TO DETERMINE OBJECTIVES FROM THE CONSTITUTION
PREAMBLE, CHILDREN'S CHARTER AND SOCIAL-ECONOMIC
GOALS OF AMERICA, AND TO RECOMMEND A GENERAL SCIENCE
CURRICULUM DEVELOPMENT TO CONFORM THERETO

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THESIS

Presented to the Graduate Council of the North
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Fulfillment of the Requirements

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By

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PREFACE

I was told that I must solve a problem in my thesis. I asked myself, "What is the problem most vital and important to me as a general science teacher? What can I do about it?" The first question was not hard to answer. The most vital problem that a teacher is confronted with is the problem of furnishing the junior citizens with activities and experiences dictated both by common sense and educational science, which will enable them to achieve their desired objectives. This task must be approached with circumspection. The main obstacle to be avoided, obviously, would be the love of science subject matter rather than the desire to furnish the student with experiences necessary to permit them to achieve the desired objectives, desired human qualities and abilities.

I then had to ask myself, "What are the desired objectives that my subject can contribute to, how are they to be determined, and after they are determined, how are they to be achieved, that is how are the students to be furnished with the necessary activities and experiences?"

The following thesis is an answer to these questions for the eighth grade level for general science. This thesis is, however, a general science curriculum development rather than a complete curriculum, that is, with the aid of what is given the teacher is to work out the curriculum.
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INTRODUCTION

AN ANALYSIS OF TRENDS IN UNIT TEACHING
AN ANALYSIS OF TRENDS IN UNIT TEACHING

Radical but vital changes have been made in educational ideas and in secondary school practice during the past few years. These fundamental principles of educational philosophy must be utilized if a worth-while, living elementary science curriculum is to be developed.

Volumes have been written on the objectives and course of study for an elementary science curriculum. There is no way of proving the validity or desirability of these objectives, but it is evident that their effectiveness depends on how closely they harmonize with the current philosophy of living. As this philosophy changes, so must the objectives, if the real needs of the child are to be met.

In this elementary science curriculum development it has seemed advisable to study certain fundamental needs of the child which depend on science, rather than to clarify any science concepts as pure science concepts. Concepts are used as tools in the realization of objectives, but they are not objectives in themselves.

Is there any source material concerning fundamental needs of children that we can go back to and use as a starting point from which to build a curriculum? We do not question the fact that "We the people of the United States" should "form a more perfect Union, establish Justice, insure domestic Tranquility, provide for the common Defense,"
promote the general Welfare, and secure the Blessings of Liberty to ourselves and our Posterity."¹

We can, no doubt, profitably hold in mind the work of the White House Conference on Child Health and Protection called by President Hoover, who announced that it was to study the present status of the health and well-being of the children of the United States and its possessions; to report what is being done; to recommend what ought to be done and how to do it. At the last session of the conference nineteen points embodying the main recommendations of the committees were presented. These points are given below as presented in the Children's Charter.

The Children's Charter²

President Hoover's White House Conference on child health and protection, recognizing the rights of the child as the first rights of citizenship, pledges itself to these aims for the children of American interest

I. For the child spiritual and moral training to help him to stand firm under the pressure of life

II. For every child understandings and guarding of

¹Taken from the preamble of the Constitution of the United States of America.

his personality as his most precious right.

III. For every child a home and that love and security which a home provides; and for that child who must receive foster care, the nearest substitute for his own home.

IV. For every child health protection from birth, his mother receiving prenatal, natal, and postnatal care; and the establishment of such protective measures as will make childbearing safer.

V. For every child health protection from birth through adolescence, including periodical health examinations and, where needed, care of specialists and hospital treatment; regular dental examinations and care of the teeth; protective and preventive measures against communicable diseases; the insuring of pure food, pure milk, and pure water.

VI. For every child from birth through adolescence, promotion of health, including health instruction and a health program, wholesome physical and mental recreation, with teachers and leaders adequately trained.

VII. For every child a school which is safer from hazards, sanitary, properly equipped, lighted, and ventilated. For younger children nursery schools and kindergarten to supplement home care.

IX. For every child a community which recognizes and plans for his needs, protects him against physical
dangers, moral hazards, and disease; provides him with safe and wholesome places for play and recreation; and makes provision for his cultural and social needs.

X. For every child an education which, through the discovery and development of his individual abilities, prepares him for life; and through training and vocational guidance prepares him for a living which will yield him the maximum of satisfaction.

XI. For every child such teaching and training as will prepare him for successful parenthood, home-making, and the rights of citizenship; and, for parents, supplementary training to fit them to deal wisely with the problems of parenthood.

XII. For every child education for safety and protection against accidents to which modern conditions subject him—those to which he is directly exposed and those which, through loss or maiming of his parents, affect him indirectly.

XIII. For every child who is blind, deaf, crippled, or otherwise physically handicapped, and for the child who is mentally handicapped, such measures as will early discover and diagnose his handicap, provide care and treatment, and so train him that he may become an asset to society rather than a liability. Expenses of these services should be borne publicly where they cannot be privately met.
XIV. For every child who is in conflict with society the right to be dealt with intelligently as society's charge, not society's outcast; with the home, the school, the church, the court and the institution when needed, shaped to return him whenever possible to the normal stream of life.

XV. For every child the right to grow up in a family with an adequate standard of living and security of a stable income as the surest safeguard against social handicaps.

XVI. For every child protection against labor that stunts growth, either physical or mental, that limits education, that deprives children of the rights of comradeship, of play, and of joy.

XVII. For every rural child as satisfactory schooling and health services as for the city child, and an extension to rural families of social, recreational, and cultural facilities.

XVIII. To supplement the home and the school in the training of youth, and to return to them those interests of which modern life tends to cheat children, every stimulation and encouragement should be given to the extension and development of the voluntary youth organizations.

XIX. To make everywhere available these minimum protections of the health and welfare of children,
there should be a district, county, or community organization for health, education, and welfare, with full-time officials, coordinating with a state-wide program which will be responsive to a national service of general information, statistics, and scientific research. This should include:

(a) Trained, full-time public health officials, with public health nurses, sanitary inspection, and laboratory workers

(b) Available hospital beds

(c) Full-time public welfare service for the relief, aid, and guidance of children in special need due to poverty, misfortune, or behavior difficulties, and for the protection of children from abuse, neglect, exploitation, or moral hazard

For every child these rights, regardless of race, or color, or situation, wherever he may live under the protection of the American flag.

At its 1931 meeting the National Education Association appointed a committee to propose to the association desirable social-economic goals of America. In 1934 the committee presented the final report covering some, but by no means all, desirable social-economic goals of America.
Ten Desirable Social-Economic Goals of America

"Social and economic policies and practices must be judged by what they do to enrich the lives of individuals. Therefore the desirable social-economic goals of America are stated in terms of the things we covet in the highest degree for the largest possible number of Americans."

1. Hereditary and strength

2. Physical security

3. Participation in an evolving culture
   a. Skills, technics, and knowledges
   b. Values, standards, and outlooks

4. An active, flexible personality
   a. Personal initiative
   b. Discriminating judgement and choice
   c. Flexibility of thought and conduct
   d. Individual differences
   e. Cooperativeness

5. Suitable occupation
   a. Guidance
   b. Training
   c. Placement and advancement

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6. Economic security
7. Mental security
8. Equality of opportunity
9. Freedom
10. Fair play

Since this curriculum outline is to consist of functional activity interest guides, every effort will be made to stay in harmony with the principles of unit teaching. Lists of foundations, qualities, criteria, and trends of unit teaching are given as follows:

Criteria for Selecting Units of Work

1. The unit of work must be selected from real life situations and must be considered worthwhile by the child because he feels that he has helped select it and because he finds in it many opportunities to satisfy his needs.

2. The unit of work must afford many opportunities for real purposing and real projects, and it will be something which the child can carry into his normal activity.

3. The unit of work must stimulate many kinds of activities and so provide for individual differences.

4Lincoln Elementary School Staff, Curriculum Making in an Elementary School, pp. 29-42.
4. (a) The unit of work must make individual growth possible.

(b) The succession of units of work must provide for continuous group growth from one level to the next.

5. Each unit of work must furnish leads into other related units of work and must stimulate in the child the desire for a continued widening of his interests and understandings.

6. Each unit of work must help meet the demands of society and must help clarify social meanings.

7. Each unit of work must be accompanied by progress in the use of such tool subjects as contribute to that unit.

8. Each unit of work must lead to the development of desirable habits.

The Qualities of a Good Teaching Unit

1. The teaching unit should have a useful purpose.

2. It should reproduce actual life situations as far as possible.

3. It should utilize materials as they occur in life.

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5Henry Harap, The Technique of Curriculum Making, p. 185.
4. It should involve a variety of direct sense experiences.

5. It should provide a considerable amount of pupil activity.

6. It should provide for some free, informal association of the pupils.

7. It should provide and force an opportunity for the pupil to originate, plan, and direct the activity, as far as possible.

8. It should provide an opportunity for manipulative or bodily activity.

9. It should be pleasant.

10. It should provide opportunities to judge, choose, and evaluate.

11. It should contain accurate information.

12. It should be within the available time for the unit.

13. The exposition should be clear enough to make it possible for a new teacher to reproduce the experience.

14. It should state clearly where materials may be obtained.

15. When references are given, they should be complete and exact.
Criteria for Evaluating Activities

1. Is the proposed activity related to the present living experience of the children?
2. Does the proposed activity give promise of outcomes relatively valuable in life now?
3. Will the activity give fuller meaning to the experience of the child in this particular environment?
4. Is the experience involved socially constant or socially variable?
5. Are the fields of subject matter involved worthwhile and representative of the big aspects of life?
6. Will this work contribute to some of the larger essential goals of education?
7. Is it hard enough to challenge?
8. Is it easy enough to insure some degree of success?
9. Is it more difficult than any previous undertaking in this sort of enterprise?
10. How often and recently have similar activities been experienced?
11. Will the activity contribute to the child's efficiency?
12. Will it teach children method in ordering

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their experiences?

13. Will it develop relationships leading to organization of experience?

14. Will it provide opportunities for learning to cooperate in living?

15. Did it come out of something in the children's previous experience?

16. Will it lead to something of larger worth?

17. Is it related to other activities in which the children are engaging?

18. Is it practicable under school conditions?

19. Are the materials and helps needed available?

20. How fully can the activity be carried out?

21. How much time will it consume?

Ten Tests of a Good Unit

1. Does the unit follow naturally the previous curriculum of these children and lead into the succession of units which will follow? Does it fit into the course of study?

2. Is it of general social value?

3. Have I or can I get the necessary background which will enrich the unit for the children?

4. Is it practical under my working conditions?

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7Warren P. Stevens, Activity Curriculum in Primary Grades, p. 299.
5. Will it appeal to the majority of the groups and are the pupils prepared to undertake it?

6. Has it worked with other similar groups?

7. Does it contain leads to and from other units?

8. Is it sufficiently complex to call out many kinds of activity in children and to provide for individual differences?

9. Does it provide for progress in the tool subjects?

10. Does it provide for the development of desirable habits and social meanings?

Criteria for Choosing Activities^8

1. The activity should be interesting to the children.

2. It should grow out of their background and experience, their play-life, and their natural and social environment.

3. It should be within their range of satisfactory accomplishment and yet complex enough to challenge them.

4. It should lead into further activities and present a variety of real problems.

5. It should be rich in content, full of meaning, and provide genuine possibilities for change and growth.

^8L.W. Clouser, Education Experience Through Activity Units, pp. 2-3.
6. It should furnish opportunity to the children for real purposing, planning, self-directing, and evaluation.

7. It should furnish opportunity for creative expression, personal initiation, problem solving, experimentation, manipulation of materials, and cooperation in group endeavor.

8. It should provide for participation by all in educative social relationships.

If the accepted theories and trends of unit teaching are to be put into the education of children there must be some accepted form for the unit proper. The form below is used in this development.

Unit Form

1. TITLE. Write an attractive title based on interest and action.

2. INTEREST STORY. Write a story of one or more pages in which you raise questions and increase the interest of the junior citizen.

3. POSSIBLE APPROACHES. List a number of things which might serve to initiate or introduce this unit of interest.

9Harold Brenholtz, and J.C. Matthews, Building Interest Guides, pp. 2-3.
4. **BIG IDEALS.** List one or more socially important ideals which will justify the use of this material. They may usually be simply and plainly stated in one sentence each.

5. **OBJECTIVES.** List a number of these, and make them very specific. They may safely commence with the following words:

   a. An interest in --
   b. A skill in --
   c. A habit of --
   d. An appreciation of --
   e. An attitude toward, as, a friendly attitude toward --
   f. A knowledge of -- (Knowledge, if it is a means of achieving the first five)

6. **ACTIVITIES.** List many suggested activities, and have them vary in types from the concrete to the extremely abstract, from whittling to essays. State them simply.

7. **REFERENCES.** Make an alphabetical list here.
   a. Junior citizen's
   b. Guide or teacher's

8. **SURVEY OF RESULTS.** (Checks, tests, etc.)

9. **LEADS OUT.** Leads out to other interests, should be suggested.

10. **CHANGE.** Evaluate work, and re-write. This part
of the work is to be done after the interest guide has been used.

Obviously, the above sources and trends are far from complete; however, they do form a foundation from which to work. The interest guides (units) to follow are outgrowths of the above foundations and trends. It is also obvious that it is impossible to incorporate in a printed unit all the experiences children should have in school. No complete curriculum can be printed. The teacher might be thought of as the curriculum; therefore, it is very important that the teacher has in mind source material concerning fundamental needs of the children and of society to go back to and use as a starting point from which to set up the actual functional activities and interests to be written into the lives of the children. The three "bed-rock" sources for foundations from which to build which have been suggested are the preamble of the Constitution of the United States, the Children's Charter, and the Social-Economic Goals of America. Using these as foundations, and staying in keeping with the fundamental principles of educational philosophy, the teacher should be able to actually write important functional activities and interests into the curriculum. The outline unit form already given seems to be the best way to carry out this task.

It is important that the unit or interest guide has
an attractive title of action based upon some interest of the children; and interest story which will increase and produce desirable interests; possible ways of introducing the unit; several socially important big ideals; specifically stated objectives; references for both the student and the teacher; and leads out to other interests; but the important part of the unit is the part which suggests the actual activities and experiences of the children. These activities should be stated so that they explain themselves, and they should, above all else, be selected so as to lead to the achievement of the desired objectives.

As has been said, the units that are to follow have been written as outgrowths of the stated foundations and trends, and in keeping with the accepted unit form. The last four of the units, however, have had the tests omitted. Each objective of each unit has been stated with the needs of the children and of society in mind as given by the three suggested foundations, and each activity of each unit has been selected for the purpose of bringing about the stated desired objectives.
UNIT ONE

HELPING BIRDS TO HELP US
INTEREST STORY

One thousand dollars ($1000.00) reward has been offered for a nesting pair of passenger pigeons. No one has claimed the money. Finding such a pair would be a great adventure. Why do you not locate a pair and collect the reward? All you have to do is just tell the people who offered all that money where there are live passenger pigeons nesting, or just catch a male and a female. This should not be hard. In the early part of the last century this was the most common bird on the North American continent. In order to get a faint idea of the number of the passenger pigeons in the time of Alexander Wilson, the ornithologist, let us imagine, if we can, one such flock as he observed in 1808. The birds moved in a column, whose front was more than a mile in width, and, flying at a rate of a mile a minute, they took four long hours to pass. Wilson estimated that this flock contained at least two billion, two hundred and thirty million, two hundred and seventy-two thousand pigeons.

Suppose you could find just one pair. You could sell them for one thousand dollars; but we fear that not even one of you will ever even see one live passenger pigeon. What happened to the countless millions is recorded in many books and will be very interesting for you to read.

The passenger pigeon is now entirely extinct. It was
destroyed by man, chiefly between 1840 and 1880. They were trapped and otherwise killed at their nesting places for shipment to eastern markets by commercially organized companies.

Even though the selfish greed of man has caused this bird and a number of others to be lost to us forever, there are many other birds living among us, and the power lies in your hands to plan the future of our feathered friends.

Birds as a class are very useful, and we protect our own interest by protecting them. Many birds which we regard simply as beautiful or poetic are very useful as well. According to some authorities, insects each year destroy at least one billion dollars' worth of forest and agricultural products in our country. Do you know, that were it not for the valuable assistance rendered by birds in eating injurious insects, these losses would be many times greater?

We must also remember the great usefulness of hawks and owls, most of which are friends of man because of their destruction of rats, mice, grasshoppers, and other pests, and also should we remember the usefulness of large numbers of birds that eat the seeds of injurious weeds and grass.

The subject of the economic value of birds, when taken up in detail, is very complex, and the questions involved are not always easy to answer. Some birds, like the yellow-bellied sapsucker, which is said to damage the trees to the
extent of $2,250,000 annually, and the sharp-shinned and Cooper's hawks, which live almost exclusively on poultry and useful wild birds, are easy to place in the destructive class. Others, like our cuckoos which feed on destructive hairy caterpillars and other obnoxious creatures, are as easy to place in the beneficial class. But in between we have many birds not so easy to place.

Many farmers think that all hawks and owls are his enemies and make every effort to destroy them. In doing so he is destroying many of his best friends. Then, on the other hand, there are people who try to tell the farmer that all hawks and owls are his friends, and that he should not shoot one under any circumstances. They should know better than this, and the farmer does know better. Such sweeping statements not only fail to convince the intelligent farmer, but they tend to make him discredit the truth concerning the birds of prey.

There are only two really harmful hawks, Cooper's and the sharp-shinned hawk, that are of any concern to us. All our other hawks and owls are species in which beneficial and harmful qualities about balance, species which are chiefly beneficial, and species which are wholly beneficial, such as the rough-legged hawk, squirrel hawk and the four kites.

From morning till night, almost the whole of his life, nearly every bird is working for us. He is not aware of the
fact that he is working for us, for he is just living his natural life, hunting for the food that he likes, and that is good for his young birds to eat, food consisting mostly of creatures which gardeners and farmers are always fighting, creatures that destroy our fruit and vegetables, worms that get into our apples and berries, caterpillars that eat the leaves off our trees, beetles that spoil our roses and our potatoes, mice that eat our crops, and seeds of harmful weeds and grass. The favorite food of most hawks and owls consists of rats and mice, gophers, and other little animals which make havoc in our crops. Each farmer spends much time and labor trying to rid his crops of them, though most of the hawks and owls would gladly have eaten them; but one or two hawks and owls have eaten his chickens, as a result the farmer kills every one he sees.

What would we do without our bird scavengers?

Why do we not help the birds help us? If we would only give them a fair chance, they would do much of our work for us, and much better than we can do it.

Before we condemn a bird because of certain of his bad habits, we should be very careful and just in balancing his harmful and beneficial qualities against each other. Many stories of harm done by birds are mere guess work from careless observation. During a number of years of my life, because of nothing but careless observation, I made every effort possible to destroy a certain kind of bird, because
I thought him to be an exclusive bee eater, and I also thought him to be unjust to other birds. He would perch as a rule on the highest branch of some tall tree or pole near our beehives and remain almost motionless. Then suddenly he would fly out and seize what I thought to be a bee and then return to his perch to repeat the action. Should any bird, large or small, fly near his perching place, he, fearlessly, seemingly for no reason at all, sallied out and dived at the intruder, usually causing the invader to beat a hasty and inglorious retreat. At first hand, these do not seem to be very fine or noble qualities. I called this bird the bee mart' n, and considered him every thing but a friend. I now know him to be a very valuable bird, because of the great service he renders us in destroying multitudes of harmful insects. The king bird feeds on beetles, canker-worms, and many winged insects, but I have learned a very curious thing about his bee eating. He eats only drones which make no honey, and are no good to the hive. This bird was working for us, though I did not know it, and no doubt, his attack on other birds was because he wished to prevent them from frightening off the insects which he was quietly waiting for on his royal throne.

Much is known about birds that will be very interesting for us to find out. There are many, many splendid bird books from which we can obtain much information about our feathered friends, but to know the living bird, to make acquaintance
with him as an individual, we must study and associate with him as he goes about his daily duties.

To appreciate the talents of our winged songster, America's most versatile bird vocalist, the mockingbird, we must watch him on some moonlight night, during his love season, as he wings his way high into the air, filling the night with his exquisite trills and serenading his mate hour after hour, or as he sits upon some branch using his unlimited talents as a mimic, juggling his long tail to keep perfect balance, while improving upon the musical notes of other birds or any other sound that might come to his attention. If you think to sing is all that this bird can do, you should watch it attack birds, many birds many times its own size, cats, dogs, snakes, and even you in defense of its nest.

The mockingbird holds official honors in Texas, Arkansas, Florida, and Mississippi as being the state bird. It is no accident that he received these posts. His qualifications were considered from all angles, his value economically, whether he was a true representative of the states, his standing as a songster, and many other characteristics. His nest is found as a rule in bushes, or other dense vegetation, and it is built of twigs, weed stalks and grasses, leaves, feathers, and even rags, and is lined with moss and fine rootlets. It is near the ground, and is loosely and poorly constructed. There are four to six greenish-blue eggs which are heavily marked with brown at the larger end.
Although both birds are most devoted parents, and share in caring for the family, the male never slights his singing. The mocker eats the rice weevil, chinch bug, cotton worm, and many other ground insects, and weed and grass seeds. The grasshopper is his favorite food, and he is also rather fond of wild fruits. During the winter time the mockingbird is a regular visitor of food trays, and he seems to have an instinctive preference for the society of men.

As the mockingbird is known as America's most versatile songster, the robin should be known as America's most versatile bird of life activity. The robin is a state bird of Michigan, Virginia, and Wisconsin. We all know him as the most familiar dooryard songster. He has a strong and aggressive personality, and is perfectly content to live about the habitation of man. He is the most universally distributed of all songbirds. His diet is far from limited. He devours large quantities of all kinds of harmful worms, insects, seeds, and is also very fond of berries.

The robin generally builds a bulky nest in trees, but his nesting site is rather varied. Materials used to make the nest are almost invariably rootlets and grasses with a mud-plaster partition between the outer wall and the softer inside lining. The nest is shaped by the mother bird pressing her breast against it. In the nest will be about four beautiful blue eggs from which hatch speckled-breasted babies. The robins are exceedingly good parents, and
usually raise two broods during a nesting season.

There are many other birds whose acquaintance would be very pleasant for us to make, whose characteristics and qualification as our fellow-creatures we should consider very carefully, and above all we should make every effort to help them help us.

POSSIBLE APPROACHES

1. Through some member of the class bringing to class a bird, or a bird nest.

2. Through interest aroused by a strange bird upon the campus.

3. Through an article on birds.

4. Through bird pictures brought to class.

BIG IDEALS

1. Birds as a class are very useful, and it is to our advantage from a selfish point of view to protect them ourselves and to insist upon others doing so.

2. Many birds which we regard simply as beautiful or poetic are very useful as well.

3. We can help birds help us by protecting them; and, in return, they will do much of our work for us in a much better manner than we can do it.

4. The stories of harm done by birds are often mere guesswork from careless observation.
5. Birds are our fellow-creatures whose acquaintance it is very pleasant to make.

6. Before we condemn a bird because of certain of his bad habits, we should be very careful and just in balancing his harmful and beneficial qualities against each other.

7. The attractive thing about bird study is the fact that there is still so much to be found out about them. There is much more to be known about birds than is now known.

OBJECTIVES

I. A purposeful interest in:

1. The birds of our community.

2. Helping the birds help us.

3. Finding the true relation of birds to man.

4. Cooperating with my classmates.

5. The functions of the National Association of Audubon Societies.

6. Improving our room for the study of birds.

7. Illustrating stories.

8. Writing and singing bird songs.

9. Writing and reading stories about birds.

10. Teaching others the value of birds, and interesting them in the welfare of useful birds.

11. Protecting our birds from wild animals and from man.
II. An appreciation of:

1. The true relation of birds to man.
2. The things that different organizations are doing to protect our wild birds.
3. The wonderful literature available on birds.
4. The beautiful and poetic qualities of our birds.
5. The fact that it is well worth our time, even from a selfish standpoint, to protect our birds.
6. Our geographical surroundings.
7. A bird as a thing of life and individuality.

III. A socially desirable attitude toward:

1. The birds as fellow creatures whose acquaintance it would be both pleasant and profitable to make.
2. The relation of birds to man.
3. The efforts of organizations for the study and protection of birds.
4. The scientific facts about our feathered friends.
5. The use we should make of the birds.
6. Using the materials of other members of the class and of different organizations.
7. Caring for the birds.

IV. A skill in:

1. Identifying the different birds.
2. Observing the activities of the common birds.
3. Obtaining information concerning birds.
4. Attracting birds to our homes and community.
5. Cooperating with the rest of the class.
6. Writing letters.
7. Writing articles for papers.
8. Collecting information about birds.
9. Drawing and painting.
10. Preparing information leaflets, charts, graphs, and posters.
11. Reading about birds.
12. Measuring and working practical arithmetic problems.
13. Talking with others.
15. Telling the difference in our bird friends and enemies.

V. A habit of:

1. Making every effort to protect the birds.
2. Providing houses, feed trays, baths, etc. for the birds.
3. Reproaching anyone who is not kind to birds.
4. Attracting birds to our home and community.
5. Paying more attention to the birds about us.
6. Collecting and organizing useful materials on birds.
7. Making use of available information and materials.

VI. A knowledge of:

1. The economic relation of the birds to the balance of nature.
2. How to gain information about birds.
3. Usefulness of birds as a class.
4. The common birds of our community.
5. The life history of many common birds of our community.
6. How to take care of the birds.
7. The useful and the harmful birds of our community.
8. Common arithmetic.
9. Our oral and written language.
10. Our geographical surroundings in relation to birds.
11. The clubs and organizations that are interested in birds.

ACTIVITIES

1. Make a plan for doing the things you want to do and can do profitably in our school and around our home to help us help birds. Many activities should be suggested by both students and the teacher. Conduct an open house dis-
cussion of the suggested activities. Organize the class for work. Below is a list of activities which should serve to guide the procedure of this unit, but they are meant to be suggestive only. From time to time new activities should be suggested and agreed upon.

2. Make an official list of the things that your class intends to do. As new activities are suggested and accepted by the class, add them to the list.

3. Draw up an agreement, written or oral, as to the cooperative duties of the members of the class.

4. Write for and collect all the material and information possible pertaining to birds. Much free and low cost materials on birds are procurable as will be noted in the bibliography.

5. Write for price list of materials on birds for sale by Superintendents of Documents, Washington, D.C.

6. Write for price list of materials on birds for sale by Massachusetts Audubon Society, 66 Newbury St., Boston.

7. Find out about and make use of the Audubon Society. The National Association of Audubon Societies will be glad to help you in a number of ways in your work with birds. There are many interesting things to be learned about this wonderful organization. If you should want to join the nearest Audubon Society write its president, Dr. T. Gilbert Pearson, at 1775 Broadway, New York City. He will be glad,
also, to furnish you with much information.

8. Establish a bird library in your school room including a filing box for pictures.

9. Place pictures, clippings, and any type of bird information on the bulletin board.

10. Make bird trips on which you go to the fields, woods, and streams and get acquainted with the birds from life. Bird trips are very interesting. The unexpected is forever happening. The early morning is the best time for birding. Bird study groups should not exceed about five. If your class is larger than this divide up into smaller groups. Avoid any unnecessary noise and do not display conspicuously colored clothes as either is alarming to birds. You might select a good place and quietly watch the birds. Observe what they are doing, how they are doing it, and also take note of everything about them. You should make permanent records of your observations.

   Below are some things to look for and record.

   a. Date when seen
   b. Place seen
   c. Weather conditions
   d. Birds seen
   e. Activities of birds.
   f. Details of birds

11. Collect and mount for display old bird nests.

12. Collect the feathers of different birds.
15. List as many birds of your locality as you can.
14. Collect pictures of all your common birds.
15. Draw and paint birds of various species.
16. Prepare identification plates to be used on field trips.
17. Make a list of the birds that we see throughout the entire year in our community.
18. List the birds that spend only part of the year in our locality.
19. Read articles on the migration of birds.
20. Read about birds to the class.
21. Write bird poems.
22. Sing bird songs.
23. Compose bird songs.
24. Write bird stories.
25. Illustrate the stories about birds written by other members of the class.
26. Make a special survey of the common birds of your community relating to complete information about the individual birds.
27. Conduct an open house forum on the economic value of the common birds. Collect and present to the class information on the common birds. Conclude as to the economic value of each of the common birds.
28. Prepare bird leaflets, as shown below, for the important birds of your concern. Each leaflet might contain
a colored picture, a description, and an economic evaluation of a bird. Any good tough paper may be used. One folded sheet should suffice. Cut the sheets for the leaflet and fold so that the picture might be placed between the folds. The artists of the class will enjoy this work. Work out an artistic cover for the leaflet. Print the name of the bird on the cover. Work out some design to go on the inside of the folded sheets.

29. Write articles discussing the habits, histories, and personalities of some of the common birds of your locality for your school or local paper.

30. Make a class book on birds. Have someone outside of school write an article for the book. Let the artists of the class paint pictures for it.

31. Display the book that your class makes in some public place, and then place it in your bird library.

32. Give class reports on:
   a. Why birds migrate.
   b. Life histories of different birds.
   c. How the bird gets his education.
   d. The ancestral relationship of birds to reptiles.
   e. How the bird is equipped for his life duties.
   f. On the life of Audubon, the naturalist.
   g. On the functions of the Audubon Society.
   h. On any other bird subject.
33. Name as many birds under these classifications as you can:
   a. Birds that are wholly beneficial.
   b. Birds that are chiefly beneficial.
   c. Birds in which beneficial and harmful qualities about balance each other.
   d. Birds which are harmful.

34. Make a life history chart of the major birds of your locality. The information about each bird should be some what as follows: where seen, field marks, distinctive habits, songs, courtship, migration date, summer range, winter range, plumage of adult, seasonal changes, nest site and structure, eggs, incubation, broods, activity of young, food of young, plumage of young, food of adults, relation to man's interest and relation to nature.

35. Cast bird book ends, etc. out of plaster. The casting negative can be prepared by pressing the object desired into smooth clay. You may use the birds that you have prepared from salt of flour, clay or wood. The face of the negative should be thoroughly covered with vaseline or oil to prevent the plaster of the positive from adhering to it. Using cardboard, make a wall around the negative from 3 to 4 inches high at the end that is to be the base, tapering it to about 2 inches on the opposite end. This is to be the mold for your book end. Elevate the top end so that the top of the walls are level and pour into the mold the
plaster. After the plaster has hardened remove the cast from the mold and smooth it with a knife. To make the illustrated book end, place a piece of tin at the bottom of the book end in the plaster after it is poured and before it hardens.

36. Make posters showing how different types of birds are made for their life work.

37. Make a number of "Help the Birds Help Us" posters. Place them in public places.

38. Paint some "No Shooting" posters.

39. Make a map showing the routes taken by birds during migration.

40. Paint different types of bird gift cards.

41. Prepare birds from paper, salt, flour, clay, or wood, and paint them.

42. Paint different types of bird gift cards.

43. Have a class discussion on the entertainment of the wild birds in winter.

44. Draw up plans to feed and care for the wild birds during the winter.

45. Build a weather cock food house for the birds. This food house is made so that it moves with the wind. It sets on a pole, and is pivoted so that it can revolve horizontally, and is also supplied with two paddle-shaped arms extended on each side to catch the wind, which turns the open side of the house away from the wind at all times.
The back should be glass plate. Keep the bird feed on the inside of the house.

46. Build a bird window box for your school or home. This should be a glass box made to fit the window opening and to project into the room about a foot, the sash coming down snug into a groove in the woodwork at the top. The wooden floor should extend into the garden about twelve or more inches. The top of the box is hinged so as to permit opening.

47. Prepare a bird Christmas tree, upon which you pour or hang bird food. The following are good bird food: suet, fat pork, hemp seed, cracked corn, millet seed, raw meat, bread crumbs, sunflower seeds, chaff, broken nuts, oats, canary seed, wheat, whole corn, kaffir corn, broken squash seed, etc.

48. Discuss hospitality for the birds for the year around.

49. Make plans to help the birds during the spring and summer.

50. Plant trees, shrubs, and vines to attract the birds to your home and school house.

51. Establish a bird bath by sinking a shallow pan flush with the surface of the ground and keeping it filled with water.

52. Make a nesting shelf for the pheobe and the robin, which will not nest in a box, but will nest on a shelf.
53. Build bird houses for a variety of birds. Did you know that many birds are in actual need of nesting sites? Some birds are in such need of a nest that they will accept almost any nest box offered to them. Some of them will accept a common starch box, or even an old can with a hole cut in the end. There is no need of this. You would enjoy building the birds a home. You can build them that will cost you nothing.

54. Draw plans for your bird houses.

55. Figure the amount of lumber necessary and compute the cost of the lumber if bought from your home town lumber yard.

56. You may build bird houses according to the following plans. With a hammer, saw, old or new boards, nails, and a few cents, you can build a nest house. Do not paint the house a bright color.

To build the downy woodpecker house, select a suitable piece of soft wood. Saw through lengthwise and dig out the two sections with a gouge to make a neat cavity. For the bluebird house, use a hollow log of the desired size.

Build large compartment houses for the martins. They are very sociable birds and like to nest in colonies. They will nest in a thirty or forty room compartment house.

Although martins do not like one or two room houses, and will not even use them if more commodious quarters are obtainable, they will use a one room house if placed high
in the air on a small post.

57. Listen to a record of bird songs.

58. Try to imitate songs and calls heard; crow, cardinal, mocking bird, etc.

59. Select a good spot, preferably near a spring and build a bird blind to be of use in making observations and taking pictures. Birds are attracted to water. If you do not have a spring with bushes near by, construct a blind. This may be done by making a sunken bird-bath. Be sure it is very shallow at the edge. To lure birds to your spot, suspend a bucket over the pool. This bucket should have a small hole in the bottom, where water will drop through one drop at a time. The dripping of water attracts birds. Construct a hiding place of leaves, branches and shrubbery.

60. Try to take pictures of birds.

61. Construct a bird bath for the school ground.

62. Construct garden markers and flower pot ornaments. These can be drawn on wood and cut out with a coping saw.

63. Bird feeders can be constructed of lumber. They should be placed upon a tree.

64. Learn the effect climate has upon coloring of birds.

REFERENCES FOR JUNIOR CITIZENS


REFERENCES FOR TEACHERS


FREE AND LOW COST MATERIAL

Boy Scouts of America, 2 Park Avenue, New York, N.Y., The price range is about 25 cents for pamphlets on "Bird
Study”, "Taxidermy”, "Nature Collection”, "Bird Homes”, etc.

Church and Dwight Company, 1416 Willis Avenue,
Syracuse, N.Y. They have sets of bird cards for each child
and also large charts.


Inland Bird Branding Assn., 124 Washington Street.,
Waukegan, Ill. They have the pamphlet "New Method of Bird
Study".

National Audubon Society, New York, N.Y. They have
all types of material and help.

N. C. Dept. of Agriculture, Raleigh, North Carolina.
They have a pamphlet, "Birds and Trees”.

Supt. of Documents, Washington, D.C. They have the
pamphlets "Birds and Bird Houses", and "Wild Animals and
Insects".

U.S. Department of Agriculture, Washington, D.C.
Bull. No. 5 "Some Common Birds”.
Bull. No. 506 "Food of some Well Known Birds”.
Bull. No. 755 "Common Birds of S. E. United States”.
Bull. No. 1456 "Homes for Birds”.
Bull. No. 1239 "Community Bird Refuges”.

U.S. Department of Agriculture., Bureau of Biological

Singer Machine Company, 149 Broadway, New York, N.Y.
They have sets of 32 colored bird pictures.

Wright Company, 311 Summer Avenue, Boston, Mass.
They have a brief description of 24 birds.

STUDENT'S TEST

Please mark with an (T) each statement that is true
and with an (F) each statement that is false or wrong. Leave
unmarked those you know nothing about about.

1. Birds as a class are very useful, and it is well
worth our time to protect them.
2. Birds help us destroy weeds and insects that injure our crops.
3. We should kill all birds that we see eating our fruit.
4. All woodpeckers are very destructive to the trees.
5. We should kill all birds that we see eating our grains.
6. All hawks and owls are useful.
8. The bobwhite is the state bird of Texas.
9. The crow is a very useful bird.
10. We should kill all the chipping sparrows.

Underline the phrase which in each of the following best completes the statement.

1. Birds are very useful because
   a. They are beautiful and poetic.
   b. It is much sport to hunt them.
   c. They eat many harmful insects and seeds.

2. Man destroyed the passenger pigeon because
   a. They were harmful.
   b. They were not beautiful.
   c. Of the selfish greed of commercially organized companies.

Please put an (A) beside the name of the bird that is useful and an (X) beside those that are harmful. Discuss the life histories of the first five that you mark with an
(A). Discuss any two of the ones that you mark with an (X).

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<tr>
<td>3. Cooper's Hawk</td>
<td>13. Chickadee</td>
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<tr>
<td>5. English Sparrow</td>
<td>15. Loggerhead Shrike</td>
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<tr>
<td>7. Mockingbird</td>
<td>17. Belted Kingfisher</td>
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TEACHER'S TEST

1. Did the experiences offered by this unit make better citizens out of the students?

2. Did the activities meet the needs and interests of society?

3. Did the activities meet the needs and interests of the pupils?

4. How many of the students have a true appreciation of the economic relation of the birds to the balance of nature?

5. How many of the students would reproach others for the destruction of birds?

6. Do the students have a more purposeful interest in
the welfare of birds than they had at the beginning of this unit of work?

7. Do the students appreciate the true relation of birds and man?

8. Have the students gained any worthwhile knowledge about birds?

9. What advances have the students made in their life activities?

10. Have the students enjoyed their work with birds?

LEADS OUT

1. To any type of nature work.
2. Making a garden.
3. Beautifying our yards.
4. Making our pets happy.
5. To radio from sending radio bird programs.
UNIT TWO

DISCOVERING THE MAGIC OF ELECTRICITY, AND MAKING A SERVANT OF IT
INTEREST STORY

What is electricity? Where does it come from? It has often been said that we do not know what electricity is, nor where it comes from. If this statement is true, then we can just as truly make the statement that we do not know what any of the most common things that we see and use every day are. If you were asked if you knew what water is, you would say yes. Yet, if you know what water is I know what electricity is. If you were asked what water is what would you answer? All you could do would be to enumerate the properties of water, telling how to control it, and how make use of it. If we know what water is, then we know what electricity is, for we know many of its properties, many ways to control it, and many many uses of it.

Electricity is a good servant but a hard master. We are now living in a century of electrical progress. Electricity and its development during the last century has made a vast change in the lives of men.

Had you attended A Century of Progress, you would have seen the wonderful records of man's conquest over the secrets of nature. Yet, of these, perhaps the most amazing are the many electric exhibits, which tell and show how electrical science has come to play such a tremendous part in the development of energy on the earth, as a source of light, as a source of power, and in chemical industry. In the
electric furnace, man can use invisible forces and produce heat that is rivaled only by the heat of the sun.

Yet, after seeing so many things being done with electricity, most of us would have to confess ignorance as to what electricity really is, and to say that it is something that does certain things: that when magnets, motors, lamps, and such things are in operation it is a something called electricity that does the work.

In the last few years so many new facts have been discovered about electricity, such a great number of new ideas in the theory of electricity have been argued out to the point where scientists agree to accept them, we know so much about the internal structure of matter, and all of this has led us to a truer knowledge of what electricity is.

What is matter? Matter is anything that has mass and occupies space. But what is matter made out of? Perhaps electricity is matter, or matter is electricity, which ever way seems best to you. I feel quite sure that electricity is the material of which the world is made.

"Why, how can that be?" you ask. "There are so many different known substances, sugar, salt, gold, lead, water, etc.; surely if they were all made of the same thing they would be alike?" I do not blame you for thinking this, but let us think over some things.

We are now taking a little side path and roaming into chemistry for just a few minutes. This is perfectly all
right, for the chemists will tell you that electricity is the thing that makes their chemicals work. I can tell you of many things composed of the same substances and yet acting quite differently. But all this talk is not permitting us to discover the magic in electricity and to make use of it, so "let's go".

POSSIBLE APPROACHES

1. Through the hobby of some member of the class.
2. Through an interest created by some member of the class bringing to class a piece of electrical equipment.
3. Through pieces of electrical equipment being placed in the laboratory.
4. Through some electrical advertisement.
5. Through some outstanding electrical report in the paper.
6. Through some member of the class telling what he saw at the Chicago Worlds' Fair.
7. Through having to repair some electrical device in the school room.
8. Through an electrical demonstration that happens to come to town.
9. Through some interesting radio program.
10. Through having a telegram sent to the school room.
11. Through interest aroused from a passing thunderstorm.
BIG IDEALS

1. We are living in an age in which man is becoming more and more dependent upon the service of electricity.

2. We can make electricity do most of our daily work.

3. Without the service of electricity we could not exist as we are in this modern age.

4. If electrical sources were properly managed we could all enjoy the service of electricity at a much reduced price.

5. Electricity is a good servant, but a hard master.

OBJECTIVES

1. A purposeful interest in:
   1. Our school laboratory.
   2. Electricity in general.
   3. Working with electrical equipment.
   4. Improving the appearance of our school laboratory.
   5. Making our school room a more enjoyable place to spend our time.
   6. Writing and binding books.
   7. In the activity of the group as a whole.
   8. An interest in the accomplishments of electricity in advancing the welfare of man.
   9. How vast amounts of electric power are produced and distributed.
10. The common terms and principles affecting the control and use of electricity.
11. Building and operating our own radios.
12. The use of electricity in our homes.
13. Cooperation of the group.

II. An appreciation of:

1. The opportunity of working with the group on this unit of work.
2. The fact that intelligent use of electricity means more today than the mere snapping off and on of a switch.
3. Problems involved in operating big power stations.
4. Electrical terms.
5. The vast number of things that we can do with electricity.
6. Group cooperation.
7. Our school room as a place to spend our time.
8. The comforts rendered us by the service of electricity.
9. The science of electricity.

III. A socially desirable attitude toward:

1. The scientific attitude in general and in particular to electricity and its study.
2. Toward cause and effect in electricity.
3. Of the observer, of one who intelligently sees
and examines the universe about himself.

4. Of confidence in the use of electricity.

5. Sharing the tools and equipment with other members of the class.

6. Our school activities.

7. The future use and supply of electric power.

IV. A skill in:

1. Manipulating the apparatus and the physical materials of electrical nature in the home, such as electric stoves, electric lighting, radio, refrigerator, doorbells, electric fans, etc.

2. Using the simple electrical nomenclature correctly.

3. Working with electricity effectively.

4. The use of books, charts, maps, etc.

5. Reading intelligently and interpreting literature dealing with elementary electricity.

6. Interpreting electrical markings on electrical apparatus.

7. Using standard methods in keeping records and recording results in the study of electricity.

8. The use of the scientific method of investigation in the study of electricity.

9. Controlling an electric current making use of resistance boxes, ammeters, voltmeters, watt-
meters, etc.

10. Interpreting the meaning of electrical measurements.

11. Calculating the operation cost of electrical apparatus used in the home.

12. Read the electric house meter and to calculate electrical cost.

15. Working safely with electric equipment.

14. Doing simple electric repair work in the home.

15. Make electricity a profitable hobby.

16. Determining electric cost and checking bills.

V. A habit of:

1. Cooperating with the other members of the class.

2. Playing safe with electricity.

3. Making the best possible use of electricity in our houses and shops.

4. Reading current events pertaining to electricity.

5. Taking proper care of the electrical equipment in our homes.

6. Determining electric costs and checking electric bills.

7. Selection of right lamps and lighting fixtures.
VI. A knowledge of:

1. Common terms and principles affecting the control and use of electricity.

2. The operation and care of electrical devices, such as bells, motors, washers, radios, batteries, stoves, irons, lights, refrigerators, etc.

3. Best lamps and lighting fixtures.

4. How the scientific method of investigation is applied to the study of electricity.

5. The meaning of the electrical markings on the electrical apparatus commonly used.

6. How an electric current is controlled by the use of resistance boxes, ammeters, and voltmeters.

7. Electrical measurements.

8. How to calculate the operation cost of the electrical apparatus used in the home.

9. How to read the electric house meter and to calculate the electric cost.

10. How to seal safely with electricity.

11. The different ways of producing electricity.

12. The principle of electrical resistance.

13. The principle of the incandescent electric lamp.

14. The applications that America's greatest industries make of electricity.
15. The relation between the amount of light and
the distance from the source.

16. How ultra-violet rays are produced.

17. The different type of arrangements of electric
lights in the room.

18. How light is affected by walls and ceilings.

19. The principle of the different types of bat-
teries.

20. The relation of electricity to weather con-
ditions.

21. The proper care of the different types of
batteries.

22. The magnet and the electromagnet.

23. The uses of the magnet.

24. The use of electricity in communication.

25. The simple radio.

ACTIVITIES

1. Make a list of the profitable things of electrical
nature that you want to do or to know.

2. Make suggestions regarding the plans or procedure
that we are to follow in discovering the magic of electric-
ity.

3. Collect as much literature and equipment for our
study or activities as possible.

You will be able to obtain all the small electric wire
that you need from old discarded electrical equipment. Visit the junk yards and the second hand shops of your location, collecting anything that you might use.

4. Write to the following places asking them to send any free material that they will send.

Western Electrical Instrument Company, Waverly Park, Newark, N. J.


National Advisory Council on Radio in Education, 60 East 42nd Street, New York City, N. Y.

5. Go to your school library and familiarize yourself with the literature that will help us solve our problems.

6. In order to produce an electrical charge, rub together two different substances. Some convenient ones would be your comb and your hair in dry weather, your dry hand and the family cat's furry back, a glass rod and silk, or hard rubber and wool. Bring the charged objects near small pieces of tissue paper, tin foil, silk, or feathers, and account for what happens.

7. Produce static electricity by friction, and determine its properties.

Try the following experiment: it works best in a dry, cold room. Rub a glass rod with a piece of silk, and
suspend it to a support by a fine silk thread. Rub another glass rod with silk and bring it near the end of the first. Note what happens. Repeat, using sealing-wax or hard rubber and a woolen cloth. Lastly, bring the charged sealing-wax near the end of the suspended charged glass rod.

The two sticks of sealing-wax possessed like charges of electricity, the two sticks of glass like charges of electricity, but the glass rod and the stick of sealing-wax possessed unlike charges of electricity. The glass was charged positive, and the sealing-wax was charged negative.

8. Explain to the class how "like" and "unlike" electric charges react to each other.

9. Construct and operate an electroscope.

Select a wide-mouthed bottle. Fit it with a cork or rubber stopper which is supplied with a heavy wire as a support for the leaf, as shown in Fig. 1.

Cut a circle of sheet metal about 1.5 inches in diameter. Bend the wire over for about a half inch in a hook and solder the metal disc on. Bend and clean the lower end of the wire, and fold over and glue on a piece of tin foil about a half inch wide and three inches long. Clean the bottle well, and dry it in a warm oven. Insert the stopper which is supplied with the wire supporting the metal disc on top and the foil on the bottom. Push the
cork down tight and pour melted paraffin over it and the electroscope is finished. The thinner the foil the more sensitive the electroscope will be.

10. Using the electroscope, determine the charges upon the objects that you charged by friction. Your teacher will explain to you how to use the electroscope.

11. Pass an electric wire that is carrying a direct current directly over the needle of a compass. Place the wire directly over the compass and then turn the compass around and around. Note and explain what happens.

12. Construct a galvanometer. Out of cigar box wood, build a small frame for the coil. As shown in Fig. 2, build the frame 1.5" x 2.5" x 1". Cut a round hole in the very center of the top about .25" diameter. Using No. 20 single cotton covered copper wire, and leaving about five inches free, start winding the coil on the left hand side of the frame. Wind three layers of 10 turns each on each side of the round hole. Secure the wiring with tape, and paraffin the coil. See Fig. 3.
Prepare a base with an upright wire as shown in Fig. 4. Magnetize two sewing needles and stick them, in opposite directions, through a piece of cardboard 1" x .25".

FIG. 3. Coil top.

FIG. 4. The galvanometer.

Suspend the needles with the cardboard through the hole with one needle just above the top of the coil and the other just below the top of the coil. See Fig. 5 for the finished product.

This galvanometer can be used for only small currents. The needles should be mounted so that they stand parallel to the wires in the coil when not in use. When a direct current is passed through the coil the needles are turned so that they stand perpendicular or cross ways to the wires of the coil.

13. Make a simple acid cell. Cut a strip of zinc and a strip of copper about six inches by two inches. Clean
the strips, and attach to each a copper wire. Then, making sure that they do not touch, place the strips in a quart jar which contains a dilute solution of sulfuric acid. Use eight parts of water to one part of acid. Making use of a galvanometer, test to see if a current of electricity is generated. This cell should ring a small electric bell. By connecting a number of the cells in series you can get a stronger current.

14. Construct and charge a lead storage battery. Set three wide mouth bottles in a row, side by side. These bottles should be about five inches high. Make a solution of sulfuric acid, using one part acid to eight parts water. Fill the bottles about three fourths full with this solution. Run about one inch wide lead plates from the middle bottles to each of the outside bottles, and then supply each outside bottle with one lead plate as shown Fig. 5. Mark one of the outside poles negative and the other positive. Charge with a regular battery charger or with four dry cells hooked up in series.

After the battery has charged for about twenty minutes, test for a current with your galvanometer. This battery will ring an electric bell or will operate a telegraph.
system for a short while.

15. Build a telegraph system, and operate it. Using a two by four by seven block of wood, drive a large nail in the middle of one side. This nail is to be the core for the electromagnet. Take just about one inch of the head part of another nail and solder it to the end of a rather stiff wire. Leaving just enough space for the sounder arm, make the wire into a spiral spring by wrapping it around some round object about one inch in diameter. Mount this as shown in Fig. 6. Also, looking at the drawing in Fig. 6, make a sending key. For this you will need two thumb tacks and a strip of elastic copper.

![Diagram](image_url)

**FIG. 6.** Telegraph sounder and key.

Connect one end of about No. 20 copper wire to one of the thumb tacks of the sounder, and make about forty wraps around the nail, connecting the free end to a binding post.

To operate, connect copper wires from the terminals
of a six volt battery to the two binding posts of the telegraph. By making two of these telegraph sending and receiving sets you will be able to click out messages to each other for some distance by connecting them in series with a battery. When you are receiving a message you must keep the key closed on your set.

16. Build a simple electric motor. Explain to the class how it operates. Any good general science book will explain how to build a simple motor.

17. Explain to the class how a simple motor works, pointing out the differences in it and the regular electric motor.

18. Interview some of the people of your home town that are supposed to know something about electricity, asking them any questions that you wish.


20. Make a list of the ways that electricity is used in your home, adding suggested ways that it could be profitably used.

21. Make a plan for any type of science data book that you wish to keep pertaining to electricity.

22. Write a play in which you might dramatize the contrast of our world without the service of electricity and of our electrical world as we find it to day, and with what it might be in the future.

23. Draw a diagram showing what happens when a hard
glass rod is rubbed with silk.

24. Prepare a large chart, illustrating the cause of lightning, and explain the principles involved to the class.

25. Report on current electrical happenings from time to time.

26. Set up a simple voltaic cell, using a glass beaker, copper and aluminum plates, and sulphuric acid solution. Test the cell, seeing if it will do electrical work.

27. Draw a diagram of the Voltaic cell showing the chemical action.

28. Give to the class an illustrated explanation of how electricity is measured.

29. Visit the telegraph stations in your town, reporting to the class your observations.

30. Plan an hour radio program, and give it to your class.

31. Visit the municipal electric plant, asking any questions that you wish, and finding out electric rates for your city or home.

32. Examine a regular lead storage battery, drawing a diagram of it which shows its construction and its chemical action.

33. Calculate the cost of studying by the light bulb in your study room for one night.
34. Draw up a plan by which our city could make more efficient use of electricity.

35. Calculate the cost of studying by the light bulb in your study room for one night.

36. Compute the electric cost for operating all the electrical apparatus in your home for one night.

37. Prepare and give a report on magnetism, bringing out something about the history of magnets, magnetic poles, action of magnetic poles, magnetic substances, magnetic induction, temporary and permanent magnetism, and the theory of magnetism.

38. Give a class demonstrated report on methods of making magnets.

39. Give a demonstrated report on different kinds of electromagnets.

40. Give a report on the use of electromagnets.

41. Draw a diagram showing the different parts of an electric motor and showing their functions.

42. Make a galvanometer, and convert it into an ammeter.

43. Give a demonstration and an explanation of series and parallel wiring.

44. Electroplate some object.

45. Prepare a report to be given to the class on the different kinds of storage cells.

46. Operate and examine all the parts of a telephone,
observing the functions of each part.

47. Build a simple teslar coil.


49. Explain to the other members of the class the action of radioactive substances, letting them examine the sphintaroscope.

50. Plan and give an assembly program in which you voice the true value and control of electricity.

51. Set up a model electrical home, and work out a budget by which you might operate it.

52. Build or make a poster, model, or any other effective means showing the ancient forms of communications of man contrasted with those that are used today.

53. Collect pictures out of old magazines and newspapers relating to the different ways of communication.

54. Draw up an electric control plan by which our world could have more electricity at a much reduced rate.

REFERENCES FOR JUNIOR CITIZENS


Boy Scouts of America, Electricity, New York, Boy Scouts of America, 1951.


Reh, Frank, Magnetism and Electricity, New York, American Book Company, 1931.

REFERENCES FOR THE TEACHER


LEADS OUT

1. To "Communicating with our Neighbors" through the study of radio, telephones, telegraphs, etc.

2. To "Solving or Discovering the Magic in Chemistry" through the relation of electricity to chemistry.

3. To radio through electrical interests.
UNIT THREE

EXPLORING OUR NEIGHBORS IN SPACE
INTEREST STORY

There are many astonishing beliefs and facts about the moon. The scientists say gravitational friction may cause the moon to disintegrate. What do they mean by gravitational friction? The scientists will tell us.

According to the English scientist, Jenes, the moon is doomed because of its continual effect of tides upon the earth. In some places the tides rise to enormous height. Unfortunately, the tides raised by the drawing power of the moon predict her ultimate death; for every tide she raises, just so much does her speed slacken by what scientists term gravitational friction. Slowly but surely the moon is being drawn toward the earth, and although it will require several billions of years, it is certain. It will come closer and closer until a danger point is reached; then will come the breaking up process, in which the moon will smash into thousands of small bodies, which in turn will fall upon the earth like giant meteorites and cause destruction all over the working, living world.

Although the moon is only some 236,000 miles from our earth, it will always remain perhaps more mysterious than any other revolving ball in the heavens. In our age, we shall see only half of its face. The reverse side remains an unsolved enigma to us. No man has ever seen it. There will be a time when the moon will no longer swing around and
around the earth. The lengths of our months and days will increase, say scientists. The days will overtake the months until they are both over 1300 hours or about 55 of our present days. Then not only will the moon always turn the same face to the earth, but the earth will always turn the same face toward the moon. They will move along together through space as though they were strung on a rigid bar.

Many people are able to find the face of a man in the moon. Can you? Can you find the giant crab, the hare, the young lady reading a book, the old lady, or the circus lady?

The man in the moon has been familiar to us since time immemorial. According to an old legend, the man in the moon was an old wood-cutter. The old wood-cutter was met by a fairy while carrying a bundle of sticks on his back on Sunday. The fairy stopped him and remonstrated with him for working on the Sabbath.

He laughed and replied, "Sunday on earth or Monday in heaven, it's all one to me!"

"Then carry your bundle forever," the fairy answered, "and as you regard not Sunday on the earth, you shall stand for eternity in the moon!"

Thereupon, the legend says, the wood-cutter was caught up with his bundle and cast into the moon.

How many figures are you able to find in the moon?

There are also legends for the other figures in the moon, and for the constellations. Do you know any?
POSSIBLE APPROACHES

1. Through a news article.
2. Through a traveling astronomer.
3. Through some unusual astronomical happening.
4. Through questions asked by the teacher.
5. Through questions asked by the student.

BIG IDEALS

1. Astronomy is the oldest and most exact of sciences except mathematics.
   2. Astronomy has given the race the means of measuring time and ascertaining direction.
   3. All perceptible light and heat, without which life itself could not exist, come from the sun and the other stars.

OBJECTIVES

I. An interest in:
   1. Astronomy in general.
   2. Stars, and their effect upon us.
   3. The moon and its effect upon us.
   4. The sun and its function in the solar system.
   5. Planets.
   6. The earth and its functions as a planet.
II. A skill in:

1. Recognizing the astronomical bodies.
2. Using astronomical nomenclature.
3. Reading and understanding astronomical writings.
4. Locating and naming constellations.
5. Reading astronomical literature.
6. Telling what time it is by the sun, the moon, and the stars.
7. Talking to people about astronomy.

III. A habit of:

1. Observing astronomical happenings.
2. Thinking in terms of your understandings of astronomy.
3. Reading astronomical reports in the newspapers and other writings.
4. Teaching our friends as much as possible about the facts of astronomy in order to do away with the survival of ignorance and superstition.
5. Making use of our understandings of astronomy.

IV. An appreciation of:

1. The broad outlook which one gets from understanding stupendous distances, masses, and forces of astronomical functions.
2. How small and insignificant we are relative to
the stupendous distances, masses, and forces of space.

3. What a wonderful instrument is the human brain to understand so much about astronomy.

4. The earth's, the suns, or even the solar system's small place in the universe.

5. Man's great accomplishments in relation to astronomical understandings.

6. The law of universal gravitation.

V. A knowledge of:

1. The powerful telescopes.

2. Stupendous distances, forces, and masses of space.

3. What the sun is and its place in the universe.

4. What the earth is and its place in the universe.

5. The great system of heavenly bodies.

6. Simple forces.

7. The causes of the seasons, and of day and night.

8. The causes of the tides.

9. The distances from us and the nature of the familiar members of the universe.

10. The phases of the moon, and the cause of eclipses.

11. The moon's affect on the planting of crops.
12. Latitude and longitude.
13. The relation of the sun to time.
14. The fact that there is no scientific evidence for the belief of astrology.
15. A knowledge of the law of universal gravitation.
16. The specific types of heavenly bodies, and of the major specific heavenly bodies.
17. The common astronomical terms.

ACTIVITIES

1. Make a list of questions that you wish to ask of astronomic nature. Compile the questions of the class, answering all of them that you can during your work with astronomy.

2. Do you know some astronomic legend as to why some figure is in the moon or about some constellation? If you do tell it to the class.

3. Ask an older person or your parents to tell you some ideas which people once held about the influence of the stars or the moon on men’s affairs, their health, or crops.

4. From time to time observe the moon. Try to discern different objects in it. Draw pictures of the moon, showing the different objects or figures that you are able to find.

When the moon is full it presents to most observers
what is popularly known as "The Man in the Moon." Still others see, in addition, the profile of a beautiful woman, "The Lady in the Moon." Some find a donkey, a crab, a girl, a lion, a dog, and, as the legend in the interest story of this unit, a hare. Fig. 7 shows the moon as the writer found it about eleven o'clock one night during fullmoon.

![Image of the Moon](image)

**Fig. 7. "The Man in the Moon"**

Can you find the smiling face of the "Man in the Moon?" Make your drawings of the moon as shown in Fig. 7, and then determine what is shown in it.

5. Make a report to the class on the moon, bringing out its origin, future, distance from the earth, its surface, diameter, periods of rotation, and other characteristics.

6. Give an illustrated explanation of the phases of the moon to the class. You can illustrate the phases of the moon using a basket ball or some other large ball, and a
flashlight or floor lamp. Have all the students gather together in the center of the room, having the room as dark as possible. Slowly carry the ball around the room, holding it up so that someone else might keep the light focused on it. The ball represents the moon, the lamp or flashlight represents the sun, and the group of students represent the earth. As you slowly walk counterclockwise around the room, have the other students note how the crescent of the lighted side grows larger and then smaller. Through close observation, thought, and some reading have a good report to give to the class. You should be able to make each member of the class understand the phases of the moon.

7. Take a photograph of the moon with your camera. On a clear night, point your camera to the moon. Focus your lens at "infinity." Use largest aperture for your lens. Leave the shutter open for several hours. When the film is developed the streak across the picture is the path of the moon.

8. Take a photograph of the moon with your camera by moving your camera so as to keep it focused on the moon. With the aid of your teacher devise a way to do this.

9. Give your reasons to the class for thinking an airplane will or will not ever travel from the earth to the moon.

10. Calculate the speed of the moon.
11. Find out the cause of the tides. You can find this in any good astronomy book. The boy scout book on astronomy gives a good discussion of it.

![Diagram of tides](image)

**Fig. 8.** Sun tides and moon tides occur together causing highest tides twice daily.

12. With the aid of Fig. 8 explain the cause of spring tides or highrising tides, and with the aid of Fig. 9 explain the cause of neap tides or lesser tides.

![Diagram of tides](image)

**Fig. 9.** Sun tides and moon tides oppose each other causing two moderate and two small tides daily.

13. Build a telescope, using two convex lenses and two mailing tubes. Your teacher will explain to you how to do this. Examine the moon through it.
14. With the aid of some of the books listed in your references, gather all the facts you can about the sun and the members of the solar system. Record all the information obtained in a large table chart as shown in Fig. 10.

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**FIG. 10. Solar System information table chart.**

15. Find out from an almanac what planets are visible tonight. Determine in what part of the sky each will be found and what time of night will be best to observe them. Locate the planets at night, watching the path of each planet for several nights or weeks.

16. Make a model illustrating the rotation of a planet on its axis and the revolution of the planet in its orbit around the sun.

17. Draw diagrams to show the planets in their orbits.

18. Give a report on the cause of day and night.

19. Give a report on the cause of winter and summer.

20. Cut circles of paper to illustrate the relative sizes of the planets and the sun.

21. Using your information table, calculate the speed
of each of the planets.

22. Make a star map to show the north star, and the constellations that you can readily locate in the heavens. On a perfectly clear evening choose for your observations a locality as free from street lamps and electric lights as possible. Face towards the north. Locate the north star, and place it upon your map. Then place all the other stars or constellations on the map in respect to the north star.


25. Explain longitude and latitude to the class.

26. Give a report to the class on the importance of the sun.

27. Give a talk on the different kinds of heavenly bodies.

28. Give a talk on how time was reckoned in clockless ages.

29. Explain to the class how time is measured today, that is, how it is determined and how used.

30. Give a report on how location, distance, and direction are determined.

31. Explain to the class why summer days are longer than winter days.
32. Write a paragraph telling in imagination what would happen if the force of gravitation should suddenly stop in the universe.

33. Explain by using two laws why the heavenly bodies move around the sun in regular paths.

34. How many miles does light travel in one second, in one minute, in one hour, in one day, and in one year?

35. Define light year, galaxy, lunar eclipse, solar eclipse, meteor, comet, planet, satellite, solar system, revolve, orbit, mass, gravity, rotate, and earth.

36. Smoke a piece of glass and examine the sun through it.

37. Make a list of and define all the new words that you have learned during your work with astronomy.

38. Answer the following questions:
   a. What is a light year?
   b. What is the Milky Way?
   c. Why do scientists believe that the earth is a sphere?
   d. Why do objects fall toward the earth?
   e. How do scientists explain the difference in the length of days and nights at different times of the year?
   f. Why should you not believe in astrology?
   g. What is astronomy?

39. Read an interplanetary fiction story. Point out
the impossible things done by the characters in the story.

40. Write a fiction story making it as true as possible to the facts that you have learned about astronomy.

REFERENCES FOR THE JUNIOR CITIZENS


REFERENCES FOR THE TEACHER


LEADS OUT

1. To any type of nature study.
2. To a study of light.
3. To a study of transportation through discussions of flying in space.
4. To work with radio through a discussion of the possibility of talking to the other planets
UNIT FOUR

CONSTRUCTING AND OPERATING OUR OWN RADIOS
INTEREST STORY

Imagine that you have walked into a scientist's laboratory; that you have asked him, "Just what is a radio, anyway? Who discovered or invented it? How does it work? Could I build and operate a radio? How much would it cost me?" Would you like to know the answer to these questions? We can work out the answers to these questions, and many more. We can get an understanding of the groundwork that forms the solid foundation of the whole of radio. Then we can actually plan and build our own radios. We can also build a radio sending station, send messages, and receive them over our own sets. The cost will be very little.

POSSIBLE APPROACHES

1. Through the requests of the students to build and operate radios.
2. Through some student bringing a radio to class.
3. Through an interesting radio program given in the school.
4. Through placing a radio in the school room.
5. Through questions asked by the students.
6. Through some radio faddist giving a talk on radio.

BIG IDEALS

1. Radio is accomplishing great things.
2. No other practical scientific accomplishment embodies so wide a variety of natural phenomena as does radio.

3. The principles and uses of radio are well worth a little attention by any of us.

4. There is now no place in the world where it is impossible to intercept radio messages.

5. Amateur radio represents, to upwards of fifty-five thousand people, the most satisfying, most exciting of all hobbies.

6. Nothing in American economic life has paralleled the rapid growth of the radio industry.

7. Like all other great inventions radio can become, as indeed to a certain extent it has already become, a power for evil.

8. It possesses an unpredictable and immeasurable potency to enlarge and enrich the range of human interests or to stunt and misdirect them.

9. One of our duties is to stimulate and study the radio game, and to devise and promote good programs.

OBJECTIVES

1. A purposeful interest in:
   1. Making and operating crystal detector receivers.
   2. Constructing and operating simple vacuum tube receivers.
3. Radio parts and symbols.
5. Messages of the future.
6. Telephotography and television.
7. The function of the different parts of the radio.
8. Understanding the groundwork that forms the solid foundation of the whole of radio.
9. The radio game.
10. Devising and promoting good radio programs.

II. A skill in:
1. Making and operating crystal detector receivers.
2. The construction and operation of simple vacuum tube receivers.
3. Reading radio symbols.
4. Drawing radio plans using radio symbols.
5. Tuning and selectivity.

III. A habit of:
1. Neat accurate work in the construction of simple radios.
2. Planning radio construction with an understanding.
3. Using radio symbols in taking radio notes and
making radio plans.

4. Listening to important announcements over the radio.

5. Keeping up with the radio.

6. Making your own plans for the construction of the different parts of a radio.

7. Finding out the science of your radio instruments.

IV. An appreciation of:

1. Neat, accurate work in radio construction.

2. The value of radio symbols.

3. The work of amateurs with radio.

4. Radio programs.

5. Radio reports on weather.

6. The value of the vacuum tube in making radio possible.

7. The service of radio communication.

8. The lively appeal of radio to the imagination.

9. Radio as a science and art.

V. A socially desirable attitude towards:

1. The progress and use of radio.

2. Radio reception not always being perfect.

3. Radio programs.

4. The use of radio.

5. The future use of radio.

6. The radio for pleasure.
VI. A knowledge of:

1. How to construct and operate crystal detector receivers.
2. How to construct and operate simple vacuum tube receivers.
3. The radio parts and symbols.
4. The function of the different parts of simple radios.
5. Wave-length and frequency.
7. The meaning of modulation.
8. A general understanding of radio transmission and reception.
9. How to construct and operate a simple sending station.
10. How different stations can operate at the same time.
12. Control by radio.
13. The action in a vacuum tube.
14. How radio programs are broadcast.
15. How the earphones reproduce sound.
17. The national aspects of radio.
18. The evils of radio.
ACTIVITIES

1. Prepare a large poster showing the common radio symbols. You must be able to translate into English the radio wiring diagram symbols which are commonly used before you know what to buy and how to wire them. The symbols given below will enable you to translate wiring diagrams. Include them on your poster.

- **Aerial or Antenna**: Single wire or set of wires for picking up the radio waves from the air.

- **Ground**: Connection with the ground through some object or structure, which will conduct an electric current.

- **Coil**: A coil of insulated wire so made and placed that it aids in tuning.

- **Crystal Detector**: A special crystal which will allow electricity to flow but one way.

- **Phones or Receivers**: The instruments that one hears through.

- **Fixed Condenser**: A condenser in which the capacity cannot be changed.

- **Variable Condenser**: A condenser in which the capacity can be changed.

- **Battery**: To furnish an electric current.

2. Make plans for the type crystal radio that you wish to make. There are many ways to mount a crystal radio, on a flat board, in a small box, etc. There are also many possible ways to connect the wires from the different parts.
of the radio. Activity No. 3 gives the plan for making one type of a simple radio. You may follow it if you wish. You may add to this simple radio, as is brought out in the following activities, or you may make the parts different from the given plan.

3. Construct a simple crystal radio.

a. Obtain the items listed below and arrange them as directed in the following procedure.

1 base board, any well dried piece of wood about 8 by 9 inches.
2 brass furniture tacks.
2 small staples.
70 feet of No. 22 insulated copper wire.
1 empty oat meal box about three inches in diameter, or any piece of non-metallic tubing of similar dimensions. A pint ice cream box is just the thing that you need.
1 strip of tin one by one half inch.
1 foot of large copper or brass wire about the size of a coat hanger.
1 crystal in solder.

b. Saw the base board 8 by 9 inches, and sandpaper the top and edges. Place the board on the table before you.

c. Wind and mount the coil. There are a number of different ways to make the coil. You may
make it according to the plan given below or according to one of the plans given in activity No. 2. A simple way to make the coil is to punch two holes in the cardboard tubing, side by side. Punch one of them 1/4 inch from the edge. Starting from the outside of the second hole, run about six inches of the wire in and out the first hole. Draw the wire tight and wind on about fifty turns, and punch two holes through which to run the wires and tie them. Leave about 1/2 inch unwrapped on each end of the coil.

Placing the beginning holes down, and using two tacks to hold it in place, mount the coil on the back of the base board two inches from the left side with the free end of the wire running to a tack one inch from the left side. This is the post that you connect the ground too. Run a connection from this tack to a tack one inch from the sides in the front left hand corner. This tack forms one of the poles for the ear phones.

Scrape the insulation off an inch portion or strip across the front of the coil. Bend a large copper wire into a lever shape and mount as shown in Fig. 11, using staples to
hold the lever firmly in place. Make sure that the lever arm contact has tight contact with the scraped strip across the face of the coil. You can now very the contact on the coil by turning the lever from one side to the other.

Run a wire from the lever to a tack one half inch from the sides in the back right hand corner. To this tack you connect the aerial wire.

**d. Mount crystal detector.** Cut a strip of tin one by one half inch, and nailing through the center, nail it one inch from the front and three inches from the right edge. Place the crystal just over the nail head and fold the tin well up around the sides of the crystal. Run a wire from the crystal holder to a tack one inch to the right of the tack that is already in the front left hand corner. This is the other post for the ear phones.

Scrape about a foot of the insulation off the small copper wire. Wrap about thirty wraps of it around about four inches of the larger copper wire. Then pull off about half of the spring that you have made. Bend about one fourth inch of the free end of the spring
straight down and file it to a sharp point. Punch the other end of the large wire into a nail hole one inch to the right of the crystal and bend it over so that the sharpened end of the spring wire is just in contact with the crystal. Run a wire from this large wire to the tack in the back right hand corner.

e. Erect the antenna or aerial. Suspend the aerial between two elevated points using insulators. It should not be less than 30 feet high and its length should be at least 75 feet. Any copper wire larger than No. 18 will do for the aerial. Run a wire from one end of the aerial to the radio. A more complete description of the aerial is given in activity No. 5.

f. Ground the radio. For the ground wire connect a wire onto some metallic object that runs directly into the ground. A more complete description of the ground wire is given in activity No. 8.

g. Connect the aerial to one of the tacks in the back corners and the ground onto the other. Connect the ear phones to the tacks in the front left hand corner, and place them upon your head. Shift the crystal contact from place to place. What program do you hear?
Your radio should look something like the one below in Fig. 11.

**FIG. 11.** How to connect a simple crystal set.

**FIG. 12.** A diagram using symbols of a simple crystal set.

4. Examine all the connections in and to your radio set. Make sure of good connections, as an electric current must flow through each of the wires of your set, including the aerial and the ground wires.

5. Put up a good cheap receiving aerial at your home. Your father will be glad to buy what few materials necessary. There are a number of different types of aerials, but a
A good single wire aerial is just as good as any for home use.

You can use any size of copper wire that is not smaller than No. 18 for a crystal radio, but for a tube set the wire should be larger. You can make a good aerial by twisting together about six strands of No. 24 copper wire. The wire need not be insulated, but an insulation does not hurt. The aerial should be at least thirty feet above the ground, and should be of such a length as to make the total length of the aerial, the lead in wire, and the ground wire not more than 150 feet.

You will need the necessary aerial wire, two screw eyes, two insulators. Cut the aerial the length needed, and slip each end through a hole in an insulator and twist it fast. Cut off and slip two more pieces of wire through the other holes in the insulators and twist them fast. Fasten one to as high an object near a window as possible, by stretching the wire tight, secure the other to any other object of about the same height.

Connect the antenna lead-in wire well onto one end of the antenna. Let it pass down and through a hole in the window sill to the radio set. The lead-in wire should be well insulated where it passes through the building.

6. Look up plans for other types of aerials.

7. Connect a lightning arrester between the lead-in wire and the ground.
8. Connect the ground wire. Use wire that is as large as No. 10, and make a good connection that runs straight to the ground. If you tie onto a water pipe be sure to scrape the connection portion good.

9. Make a large poster showing the aerial and lightning arrester connection.


11. Make a slide tuning coil.

12. Make a poster showing schematic diagram of your simple crystal radio, as shown in Fig. 12.

13. Add condensers to your simple crystal radio set. Connect small condenser across the ear phone posts, and a large condenser in parallel with the ear phones and crystal as shown in Fig. 13.

14. Prepare a large room poster, as in Fig. 13, showing the symbolic diagram of a complete crystal radio with condensers. Label each part.

15. Construct a condenser of tinfoil and glass plates.

16. Set up and operate a simple buzzer sending set. This will be a miniature radio station.

You will need an induction coil, or spark coil as it is called, that will give a spark of at least 1/2 inch, three dry cells, or any source of about 6 volts of direct current, and a few feet of about No. 10 wire.

Connect the batteries in series, and connect one end
of them to a key, and the other end to one of the binding posts on the base or front of the spark coil. Then run a wire from the other end of the key to the other binding post on the front or base of the coil. Prepare a spark gap between the two binding posts on top of the coil: run a piece of pointed wire from each post so that there will be a spark gap of 1/16 inch.

FIG. 15. Showing condenser connections.

FIG. 14. Diagram of sending set.

Then connect about an eight foot aerial to one of the top binding posts, and ground the other top binding post. Your sending set is now ready for use as is shown in the diagram of Fig. 14.
After having set up the sending apparatus as above explained arrange a receiving set near the transmitter. Ground the receiving set in the usual way, and supply it with an aerial of the same length of the sending set. You will get better results with the receiving set which is supplied with condensers. Operate the buzzing set by opening and closing the switch. Tune in on the buzz with the receiving set. You should be able to send a buzz code message over these sets for at least fifty or more feet. You do not have to keep the sets in the same room.

17. List as many things as you can that radio is used for.

18. List all the things that you can that would be impossible without the aid of radio.


20. Explain to the class the theory of your simple radio sets.


22. Explain to the class how different stations can operate at the same time.

23. Draw a diagram and explain how a vacuum tube operates.

24. Give a class report on why reception is not always perfect.

25. Explain telephotography and television to the
26. Have a class discussion of messages of the future.

27. Have a general class discussion on how radio is to be controlled in the future.

28. Find out what the United States Radio Laws state about wave length, power, operating hours and kinds of apparatus for amateur radio stations; whether a license is necessary for all such stations, whether the operator needs a license; how one knows what calls to use at an amateur station.

REFERENCES FOR JUNIOR CITIZENS


REFERENCES FOR THE TEACHER


LEADS OUT

1. To communication in general.

2. To electricity.

3. To communication in the future.

4. To transportation.

5. To safety.
UNIT FIVE

PLAYING SAFE
INTEREST STORY

The car was gleamingly beautiful as it sped down the straight highway. Its sweeping airfoil design, its speedy movement of long flowing grace seemed to harmonize with the straight, but watery pavement, which had just been washed by a summer shower.

Then came a little slip. The front right wheel slipped off the pavement, and jumped back on. The car swerved to the left and started back to the right, lifting the front wheels high off the ground and giving it a spin. Careening and rolling, it plunged down a bank, battering and smashing its occupants every inch of the way. Smashing knees and splintering shoulder blades, cutting legs and arms clean to the bone through veins, arteries and muscles like a piece of beef under the slash of a butcher's knife, the car swirled to an insane stop by wrapping itself completely around a large oak tree.

Just imagine that you were in this wreck. Think of seeing the splintery end of a post come through the windshield, tearing off heads on its grotesque mission. Take a look at yourself as the men in the white jackets lift you from the ground to the stretcher as the realization that your leg or arm is missing distracts your attention from the screams and groans of others.

The above is not scare-fiction, but it is a descrip-
tion of what happens day by day. What are you going to do about preventing such happenings? Why not play safe?

POSSIBLE APPROACHES

1. Through the occurrence of any accident.
2. Through newspaper articles.
3. Through first aid talks by members of the class.

BIG IDEAS

1. When we come to know the true meaning of safety we realize that far from taking the adventure out of life, it is the very thing which is going to help us put adventure into life.

2. It is well worth our time to stop and weigh the value of our acts to see whether the chance taken is really worth while.

3. Society demands that the individual be a self-protective body and always conscious of the effects of his actions on group life.

4. The individual should demand that society work out plans and programs increasing group efficiency and individual advancement.

5. With the automobile has come the problem of moving traffic efficiently and expeditiously and the still more serious problem of moving it safely.

6. Whether on the highways or elsewhere, the benefits
of what has been called the Machine Age have become an integral part of our national life and the solution of the problem of accidents lies in the adjustment of the individual rather than in any far-fetched scheme which attempts to halt progress.

7. A knowledge of first aid is of great practical value not only to the individual, but to the public at large, and not only in our industries but everywhere.

OBJECTIVES

I. A purposeful interest in:

1. The safety problem in general and its solution.

2. Individual responsibility in the safety problem.

3. Individual information in safety.

4. Doing something about safety.

5. The public agencies working for safety and health.

6. Gaining a knowledge of safety practices.

7. Educating others in safety principles.

8. Our traffic problem.

9. The art of driving.

10. First aid in general.

11. Essential information in safety.

II. A skill in:
1. Setting up apparatus and doing experiments safely in the laboratory.
2. First aid in general.
3. Dealing with machinery safely.
4. Operating a car.
5. Driving according to traffic regulations.

III. A habit off:
1. Stopping and weighing the value of our acts to see whether the chance taken is really worth while.
3. Following the best possible first aid practice.
4. Not taking unnecessary, careless or foolish risks.
5. Protecting ourselves and others at play.
6. Driving more safely and walking with more care when in the way of cars.
7. Not leaving anything to careless chance.
8. Not running needless risk because of ignorance or lack of thought.
9. Avoiding risks which no amount of skill can make safe, such as walking across trestles, trying to beat trains over crossings, driving cars at high speed with worn-out tires on the front wheels, looking down gun barrels, swimm-
ing after eating, and playing with blasting
caps.

IV. An appreciation of:

1. One's own safety.
2. The fact that modern life finds itself
continually growing more complex.
3. The fact that the twin menaces to safety
everywhere are ignorance and carelessness.
4. Safety education.
5. The fact that the individual is constantly
thrown into myriads of ramified situations.
6. Safety being a key word in our process of
individualization and socialization.
7. The extent to which science is applied to
every phase of life in order to enjoy safety.
8. First aid.
9. Prevention being recognized as far better than
cure.
10. First aid as being a means of protecting against
death or alleviating pain by immediate action
in case of accidents.

V. A socially desirable attitude toward:

1. The meaning of safety.
2. The relation of the safety of the individual
to the safety of society.
3. Dangers of our Machine Age.
4. The safety demands of society.
5. The advantages of safety.

VI. A knowledge of:

1. The different causes of accidents.
2. Best precautions against general accidents.
3. Best precautions against the major specific accidents.
4. The great unnecessary sacrifice of human life because of ignorance and carelessness.
5. The ramified situations which the individual is constantly thrown into.
6. The fact that prevention is far better than cure.
7. The different types of motor vehicle accidents, and the relative danger of each.
8. How to help avoid motor accidents.
9. How to cooperate with traffic officers.
10. The traffic regulations of the community and something about the uniform vehicle code.
11. The most common physical defects of motor vehicles that may cause accidents.
12. The major hazards of operating motor vehicles.
13. What the community and state are trying to do.
15. How to put out different types of fires.
16. How to use the fire extinguishers.
17. How to call the fire department.
18. The cause and prevention of railroad accidents.
20. The common home accidents and how to prevent them.
22. Safety in the different industries.
23. General first aid.
24. How to treat cuts, lacerations, abrasions, scratches, bruises, sprains, strains, fractures, sunburn, scalds, etc.
25. What to do for bites of poisonous snakes or dog bites.
26. What to select for a home or school first aid kit.

ACTIVITIES

1. Make a survey of your community to find out how accidents occur in your community. You might, in your survey, concern yourself with the accidents which have happened during any past period that you wish. A period of one year is very desirable.

You shall not have any difficulty in getting people to tell you about their accidents. People who have been in an accident usually like to tell just how it happened.
You might prepare and have them fill out an accident sheet.

After all the information possible has been collected compile the data and make a count of the total number of accidents reported.

2. Make a large wall poster showing the different types of accidents happening in your community for the past year with the number of each.

3. Try to account for each of the major accidents reported in activity one. Hold class votes to determine a judgement of each accident.

4. Make accident report posters, on which you report the different types of accidents occurring in your community during the past year, with the number of each type given. Place the posters in public places.

5. Make a survey of school safety. Hold an open house forum. Discuss the accidents that have occurred in your school, the causes, and how they could have been prevented. Give suggestions as to how similar accidents are to be prevented in the future.

6. Make a report list of all the accidents that occur in school for one month, and give this report to the principal of your school. He should be very interested in it.

7. With the aid of the newspapers, and any other available sources, make a report on the types and numbers of motor vehicle accidents that are occurring through the
country. From the facts collected concerning the accidents fill in the blanks in the following list of one month:

<table>
<thead>
<tr>
<th>Type of Accident</th>
<th>Number of Accidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor-car striking pedestrian</td>
<td></td>
</tr>
<tr>
<td>Motor-car colliding with motor-car</td>
<td></td>
</tr>
<tr>
<td>Motor-car colliding with railroad train</td>
<td></td>
</tr>
<tr>
<td>Motor-car colliding with electric train</td>
<td></td>
</tr>
<tr>
<td>Motor-car striking bicycle</td>
<td></td>
</tr>
<tr>
<td>Motor-car striking house-drawn vehicle</td>
<td></td>
</tr>
<tr>
<td>Motor-car colliding with fixed object</td>
<td></td>
</tr>
<tr>
<td>Operating accidents without collision</td>
<td></td>
</tr>
<tr>
<td>Non-operating accidents</td>
<td></td>
</tr>
</tbody>
</table>

8. From the report of activity No. 7 answer the following questions:

   a. What class of accidents is responsible for
      the most deaths?
   b. What proportion of these accidents come from
      the two most important types of accidents?
   c. What proportion comes from the next most
      important two accidents.
   d. Which class of these accidents do persons of
      your age most need to look out for?

9. Make a list of ways to help avoid motor accidents.

10. Make a list of ways in which we can cooperate
with the traffic officer. Comment on each if you wish.
Below are a few examples.

a. Do not try to outwit and oppose traffic officers. Without them we should be in a helpless tangle with our cars on the street.

b. Obey all traffic signals even if no officer is watching.

11. Make a list of traffic accident facts which will make you think. Examples are given below:

   a. During 18 months of the World War, 50,510 American citizens were killed or died of wounds. During 18 months of 1926-1930, 50,900 persons were killed in automobile accidents.

   b. About nine out of ten of the cars that killed thirty-three thousand persons last year had nothing wrong with the car. The faults were with the drivers and the pedestrians.

12. Make a collection of traffic accidents from newspapers.

13. Write a short slogan that might be used in a traffic safety campaign. Sketch a safety poster in which this slogan is incorporated.

14. Hold a general discussion of starting, stopping, turning, and parking a car. Discuss such things as correct signals for right turn, left turn, and stop; as to where your car should be in the roadway for a left turn, a right
turn, or a straight drive at an intersection; correct and incorrect parallel parking; and correct and incorrect angle parking.

15. Plan and prepare posters on all types of car safety.

16. Organize and operate a school boy patrol for your school if it is necessary. The function of the school boy patrol is to instruct, direct, and control the members of the student body in crossing the streets at or near schools.

17. Find out, if possible, from your county traffic officer or city authorities the number of traffic injuries and deaths in your community for the past year, and fill out the report below.

   a. Total population......................
   b. Number of accidents................
   c. Number of deaths....................
   d. Number of injuries...................

18. Find out the number of traffic injuries and deaths in your state for the past year, and fill out the report below. This information may be obtained from the Department of Public Safety, State Capital.

   a. Total population......................
   b. Number of accidents................
   c. Number of deaths....................
   d. Number of injuries...................

19. Explain to the class why it is so dangerous to start a motor in a closed garage.
20. Make a list of common accidents to pre-school children. Try to explain the causes of these accidents. Suggest prevention for each.

21. Make a list of the hazards that may exist in or about homes. Below are some examples:
   a. Unprotected stoves or fireplaces.
   b. Leaving matches where children can reach them.
   c. Allowing children to play with certain kinds of toys.

22. Make a survey of your home and list some of the danger points which you can in some measure correct.

23. Make a list of "Donts" on home safety.

24. List some safety precautions your mother should observe in the kitchen.

25. If you are employed, list dangers connected with your work and give precautions that you are expected to observe. If you are not employed, answer the above questions for your father or your mother.

26. List the fire hazards existing in your community and describe some ways in which you can help to correct them.

27. Explain to the class how the fire alarm is given in your school, your home, and in your community.

28. Give a general report on how to put out different types of fires.

29. Make and operate a simple fire extinguisher.
You will find directions given for the construction of a simple fire extinguisher given in a number of general science books.

30. Make a list of all the possible chances for an accident in your normal life, and give precautions for each.


32. Make a list of the common poisons and give the antidote for each.

33. With the aid of a first aid book prepare yourself for applying first aid in the case of the following: shock or prostration, asphyxiation, broken bone, burns, poisons, scratch or cut, bleeding, bruises, sprains, drowning, sunburn, snake bites, poison ivy, fainting, sunstroke, foreign body in eye, etc.

REFERENCES FOR JUNIOR CITIZENS


Meredith, Cliff, Fire, New York, Reynol and Hitchcock, 1934.


REFERENCES FOR THE TEACHER


LEADS OUT

1. From the automobile to transportation in general.

2. From electrical accidents to work with electricity in general.

3. From fire accidents to fire in general.

4. From first aid to medicine.
In this elementary science curriculum development there are three "bed-rock" sources for foundations from which to build used: the preamble of the Constitution of the United States, the Children's Charter, and the Social-Economic Goals of America.

In order to stay in harmony with the trends in educational ideas and with secondary school practice a brief analysis of foundations, qualities, criteria, and trends of unit teaching was made. An effort was made to write these foundations, qualities, criteria, and trends into the activity units.

From the analysis of the sources of objectives and trends in educational ideas it is evident that there must be no place in this new program for the teacher who is in love with science subject matter as such. The facts and principles of science must be used only as tools. They must be placed in the background and used only as a means to contribute to the needs and interests of the child and of society.

Science concepts in an elementary science curriculum should be used as tools when objectives are to be accomplished, not as the objectives.

The units that are given are themselves the real conclusions in regard to the coordination of science concepts and accepted sources and trends of unit teaching.
BIBLIOGRAPHY

Brenholtz, Harold, and Matthews, J. C., Building Interest Guides, Denton, North Texas State Teachers College, 1934.

Clouser, L. W., Education Experience Through Activity, Units, New York, Lyons and Carnahan, 1933.


Lincoln Elementary School Staff, Curriculum Making in an Elementary School, Boston, Ginn, 1927.


Stevens, Marion F., Activity Curricula in Primary Grades, New York, D. C. Heath and Company, 1931.