium. Young America, 11 minutes. Setting up, stocking and maintaining a classroom aquarium.

h. Monarch Butterfly. Britannica, 11 minutes. Shows the development of the caterpillar into the chrysalis.

i. Pond Insects. Britannica, 11 minutes. Life cycle, food habits, and struggle for existence of the diving beetle, the may fly, and the dragon fly.

j. Tiny Water Animals. Britannica, 10 minutes. Life processes and activities of amoebae and paramecia; reproduction of amoebae; other interesting creatures.

2. Filmstrips*

a. Ann visits the zoo.

b. Insect communities.

c. Kinds of plants.

d. Living things.

e. Structure of flower plants.

UNIT XII. MICRO-ORGANISMS AND THEIR WORK

A. Introduction:

There is a world of small life all around us which we could never know, if the microscope had not been invented. That world is a world of tiny plants and animals which live and move and have their being like any other organisms. Many of them only have one cell, but they need food, air, heat, and moisture, just as we do.

The world of microscopic plants and animals is necessary to our life. These billions of micro-organisms perform many useful services for us. They make our foods tasty and digestible; they assist us in making textiles and leather goods, and help to maintain the fertility of the soil.

Some micro-organisms are harmful. Various kinds of bacteria can cause severe sicknesses or even death. This unit will help us to distinguish between the good and bad creatures of the microscopic world.

B. Unit Objectives:

1. To develop an understanding of the importance of microbes to man.
2. To develop an appreciation of the work of microbes in daily living.

C. Content:

1. What are some good reasons for cooking foods?
2. Why are many tiny plants and animals called micro-organisms?
3. What conditions are necessary for the growth of molds?
4. What may one do to prevent the growth of molds in the house?
5. Why will forzen foods keeps indefinitely?
6. Name several substances which carry disease germs.
7. Why may milk be a dangerous food?
8. Why are yeast cells both a blessing and curse to mankind?

D. Activities:

1. Experiment to determine whether or not air, water, and food contain living organisms.

2. Experiment to show favorable and unfavorable conditions to the growth of bacteria.

3. Experiment to determine the effect of bacteria on foods.

4. Observe the action of yeasts and molds on various kinds of food.

5. Visit a dairy to see how milk is pasterurized.

6. Moisten a slice of fresh bread and set it in a cool, dark place. Notice results.

7. Show how decay may be both useful and harmful to man.

8. Visit ice-cream factories and bakeries.

E. Reports:

1. Louis Pasteur.

2. Filterable viruses.

3. Modern methods of making cheese.

4. Yeasts and molds.

F. References:

1. Beauchamp, W. L., Science Problems. Book I, Scott Foresman Co., Dallas.

2. Carroll, Franklin B., Understanding Our Environment. Allyn and Bacon Company, Dallas.

3. Powers, Damuel, Exploring Our World. Ginn and Company, Dallas.

4. Smith, Victor, Exploring Science. J. B. Lippincott Co. Philadelphia.

5. Wood, G. C., Our Environment, How We Use and Control It. Allyn and Bacon, Boston.

G. Audio-Visual Aids:

1. Films*

a. Microbes. Almanac, 16 minutes. Deals with fight against infections diseases.

b. Milk. Britannica, 11 minutes. Milk production under hygienic

control; dairy farm, herbs, calf with mother, feeding, milking, bottling and delivery.

2. Filmstrips*

   a. Controlling germs.

   b. Bacteria, good and bad.

   c. Body defenses against diseases.

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A well illustrated course of study for the teaching of general science.

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A bulletin containing a science education program in the high school with suggested improvements.

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

Curtis, Francis D. Everyday Biology. Boston: Ginn and Company, 1940.
A study of a simple and logical organization, of materials which cover the scope of elementary biology.

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 School 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.

Hurd, Paul D. "Mid-Century Trends in Science Teaching," California Journal of Secondary Education. XXVIII (May, 1953), pp. 244-50.
A report of trends and issues in teaching science and mathematics in the secondary school.

Miller, David F., and Glenn W. Blaydes, Methods and Materials for Teaching Biological Sciences. New York: McGraw-Hill Book Company, Inc., 1938.
A book which may be used for teachers of elementary courses in the biological sciences from the Junior High School to Junior College.

National Society for the Study of Education, "Science Education in American Schools," The Forty-Sixth Yearbook. Chicago: University of Chicago Press, 1947.
A valuable source of information for use in assisting the teaching of various sciences.

New Mexico State Board of Education, Science Tentative Guide for High School Teachers, Santa Fe, 1953.
A valuable source of information for use in assisting the teaching of the various sciences.

Oklahoma State Department of Education, Suggested Guide for the Teaching of Science. Oklahoma City, 1949.
An excellent guide for teaching high school science.

Palmer, Elra M. "Trends in Science Education," Baltimore Bulletin of Education, XXVIII (March, 1951), pp. 12-15.
A publication listing the trends in science education.

The High School General Science Committee of the Course-of-Study Council, Course of Study in General Science for High School. St. Louis, 1948.
A well organized course of study for general science teaching.

VITA

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Candidate for the Degree of

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Seminar Report: A GENERAL SCIENCE COURSE OF STUDY FOR LINCOLN HIGH SCHOOL

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