OUTLINES IN NATURE STUDY AND HISTORY

ANNIE G. ENGELL

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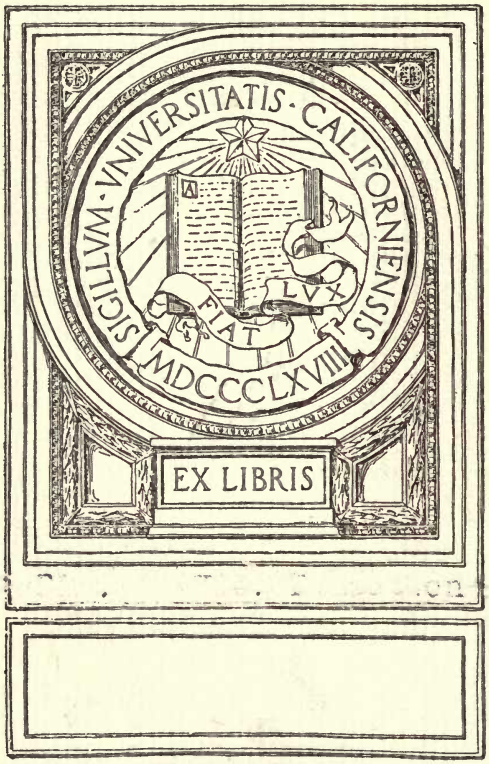
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OUTLINES IN NATURE STUDY AND HISTORY

A TEXT-BOOK

FOR PUPILS IN ELEMENTARY SCHOOLS

BY

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NOTE TO TEACHERS.

The most advanced thought on systematic education considers the harmonious development of all of the intellectual faculties, together with the relative value and interdependence of the three aspects of mental operations, — intellect, feeling, and will. Formerly, when the aim of education was conceived to be the acquisition of a fixed number of facts in certain branches rather than the development of mental power, memory was the only faculty deemed worthy of receiving special training.

The preëminent value and importance of memory cannot be denied, but it can be properly strengthened and developed only by a judicious training of the other faculties. "Seek ye first the kingdom of intelligence, and all knowledge may be added unto you."

Growth of intelligence requires and presupposes a world of sights and sounds by means of which mental activity may be stimulated. According to Herbert Spencer, "No act of cognition can be absolutely free from emotion." Therefore, Nature Study is a means particularly adapted to the attainment of intellectual power. It should be presented so as to arouse curiosity, engage attention, direct observation, and inspire a desire to investigate causal conditions.

In this way the powers of comparison, judgment, and reasoning will be supplied with material calculated to stimulate their activity, and the storehouse of memory will become filled through the child's own efforts. Lack of interest in this branch of study is owing principally to its being made symbolic rather than natural.

All information cannot be acquired by personal investigation for obvious reasons. Most knowledge obtained in later years must of necessity be symbolic. For this reason, it is well, in connection with so concrete a subject as Nature Study, to inspire the intensest love of research, and also to show the child the proper use of text-books, and to train him in the best methods of study.

After a subject has been thoroughly investigated and comprehended, to make it valuable to the student it must be memorized for future use. Train the children, therefore, to study by heart and not by rote. They will not memorize the mere words of a book unless permitted or obliged to do so by an inefficient teacher. The printed sentences of a text-book or the script of dictated notes should not, under any conditions, precede or supersede the thorough observation and investigation of the real thing. The text-book should be used only for reference and review.

When a child has been thus trained to the proper use of a text-book, the burden of study in more advanced grades will be decreased and the pupil will "know that he knows," or will be equally positive when he "knows that he does not know" a subject. Habits of intelligent study are thus formed which will be of infinite value to him whether his attendance at school be for few or many years.

The primal object of language work in elementary schools is to develop in the child the power to express his thoughts in well-constructed sentences. The difficulty which confronts many teachers is that the child has no thoughts to express. Clear and well-defined thought will assist greatly the power of expression. The need of a book to fill these requirements has been recognized by many. By placing such a book in the hands of the pupils, the boundaries of the schoolroom will be widened, and home and school life will more nearly become a unity.

The presentation of questions was designed to stimulate curiosity in the child and indicate a line of observation and investigation outside of school hours. It was further intended to create discussion and to lead pupils to talk fluently as well as to think logically. The real knowledge which the child gains through his own effort and experience he will only too gladly disseminate among his companions, and he will come to the class filled with enthusiasm for the subject, — the enthusiasm of discovery. In this way some additional time will be gained for the teacher in the well-filled school day.

All of the questions are answered somewhere in the book, although it may not be in the summary immediately following. Were this the case, there would be a possibility of the work's deteriorating into the mechanical answering of questions, and the object of the book would be defeated.

The questions on a subject may be assigned to the class for consideration.

When the conversational lesson takes place, it should be accompanied by as much concrete material as possible, and also by drawings illustrating various parts of the lesson. Because the child's own work will be more valuable to him, it was deemed advisable in a book of this character to omit all illustrations. These drawings should be made by each child in a book devoted to the purpose and retained for future reference. A collection of as many specimens as possible should also be made.

Following all this work of investigation and discussion should come the written account of the subject by each pupil. Power to express thought will develop rapidly in this way.

The summary can be used as a reading lesson for general review — a ready reference by which the memory can be refreshed from time to time. The drudgery of note-taking, with its deleterious effects on both spelling and writing, will be avoided.

By this method Nature Study and language work can be combined as a preparation for more formal study. Power to think incisively and accurately will be developed, as well as power to express resultant conclusions in well-arranged sentences, and thus will be accomplished the end and aim of language work in elementary schools.

ILLUSTRATIVE LESSONS.

Before starting the lessons in Nature Study, the teacher should familiarize herself with the subject matter of every summary. Every question contained in the book is answered in some one of the summaries on the subject.

For each lesson there should be concrete material in the schoolroom. When the real objects cannot be secured, pictures may be substituted. Pupils and teachers must coöperate in obtaining this material.

The lessons are so arranged as to lead the pupils to see that there is much to learn about each subject. For this reason the questions precede the subject matter. In order that the teacher may know how to use these lessons most profitably the following work on plant study has been outlined: —

FIRST DAY'S LESSON.

Teacher: — "To-morrow we will commence to study about plants. You have all seen plants growing. Sometimes we have them growing in the schoolroom. Many of you have them at home. They can also be seen in the various public parks. You must all examine some and find out all that you can about them. When we come to school to-morrow we will tell each other all that we have learned.

"On page 1 in your book on Nature Study and History you will find questions about plants. Read these questions and find the answers to as many of them as you can. Any one who wishes to do so may bring a plant or a part of a plant to school."

SECOND DAY'S LESSON.

Teacher: — "How many children read the questions about plants? How many children can tell us something that they learned from examining some plants?"

The children are then to be given an opportunity to talk, — each child telling to the class all that he has found out on the subject.

In this first talk on plants, the teacher may consider all of the questions or as many as seem best fitted to the needs of the class, directing the attention of the pupils to the others, and telling them that this knowledge they will learn in later lessons. In each lesson the teacher may supply any information which the pupils cannot discover for themselves. This talk is simply an introduction to the study of plants. The class is now ready for the lesson on the development of the plant from the seed.

THIRD DAY'S LESSON.

The teacher must provide some dried peas, beans or corn for the use of the pupils during this lesson. These can be purchased at any seed store.

The dried seeds are to be distributed among the pupils. Each child will examine and make a drawing of the seed on his own desk. The teacher may then collect the seeds and place them in two tumblers, half the quantity in each.

Teacher: — "You all see that I have placed half of the seeds in each of these tumblers. The seeds in one glass are to remain dry. We will cover the seeds in the other glass with water. To-morrow we will look at them again and see whether the seeds in the two tumblers look just as they do now."

FOURTH DAY'S LESSON.

The teacher will have the pupils examine and compare the seeds in the two tumblers, and then have the pupils note the difference and state the effect of the absorption of water.

Each pupil will now receive a soaked seed, and make a drawing of it beside the drawing of the dried seed previously made.

The soaked seeds may now be planted by the pupils. Place some in moist sawdust, some in raw cotton (in a tumbler of water), and some in moist soil.

Enough seeds should be planted to give one to each pupil on the following day.

FIFTH DAY'S LESSON.

Remove the seeds from the sawdust, soil, and cotton, and distribute them among the pupils.

Have the pupils describe the condition of the seed. Each pupil will make a drawing, showing one day's growth.

Return the seeds to the tumblers. A few of them may be retained for the purpose of investigation.

Open these and have the pupils see the seed leaves and radicle. The pupils may now watch for these to appear in the seeds that are still growing.

Each succeeding day's lesson is to consist of similar observation, conversation, and drawing, to show the growth and development until a perfect plant is formed, showing root, stem, and leaves.

During these lessons some plants should be placed in the dark. Some should be placed where they will receive no heat; others should be given no moisture. Lead the pupils to note the effect of depriving the plant of light, heat, or moisture, and also to see the necessity of these elements to plant growth.

Show the pupils also that the plants would not continue to grow and thrive in either sawdust or cotton because these do not contain materials for nourishing the plant such as are found in soil.

After these talks, have each pupil write an account of how a plant grows from the seed. The summary can be used as a reading lesson for review. It is also to be used by the pupil as a reference with which to refresh his memory from time to time.

Succeeding lessons in Nature Study and History are to be conducted according to the same methods. Observation, investigation, and discussion along the line indicated by the questions must always precede the written lesson.

OUTLINES IN NATURE STUDY.

I. PLANTS.

PLANTS IN GENERAL.

Conversational Lesson.

Compare the stems of a number of plants. Name some plants that have soft stems; woody stems. Name some whose stems or branches are covered with bark.

Which plants are called herbs? shrubs? trees? How do shrubs and trees resemble each other? How do they differ?

What are vines? In what various ways do they climb? Name some that climb by means of tendrils; rootlets. Some that climb by winding the plant itself around its support.

Compare these classes of plants with reference to their length of life, size, shape, etc.

On what do plants feed? What do they breathe? Which part of the plant performs the work of breathing? What other uses have the leaves? How does a plant provide for its future growth? Name some plants in which the seed pod is made attractive so that the seeds will be planted elsewhere. Name some plants in which the material for future growth is stored in the seed leaves.

Name some plants in which the material for future growth is stored in underground stems; in the roots.

How are the seeds of the pine tree protected? Why is the chestnut encased in a burr? Why has the walnut so hard a covering? Of what color is the covering of the walnut? the filbert? the chestnut?

Of what advantage is it to the tree that the seed cover should be of this color? Why should the seeds of these plants be so fleshy?

Why are the unripe fruits of various trees and bushes green in color?

Of what use to plants are insects? Of what use to plants are the color and the fragrance of the blossoms? Of what use are thorns to plants?

Of what use is rain? snow? How do worms assist the growth of plants? In what ways are air and wind of use to plants?

How do beasts, birds, and streams assist in scattering seeds?

Of what uses are plants to beasts? birds? reptiles? insects?

In how many ways are plants useful to man? Name some plants that furnish us with food, medicine, dyes, perfumes, building materials for houses, furniture, vessels, fuel, etc.

Watch some flowering plants to observe their habits. Some blossoms close at twilight; some close during the heat of the day. Why? Why is the sunflower so called? Why is the moonflower so called? Why is the heliotrope so called? Why has the morning-glory its name? Some blossoms are open at night; to what animals are they of use? Some flowers are supplied with hairs so arranged that insects cannot enter them. Other flowers have their parts so arranged that insects can enter, but cannot leave them.

Plants have many peculiar habits; some like plenty of water; some grow best among rocks.

DEVELOPMENT OF THE PLANT FROM THE SEED.

Examine some peas, beans, corn, wheat, and other seeds. Soak some of these seeds for twenty-four hours, and then examine them again to find out what effect the soaking has had.

Plant some of these seeds and watch them grow. Pull them up from time to time to see how the root is growing. These can be planted in moist earth, sawdust, or raw cotton. Keep the materials moist. Another way is to cover a tumbler of water with a piece of netting or other thin cotton goods, and place the soaked seeds on the wet cover.

Make a drawing of the dry and the soaked seeds; also daily drawings to show the growth.

What things are necessary to the growth of a plant? Where does it obtain its food or the materials for making it grow? Will a plant grow in the dark? in the cold? where there is no moisture? in extreme heat? Place some of the growing plants under these various conditions and observe the effect upon them.

What things are necessary to the growth of plants?

How are plants supplied with light, heat, and moisture?

In the larger cities there are many places which can be visited for the purpose of examining numerous varieties of plants. In Philadelphia, for instance, Bartram's Garden and Horticultural Hall contain many species of plants.

A visit to the woods and fields will be the means of obtaining much interesting information.

Summary.

After the seed has been placed in the soil, it receives heat from the sun, and moisture from the rain. These cause the seed to burst open. It sends a tiny root down into the ground and a stem up through the ground. The stem grows above the ground and bears leaves and flower buds. These flower buds grow larger and become flowers. Inside of the flower is the fruit. After the flower petals fall off, the fruit grows larger. In the fruit we find the seeds for new plants.

The root also grows larger. It takes in food from the soil for the growth of the plant.

Light, heat, air, moisture, and earth supply the plant with materials for its growth.

ROOTS.

Conversational Lesson.

What is a plant?

Name the parts of a plant. Where is the root of a plant? Of what uses is it to the plant? How do roots vary in size and shape? Do all plants need the same kind of food? Why do farmers change the kind of crops in a field in different years? Where does a plant obtain its food? What brings food to the roots of plants?

Collect as many different kinds of roots as possible. Make drawings of them to show the different shapes. Many roots can be planted in moist sand in September, and the growth of the plant watched.

Summary.

A plant is anything that grows with a root, stem, and leaves.

The root of a plant absorbs food from the moist ground. It also furnishes

a base which supports the plant in an upright position. It fastens the plant in the ground so that it can most easily obtain the necessary food.

Roots vary in shape. Some have one main body which is broad at the top and tapers toward the bottom. Among roots of this kind are the radish, carrot, beet, and turnip. These roots are furnished with hair-like rootlets, which absorb the liquid food.

Others have no main body, but are made up of a number of fibrous branches. These are either thread-like or fleshy. Among roots of this kind are those of the morning-glory, dahlia, sweet potato, grains, and trees.

Plants having thick, fleshy roots store up material in the root on which the plant can live during the winter, or be prepared to renew its growth the next spring.

STEMS.

Conversational Lesson.

Make a collection of as many stems as possible. Examine their structure with a microscope and find out how it differs in different plants. Also find out how the stems differ in size and shape.

As the stems of many plants will decay in a short time, drawings of them should be made to show the various shapes.

Where are stems of plants? Of what uses are they to the plant? How does the sap get up into the stem?

(To find this out, hold a strip of muslin with one end in a basin of water, and see what happens.)

Is the sap of all plants the same? Of what use is sap to a plant? What causes a flower or part of a plant to wilt when it is plucked? What two things cause the earth in a flower-pot to become dry?

Why are some plants supplied with thorns?

Summary.

The stem is the part of the plant which rises above the ground and bears the leaves and flowers. The stems carry the sap from the root to the leaves, where it is acted on by the air, and a part of the moisture is taken from it and sent out by the leaves. The sap then goes through the stems to every part of the plant to supply it with materials for growth.

Stems are of many different shapes. Some are round and solid like a cylinder. Among these are the violet, honeysuckle, etc. Some are shaped like a half cylinder, as the palm. The stems of some plants are hollow, as in grasses and grains. Some plants have stems that are jointed, as grains, the carnation, and the bamboo. Some stems are thick, with several flattened sides, as the stem of the squash. Some are flattened, as that of the onion. Others are kidney-shaped, as the rhubarb.

Some stems are supplied with thorns to protect the plant against snails, slugs, and other creatures that would injure it.

In the class of plants called shrubs the stems are woody. The trunk and branches of trees are covered with bark.

The sap of some plants is thin and watery, while that of others is thick and gummy. Among the plants whose sap is thick are the fir, rubber-plant, cherry, and pine.

In some plants the sap is colored. Among these are the poppy, milkweed, sorrel, sumac, etc.

LEAVES.

Conversational Lesson.

Where are the leaves of plants? Of what uses are they to plants? What would be the result if all of the leaves were removed from a plant? Why would this happen?

Examine as many different leaves as possible and compare their edges, the number of parts of which they are composed, the arrangement of their veins, etc.

Examine the leaves of the ivy, the violet, the rose, the lilac, the wistaria, the cypress, the larkspur, the strawberry, the clover, the horse-chestnut.

Which of these leaves have one part? Which leaves are composed of several parts?

Examine the leaves of the morning-glory, the geranium, the peach, the begonia, the fleur-de-lis or flag, the lilac, the carnation, the pine, and various grasses. How do they vary in shape? What is the shape of each of these leaves?

What kind of edge has each of the following leaves, — the lilac, the rose, the violet, the maple, the oak, the daisy, the buttercup, the dandelion, the rose-geranium, oxalis, etc.?

Examine the veins and find out the arrangement of the lobes and notches in reference to the veins.

Find some leaves which have a pointed tip; some that have a rounded tip; some with a notched tip. Compare also the bases of leaves. Find some that have a heart-shaped base; some that have a flat, broad base; some that have a tapering base. Notice how the leaf and the stem are joined in different plants.

Examine a number of plants to find out how the leaves are arranged on the stem, — whether they are single or in groups; whether they are opposite or alternate, etc.

How are the leaves of the following plants arranged: the morning-glory, the maple, the ivy, the horse-chestnut, the cedar, the daisy, the wistaria, etc.?

The surfaces of leaves are of different kinds. Examine the

leaves of the lily, the lilac, the geranium, strawberry, etc., and find out how their surfaces differ.

Compare the upper and under surfaces of leaves.

Examine a number of leaves and find out how their veins are arranged. Of what use are veins?

A collection of leaves should be made, consisting of as many varieties of leaves as possible. These can be pasted on cardboard, and drawings of them made to illustrate the differences of shape, edge, etc.

Use a magnifying glass to examine the leaves and their various parts.

Summary.

Leaves of different plants vary in size, from the tiny leaf of the forget-me-not to that of the elephant's ear.

Some leaves are simple and some are compound (that is, composed of several parts or leaflets). Among the simple leaves are those of ivy, geranium, sweet william.

Some compound leaves are those of the rose, the clover, the pea, the bean, strawberry, etc.

The edges of some leaves are notched in various ways, — as the rose, the violet, the holly, the cherry, the willow, the palm, etc.

The edges of some leaves are plain, — as the carnation, the morning-glory, the clover, the elephant's ear, etc.

Some leaves are lobed and also have notched edges, as the maple.

Some leaves are lobed and have plain edges, as the sassafras, the oak, the rose-geranium, etc.

Leaves are of various shapes. Among these are heart-shape, as the morning-glory; oval, as the leaflet of the rose; needle-shape, as those of evergreens; lance-shape, as that of the peach; shield-shape, as those of the nasturtium and the geranium.

Some leaves are thick, as those of the mullein and India-rubber plant; some are fleshy, as those of the portulaca. The surface of some leaves is smooth,

as the ivy and laurel. Others have a hairy surface, as the mullein, geranium, and strawberry.

The veins of leaves are arranged in various ways. Some are parallel and extend from base to tip, as in the lily of the valley, the fleur-de-lis, etc Some are feather-veined, as the rose, the lilac, the oak, etc. Some are hand-veined, as the ivy, the geranium, the nasturtium, etc.

Leaves of plants vary in color. Generally they are green, of various shades, as the nasturtium, the palm, the rose, etc.

Others have leaves of some other color, as the coleus, the mullein, the silver maple, the miller's plant, Japanese honeysuckle, ribbon grass, etc.

The leaves of some plants have a pleasant odor, as the pine, geranium, mint, lemon, etc.

Leaves are of use to the plant in absorbing light and heat. They also take in material from the air (carbonic acid gas) which acts on the sap so that it will give more nourishment to the plant. Leaves also send out moisture which the plant does not need.

FLOWERS.

Conversational Lesson.

Of what use to the plant is the flower? Which part is called the calyx? the corolla? the stamens? the pistil? Why is the end of the flower stalk called the receptacle? To what is the pistil fastened? Of what use is it? Of what use are the stamens? Of what use are insects to flowers? Of what use is color to flowers? Of what use are flowers to insects? Of what use are flowers to birds? Why are some flowers open at night? How do the corollas of different flowers vary in structure, size, shape, color, number of parts, etc.?

What injury is it to pluck the blossom of a plant?

How do flowers vary in their arrangement on the stem or

branch of a plant? Name some flowers that are fragrant. Of what value is odor to the plant?

As many blossoms as possible should be examined with the aid of a magnifying glass, and their various parts observed.

Drawings to illustrate the various parts and shapes should also be made.

Summary.

The blossom protects the seed pod. It is composed of several different parts. These are the calyx, the corolla, the stamens, and the pistil. The receptacle is the end of the stalk which holds all of the parts of the blossom together.

The calyx is the green covering between the stem and the corolla. "Calyx" means cup, and it is so called because it holds and protects the rest of the blossom.

The corolla is that part of the blossom inside of the calyx. It is either white or colored, but very rarely green. It contains a sweet fluid, on which many insects feed. Its color is useful to attract insects. It protects the honey for which the insects visit the plant, and it protects the pollen which is the food of the seed vessel.

The stamens are a number of slender, thread-like parts inside of the corolla. At the top of each stamen is a little box or ball containing yellow dust called pollen.

The pistil is that part of the plant which is attached to the seed pod at its base. The pistil is in the center of the stamens. It is capped by a rough, moist knob. The pollen of the stamens falls on this knob and is used to nourish the seed in the pod at its base.

Winds and insects assist in causing the pollen to reach the pistil.

The colors of flowers attract insects, which are useful in supplying the seed vessel with the pollen.

Flowers vary in color and in the arrangement of their various parts.

Sometimes the corolla is composed of a number of parts, as in the buttercup, the apple-blossom, the dandelion, etc. In some plants the corolla consists of one part, as the morning-glory, phlox, spring beauty, etc.

The corolla is of various shapes. Among these are bell-shape, as the lily of the valley; star-shape, as the quaker lady; salver-shape, as the geranium; funnel-shape, as the morning-glory.

The corollas of some flowers are irregular in shape, as the violet, the sweet pea.

Some flowers grow singly, as the pansy, the violet, buttercup, the quaker lady, etc. Others grow in clusters, as the lily of the valley, hyacinth, mignonette, golden-rod, clover, yarrow, etc.

The stripes in the petals of some flowers all point to the place where the insect can obtain honey.

The hairs which are on the petals of some flowers prevent the entrance of insects (such as the ant) which would obtain the honey without benefiting the plant by dusting the pollen on the seed vessel.

Some flowers have no pollen. Bees, butterflies, and moths carry pollen from other flowers to those that have none.

FRUITS AND SEEDS.

Conversational Lesson.

When the flower petals fall off, what part of the plant develops rapidly? Where is the fruit while the blossom is still on the plant?

Of what use to the plant is the fruit? What injury is done to the plant if the blossoms are plucked?

Of what uses are fruits to man?

Examine as many fruits and seeds as possible in reference to their difference in structure, size, shape, color, number of cells, and seeds.

Soak and open a number of seeds, and observe the parts inside of the seed.

Summary.

When the seeds have been sufficiently nourished by the pollen, the stamens and corolla are no longer needed. These fall off, and the sap that is sent through the blossom stem is used for the growth of the seed pod.

When the seed vessel is ripe it is called the fruit.

Fruits are arranged in classes according to the covering of the seeds and the arrangement of the seed cells.

Some fruits have a thin, dry covering composed of several valves, which split open. Fruits of this kind are called pods, as the pea, bean, willow, larkspur, etc.

Some fruits have a covering that is not composed of separate parts, as the buttercup and various grains.

In some plants the seeds have a thick, hard covering, as the walnut, filbert, acorn, almond, etc.

In some plants, the inner wall of the seed holder becomes thick and hard and the outer part becomes fleshy, as the peach, plum, prune, olive, cherry, etc.

The seed cells of some fruits have horny walls surrounded by a fleshy covering, as the apple and pear.

The seeds of some fruits are not arranged in cells but have a fleshy covering in which they are distributed. A fruit of this kind is called a berry, as the currant, cranberry, tomato, watermelon, cucumber, squash, orange, banana, etc.

Within each seed is a tiny plant consisting of a radicle (stem) and seed leaves. At one end of the radicle is the plumule, which grows upward and forms the stem. The other end of the radicle grows downward, and becomes the root.

Some seeds contain one seed leaf, as the various kinds of grain. In some other seeds there are two seed leaves, as the pea, bean, morning-glory, almond, etc.

The seeds of pine trees contain several seed leaves.

TREES.

Conversational Lesson.

Why are trees plants? What difference is there between trees and other plants? What is the main body of a tree called? What is the difference between a stalk and a trunk? Which live longer, — plants with woody stems, or those whose stems are not woody?

How do trees indicate their age? During which seasons do trees grow? Of what uses to the tree are the following: the roots? the sap? the trunk and branches? the leaves? the bark? the fruit? Of what use are leaves after they fall from the tree? Compare the bark of different trees and find out some that have smooth and some that have rough bark. Compare also in reference to color, thickness, etc.

How does the chestnut tree protect its seed leaves? the walnut? the pine? Why are the seeds protected in this way? Of what uses are trees to man? to beasts? to birds? to insects? Name some trees of which we use the bark, the bast, the sap, the leaves, the fruit, the seeds.

Name some trees that furnish materials for each of the following purposes: food, medicine, fuel, shade, building purposes, etc. From which part of a tree do we obtain cork, quinine, olive oil, material for making matting, baskets?

Of what uses are the maple, sugar maple, birch, yellow pine, white oak, walnut, peach, India rubber, fir, cinnamon, nutmeg, palm, olive, cinchona, ash, white pine, linden or lime tree, willow, elm?

Which part of each of these trees do we use?

What are forests? Of what uses are forests? Name some trees that are found in forests.

Of what wood is each of the following articles in the schoolroom made: floor, desks, teacher's desk, chair, blackboard frame, bookcase, lead pencil, etc.?

Examine a cross section of a tree and observe the pith, the rings of growth, the sapwood, etc.

A collection of the different kinds of wood should be made, as well as a collection of leaves. These should be drawn, also, to indicate how the leaves of trees differ in size, shape, arrangement, etc.

A visit to the woods or to a park will be a means of obtaining much valuable information. Bartram's Garden, in Philadelphia, contains many varieties of trees and plants.

A dictionary or encyclopedia, and many other books in any public library, will furnish much information in reference to trees and other plants, their uses to us, the uses of their different parts to the trees themselves, etc.

Summary.

Plants are divided into three classes, according to their length of life and kind of stem. These are called herbs, shrubs, and trees.

Herbs are plants with soft stems which do not live through the winter. Sometimes the root remains alive and the plant grows again in the next spring. Sometimes the root also dies. Among plants of this kind are the morning-glory, pea, dandelion, carnation, etc.

Shrubs are plants with many woody stems rising from the root. They are generally less than ten feet high. They are able to endure the winter season. Among plants of this kind are the blackberry, spiræa, hydrangea, and syringa or orange blossom.

Trees are plants with woody stems branching from a trunk. They grow from ten to sixty feet high. The trunk is generally somewhat conical in shape, larger at the base and tapering toward the top.

The part of the tree that is just under the bark is the only part that is really alive. This is called the sapwood. Through the sapwood the sap starts to rise in the spring to feed all of the parts of the tree that are above the ground, so that they can grow. A new layer of wood is thus formed each year. During the winter season the tree ceases its work of growing.

The pith in the center is white and soft, and always remains the same. Young trees grow faster than older ones. For this reason the rings near the center are thicker and plainer than those near the bark.

A forest is a large tract of woodland that has never been cultivated.

The moisture in the form of rain, snow, etc., that falls in forests, does not run off on the surface. The snow melts more slowly in the forest than it does in other places, and the moisture from the rain and snow sinks into the ground, and forms springs which come to the surface and supply creeks and streams with water.

Trees purify the air for human beings. The leaves take in carbonic acid gas from the atmosphere and send out oxygen. The roots absorb moisture from the ground and send it out slowly into the air through the leaves. The leaves absorb heat and light for the use of the tree, thus further modifying the temperature. Forests influence the rainfall, modify the climate, and afford protection and homes to many animals.

Trees furnish us with food, medicine, fuel, shade, materials for building purposes, such as houses, vessels, furniture, etc.

PARTS OF PLANTS USED FOR FOOD.

Conversational Lesson.

Name some plants that furnish us with food. Name some plants of which we eat the seeds; seed-covering; roots; stems; sap; bark; leaves.

Why is it that some plants are not used as food? What property must a plant possess to make it valuable as food?

What color is the covering of the walnut, the filbert, the chestnut, etc.? Of what advantage to the tree is it that its seed-cover should be of this color? Why are these seed-covers so hard? Why is the chestnut covered by a burr?

What parts of the seed do we eat in these foods? Why are they so fleshy?

Why are many unripe fruits and berries green in color? Why are ripe fruits of various bright colors?

Name some plants whose roots are used for food. How do they differ in color, size, shape, arrangement, etc.? What is the reason for the fleshy texture of these roots? By what means do these roots perform their work of absorbing liquid food from the ground?

From what part of the plant do we obtain each of the following foods: celery, rice, pepper, mustard, nutmeg, cinnamon, vanilla, coffee, cocoa, tea, chestnut, walnut, water cress, onion, spinach, strawberry, olive, fig, date, watermelon, white potato, etc.?

Toward which end of the potato do the eyes of a potato curve? Which part of the potato does the farmer plant?

Collections of roots, stems, leaves, fruits, seeds, etc., that will not decay should be made. Pictures of many of them can be found in seed catalogues. Drawings of each class of foods should also be made.

Summary.

The roots of some plants are used for food. Among these are the turnip, carrot, radish, beet, etc. These roots were used by the plants for storing food to assist the growth of the plant during the following year.

Among stems that are used for food are those of the celery, rhubarb, asparagus, white potato, and onion. The white potato is an underground stem, bearing tiny buds and leaves (eye and scale). The onion is a short, undeveloped, underground stem, bearing a great many crowded leaves which overlap each other.

Among seeds which are used for food are peas, beans, celery seeds, rice and other grains, pepper, coffee, mustard, nutmeg, vanilla beans, cocoa beans, and the kernels or seed leaves of various nuts, such as the chestnut, walnut, filbert, etc.

Some plants whose leaves furnish us with food are the cabbage, celery, tea, parsley, lettuce, water-cress, spinach, thyme, sage, sweet marjoram, etc.

The seed-covering of some plants or fruits is used for food. Among these are the apple, date, prune, peach, pineapple, blackberry, strawberry, olive, pepper, etc. Cinnamon is the inner bark of a tree.

HOW PLANTS ARE PREPARED FOR FOOD.

Conversational Lesson.

Of what use is food to us? Why are some plants used for food?

Name some plants that furnish us with beverages, — tea, coffee, cocoa, wine, cider, etc.

From what plants do we obtain extracts or essences for use as flavoring, such as vanilla, lemon, etc.?

Mention some oils that we use for food, and tell from what part of the plant each is obtained.

What is meant by seasoning? Mention some plants that are of use for this purpose. From which part of each plant is this food obtained?

How do we obtain sugar, molasses, cinnamon, and other spices?

Summary.

Some plants furnish us with material for making beverages. Tea is made from the leaves of a plant that are gathered and dried. This plant grows principally in China.

Coffee is the seed or bean of a plant. Each berry contains two seeds. The seeds are removed from the fruit, freed from every particle of covering, and thoroughly dried. The coffee plant grows in parts of South America and the East and West India Islands. It grows only in warm countries. Cocoa is made from the ground bean or seed of a tree that grows in Central America and the West India Islands.

Wine is made from the pulp and juice of grapes. Vinegar and cider are made from the juice of apples.

Spices are also obtained from various plants. Nutmeg is the dried seed of a juicy, pulpy fruit that looks something like a mellow peach. The tree on which it grows resembles the laurel. Cloves are the unripe flower buds of a tree. Cinnamon is the inner bark of a tree. The finest cinnamon is obtained from the new shoots that spring from the roots.

Mustard is the powdered seed of a plant. Pepper is made by powdering the dried berry of the pepper plant. All of these spices grow in the East and West India Islands. They grow only in warm countries.

From some plants we obtain oil. Olive oil is pressed out of the pulp and seeds of the fruit of a tree. The seeds of the cotton plant furnish us with oil. Vanilla extract is obtained by soaking the vanilla bean in alcohol and adding water and sugar.

Flour is obtained by threshing the grain from its husk. The grains are ground and crushed between heavy rollers. The flour is then separated from the hull by being passed through very thin material called bolting cloth.

Sugar is obtained from the sap of the sugar cane. Sugar cane is cut into pieces and boiled until a thick syrup is obtained. This is separated into two parts. The thick fluid is molasses, and the remainder, or sediment, is brown sugar. It is whitened by another process. We obtain sugar also from beets and certain kinds of maple trees.

Some plant foods are not fit to eat until they are cooked. The heat acts on the materials in them in such a way as to make them of more use in nourishing the body. Sometimes they need heat and moisture also. When flour is made into bread it needs fermentation, moisture, and heat to render it fit for use as food.

II. THE HUMAN BODY.

GENERAL PLAN OF THE HUMAN BODY.

Conversational Lesson.

What are the principal divisions of the human body? To which part are the arms and legs joined? What forms the framework of the human body? How is the skeleton covered? With what are the muscles covered?

In which part of the body is the brain? the stomach? the heart? What other organs are in the trunk? Where are the blood vessels? What uses has the blood?

Summary.

The human body is made up of two principal parts, the head and trunk. To the trunk are attached the arms and legs. It consists of a bony skeleton covered with flesh (or muscles) and fat. Throughout the flesh are blood-vessels through which the blood flows to carry new materials to the different parts of the body and to take away those which are worn out.

The flesh is covered with two layers of skin. At the ends of the fingers and toes are nails, and on the head there is a growth of hair. There are also fine hairs all over the body.

The trunk is like a house with two rooms in it. In the upper chamber are the heart and lungs. In the lower chamber are the stomach, liver, and intestines. These two chambers are separated by a large muscle.

The bony part of the head is called the skull. Inside of the skull is the brain, from which the nerves radiate to all parts of the body.

HOW TO TAKE CARE OF THE HUMAN BODY.

Conversational Lesson.

Why do we need food? How much food do we need to eat? What is meant by nourishment? What is the result if we do not eat enough nourishing food? if we eat too much?

What else besides food do we take into our bodies? Of what use is air to us? What organs in the body use the air which we inhale? What is done with the air after the blood has used it? What kind of air do we breathe out?

What is meant by exercise? Of what value to us is exercise? What is its effect on different parts of the body? What is the effect of too much exercise? too little? What is the use of sleep?

Why is it necessary to bathe the body frequently? Why must the clothing be changed frequently at all seasons of the year?

Why do we need clothing? Do we wear the same kind and amount of clothing at all seasons? What changes do we make?

Summary.

To keep the body healthy we must care for it in many ways. We must eat enough wholesome food to nourish it well. We must breathe pure air at all times, when we are asleep as well as when we are awake. The whole of the body must be bathed, and clean clothing must be put on frequently. We should dress according to the weather, varying the kind and amount of clothing according to the temperature and the amount of moisture. Each part of the body must have the proper kind and amount of exercise to enable it to do its work well. The body must be held in an erect position in sitting

or standing. A sufficient amount of sleep and rest is necessary to the health of the body. We must avoid the use of stimulants and narcotics.

FOOD — WHOLESOME AND UNWHOLESOME.

Conversational Lesson.

Why does the body need food? What causes the different parts of the body to wear out? To what does food become changed before the body can use it? How much food does the body need?

Why are those foods unwholesome that are not easily digested (or made into blood)? Why is it unwise to eat too much food? Why is it injurious to eat between meals? Is unripe fruit wholesome or unwholesome? Why?

Name some classes of food that the body needs. Why is it injurious to eat too much sugar, oil, starch foods, etc.? Why is it injurious to eat foods that contain too much nourishment?

Why should food be properly cooked?

Summary.

The body is constantly wearing out, and needs new material to build up the different parts. The food that is eaten is made into blood. The blood carries these new materials to each part of the body. Food should contain the kind of material that the body needs for its nourishment.

Wholesome foods are those that contain the materials necessary for the growth and repair of the body. They are easily digested. Unwholesome foods do not nourish the body, or they are not easily digested. Some unwholesome foods interfere with the building up of the body. Foods that contain too much nourishment are unwholesome if taken in large quantities.

Digestion is the process of changing the food into a condition to be taken into the blood.

The first thing necessary in the process of digestion is thoroughly chewing the food and mixing it with the saliva that is in the mouth. The food then passes down the gullet to the stomach. The stomach contains a fluid called gastric juice, which is mixed with the food by the churning action of the stomach.

From the stomach the food passes into the intestines, where it is acted on by several other fluids. All through the intestines are tiny blood vessels which absorb material to make blood.

CLEANLINESS AND BATHING.

Conversational Lesson.

Use a magnifying glass to examine the skin. Find out how many layers of skin cover the body. Of what use is the skin? Of what uses are the oil glands and sweat glands? What property of the skin permits us to move in any direction?

How does the skin help to purify the blood? How does it help to regulate the heat of the body? What causes the skin to become dirty?

How does the skin wear out? Why is it necessary to bathe the body frequently?

Summary.

The skin which covers the body consists of two layers. The outer layer is the scarf skin. The inner layer or true skin is filled with blood vessels and nerves. The use of the scarf skin is to protect the true skin,

The skin is also furnished with oil glands and sweat glands. The oil glands secrete oil which nourishes the skin. The sweat glands send waste matter out of the body. Perspiration is of use in regulating the temperature of the body.

The scarf skin is constantly wearing out, and falls off in tiny scales. The oil and sweat cause the dead skin to stick to the body and also attract floating dirt and dust. If the skin is not washed frequently, the tiny glands get clogged, and the body will become unhealthy. Every part of the body must be washed often so that the skin will be able to do its work properly.

We should put on clean clothing frequently, because clothing holds the scales of the dead scarf skin, which is constantly wearing out.

CLOTHING IN HOT AND COLD WEATHER.

Conversational Lesson.

Is the body warm? Is it warmer or cooler than the air around us? Prove this with a thermometer.

How does a piece of heated metal or other article become cool? How does the human body lose its heat? What effect has fanning the body? Why?

In what way does clothing protect us from heat? from cold?

What effect has the wearing of woolen clothing? Why does it cause us to feel warm? What effect has the wearing of cotton clothing? Why?

Examine pieces of silk, wool, cotton, and linen goods with a magnifying glass. What is the difference in their fibers? Which is the warmest? Why? Which is the coolest? Why?

Why do we wear hats in summer?

Summary.

The heat of the body is constantly passing off from the surface. Anything that causes the heat to pass off more rapidly makes us feel cooler. Anything that prevents the heat from leaving the body makes us feel warmer.

In cold weather we wear woolen clothing to prevent the heat from escaping from the body, and also to protect it from the cold air.

In summer we wear thin cotton or linen clothing so that the heat of the body can easily escape. This also permits the fresh air from the outside to reach the skin, and thus assists it in cooling the body. Clothing also protects the body from the heat of the sun.

THE TEETH.

Conversational Lesson.

Examine the teeth of a cat, dog, horse, cow, etc., as well as those of people. Of what use are teeth? On what does each of these animals feed? Compare our teeth with those of these animals. Are our teeth all of one shape? Of what use are the teeth of each shape? How many teeth have we in each jaw? How many teeth of each kind have we? What is meant by a tooth decaying? What are some of the causes of decay? Why does a tooth ache? Of what use is the enamel? Why is it necessary to cleanse the teeth as well as the rest of the body?

How many sets of teeth do we get? Why are we supplied with a second set? What are the differences of size and shape of the teeth in the two sets? Why do we have twenty teeth at first and thirty-two later?

Summary.

The teeth are hollow and are made of a hard, bone-like substance, covered with enamel. They are fastened in the jaws by roots. Each tooth is supplied with a nerve. The part of the tooth that we see is called the crown. There are thirty-two teeth in a full set, sixteen in each jaw. Beginning at the middle of each jaw, there are, on each side, two incisors or cutting teeth, one canine or dog tooth, and five grinding teeth.

The cutting teeth or incisors have sharp edges for cutting or biting the food. Animals that gnaw have teeth of this kind. The canine or dog tooth is sharp for tearing food. Animals that feed on flesh need teeth of this kind.

The grinding teeth are large, strong teeth, and they have broad surfaces for grinding the food. Animals that feed on grass or grain have teeth of this kind. The first two grinders are called bicuspids because they have two points or cusps. The last three grinders are called molars.

Teeth decay when the enamel begins to wear out. This is caused in various ways. Food that is too hard or too hot or too cold will cause the enamel to crack. Picking the teeth with a pin, biting thread or string, cracking nuts or other hard substances are likely to injure the enamel and cause the teeth to decay.

The teeth should be thoroughly cleansed after each meal.

THE LUNGS AND BREATHING.

Conversational Lesson.

Examine the lung of a chicken to obtain an idea of the color and texture of the material of which our lungs are made.

Look at pictures of the lungs to find out their shape.

Where are the lungs? For what are they used? How do they obtain air? Of what two movements does breathing con-

sist? What movement is made by the lungs when we inhale air? When are the lungs larger, — when we breathe in air or when we breathe out air?

What kind of blood is sent to the lungs? What kind of blood leaves the lungs? What is the difference in the color of pure and impure blood?

Why is the breath warm when it leaves the body?

Breathe on the bulb of a thermometer. What is the result? What does this prove? Breathe on a piece of looking-glass. What is the result? What does this prove? Breathe into a bottle containing lime water. What is the result? What does this prove?

What causes hiccoughs?

Summary.

We have two lungs in the chest. They are made of pink, spongy material, and are filled with blood vessels and air cells. We use the lungs for breathing.

Breathing consists of two movements, one by which we breathe in air, and the other by which we breathe out air. We breathe in pure air and we breathe out impure, poisonous air.

The object of breathing is to purify the blood. The pure air which we inhale contains oxygen. It enters the blood and changes it to a bright red color.

The air which we breathe out takes impurities from the blood. It contains carbonic acid gas.

The pure blood flows from the heart through the body to carry new materials for building up the different parts of the body. It also gathers the waste material from each part of the body. This makes it impure and dark in color. Then it returns to the lungs, where it gives up its impurities and receives a supply of pure air in exchange.

IMPORTANCE OF BREATHING PURE AIR.

Conversational Lesson.

Where is the air? Can it be seen? How do you know that it is all around you? Of what use is it to us? What is the difference between the fresh air that we take into the lungs and the air after it has been used in the lungs?

What effect does breathing pure air have on the blood? What would be the effect on the blood if we were to inhale impure air? on the brain? What is the work of the brain?

When air is very impure which sense warns us of our danger? Does impure air have a pleasant or an unpleasant odor? Are we always able to find out by the sense of smell when the air is impure? When the air in a classroom (or other room in which there are many people) becomes impure, what is the effect on the occupants? What is it necessary to do to avoid this?

Summary.

Air is made up chiefly of two gases: oxygen and nitrogen. The one that we need in breathing is oxygen. We breathe in air that contains oxygen and some of it is used up by the blood in the lungs. The air that we breathe out contains impure, poisonous air in place of the oxygen that is used. This impure air is called carbonic acid gas.

The object of breathing is to make the blood pure. If the blood is not pure it cannot do its work, and the different parts of the body are not properly nourished. Inhaling impure air will thus injure every part of the body. If the lungs are constantly supplied with air that is not pure, they will become diseased.

If the brain is supplied with impure blood, it will be unable to do its work.

Inhaling impure air will cause a feeling of dullness and drowsiness. If the air that is inhaled contains a large quantity of poisonous gas, unconsciousness will follow.

VENTILATION OF ROOMS.

Conversational Lesson.

If all animals that breathe air are constantly breathing out impure, poisonous air, why does not the air around us become impure? How do plants help to purify the air? How does wind help to purify the air? How does rain help to purify the air?

Is the air inside of buildings used in breathing? Does it become impure? Is it then fit for breathing? How can it be made fit to breathe? What is ventilation?

The purity of the air in a room can be tested by exposing a jar of lime water. It will become clouded if the air is impure.

Which is purer, warm water or cold water? Which is purer, warm air or cold air?

Can a room be ventilated without using cold air?

Summary.

The open air is constantly being changed by the breathing of plants and animals. Animals breathe in oxygen and breathe out carbonic acid gas. Plants breathe in carbonic acid gas and breathe out oxygen. Wind and rain also help to purify the air, so that it is fit for us to breathe.

The air inside of buildings becomes impure in many ways. Fire and gas consume the oxygen, and people are constantly making the air impure by taking its oxygen and giving it carbonic acid gas in exchange.

If this inside air is not constantly changed, it will soon contain a large amount

of carbonic acid gas, and thus be unfit to breathe. For this reason there should always be a current of fresh air passing through the different rooms. There should always be an opening to admit pure air and another to let out impure air.

The air in a room can be changed rapidly by opening all the doors and windows.

THE BONY STRUCTURE.

Conversational Lesson.

Examine the bone of a sheep's leg, the shin bone of beef, or other bones of animals, to find out their structure, appearance, materials of which they are made, etc.

Examine the bone under a magnifying glass. What appearance has a bone? What is the inside of a long bone like? Of what use is this? What are the ends of the bone like? What difference is there between the ends and the shaft?

Place a bone on top of some hot coals, and tell what happens.

Soak a bone in some weak muriatic acid, and tell what happens.

From these two experiments find out what two kinds of material make bone.

What is the difference between the bones of a child and those of a grown person?

Think about the different bones of the body and find out their uses: The skull, the ribs, the bones of the arm and leg, the collar-bone, the shoulder-blades.

Of what use are the bones to the muscles? Consider the various sizes and shapes of bones, and how they are fitted for their special work in the body.

Summary.

The bones form the framework of the body. They have three uses. They give shape and support to the different parts of the body. They protect organs inside of the body and are used as a firm place to which the muscles are fastened so that they can act. There are more than two hundred bones in the human body. They are of many different shapes and sizes according to their work. Some of the principal bones are the skull, jawbones, ribs, collar-bones, shoulder-blades, and the bones of the hands and arms, legs and feet.

Bones are made of lime and gristle. Some bones are hollow, and are filled with marrow.

THE HEAD.

Conversational Lesson.

Pupils should examine a skull. Notice the number of bones which compose it and the way they are joined; the roughness of the skull for the attachment of muscles; the holes for blood vessels and nerves to pass through; the cavities for eyes, brain; reason for its shape.

How many upper jawbones are there? How many lower jawbones? Can we move the lower jaw? Can we move the upper jaw? Why is it useful to have the skull rounded in shape?

What are the uses of the skull and jawbones?

Summary.

The skull is an oval, bony case which holds and protects the brain and gives shape to the head. It is made up of a number of separate bones, fastened

together with edges like the teeth of a saw. In children these bones are not fastened firmly, but grow together as the child grows older.

The jawbones are the bones of the mouth in which the teeth are set. There are two upper jawbones and one lower jawbone. The lower jaw is movable. Each jaw contains sixteen teeth. The jaws give shape to the face, and are also used in eating and talking.

Pictures and drawings should be made to illustrate this lesson.

BONES OF THE TRUNK—THE SPINE.

Conversational Lesson.

Why is the trunk so called?

String together circular pieces of wood with pads of felt between. This will serve to illustrate the structure of the spine. Consider the spinal cord and its uses.

Consider why the spine is made up of a number of parts instead of being a solid bone.

What uses has the spine? Of what use are the pads of gristle? The separate bones can be felt in a row down the back.

If a vertebra cannot be obtained, pictures should be used to show shape and size. This should be followed by drawings.

Summary.

The spinal column or back-bone is made up of twenty-four separate bones, piled one on another. Between the bones are pads of gristle. The pads are springy and prevent the bones from grating; and also break the force of a shock or fall. Each bone in the column has a hole through it. The spinal cord runs through these holes. The spinal column supports the entire body, and permits us to bend in any direction. It also protects the spinal cord.

THE COLLAR-BONE.

Conversational Lesson.

Consider the shape and use of the collar-bone. How many collar-bones have we? What is the collar-bone of a chicken called? How does the wishbone differ in shape from our collar-bone? What is the reason for this difference?

Summary.

The collar-bones are fastened to the breast-bone in front, and to the shoulder-blades. They are useful for keeping the shoulders back and to keep them firm when the arms are used.

THE SHOULDER-BLADES.

Conversational Lesson.

Consider the number, shape, size, position, and uses. Pictures showing position and adjacent bones should be examined.

Summary.

The shoulder-blades are the two large, flat, triangular bones on the back, outside of the ribs. They are fastened to the backbone at the back and to the collar-bones at the shoulders. They help to keep the arms in place and to protect the lungs.

THE RIBS.

Conversational Lesson.

Preparation for this lesson may consist in the endeavor of each pupil to find out the number of ribs in his own body, and where the ribs are fastened. Breathe forcibly, but slowly, and note the movements of the ribs.

Pictures of the ribs, to show the conical shape, should also be examined.

What uses have the ribs? What organs are protected by the ribs?

Summary.

The ribs are the thin, flat bones which pass around the body. There are twenty-four ribs, twelve on each side. They are all fastened to the spinal column. The seven upper pairs are also joined to the breast-bone. The next three pairs are not joined to the breast-bone, but each rib is joined to the one above it by gristle. The two lower pairs are not joined to anything in front.

The ribs form the framework of the chest and protect the heart and lungs.

BONES OF THE ARM AND HAND.

Conversational Lesson.

By examining the arm, the bones in the upper arm and fore-arm can be traced by each pupil. How many bones are there in each arm? In the same way the bones forming the palm and fingers can be found. Consider also their number, size, and shape. Note the beauty of the mechanism of the hand; the use

of the thumb. Consider also how one bone in the forearm turns round the other.

Summary.

The arm consists of three parts, — the upper arm, the forearm, and the hand. The upper arm contains one large bone. The forearm contains two bones. The hand consists of three parts, — wrist, palm, and fingers. There are eight bones in the wrist, five in the palm, three in each finger, and two in each thumb.

Illustrations.

BONES OF THE LEG AND FOOT.

Conversational Lesson.

After the previous lesson pupils can make preparation for this lesson by trying to ascertain the number of bones in the leg and foot, by comparison with the arm and hand.

What bone is there in the leg to which there is no corresponding bone in the arm? What is its use? How many bones in each foot? each toe? each leg?

Summary.

The leg consists of three parts, — thigh, lower leg, and foot. The thigh contains one bone, which is the largest and strongest bone in the body. The lower leg contains two bones. The kneepan is a small bone which protects the kneejoint and gives firmness to the leg.

The foot consists of four parts, — the ankle, heel, instep, and toes. Seven bones form the ankle and heel, five bones form the instep. Each toe has three bones except the great toe, which has only two.

Illustrations.

THE JOINTS.

Conversational Lesson.

Procure a joint of a sheep's leg at the butcher's. Open the joint, and the various parts may then be examined. Of what use is the cartilage? the synovial fluid? the ligaments? Why do we oil machinery? What takes the place of oil in a joint of the body?

Name some joints in the body. The movements of the various joints in the body will show the various ways in which the joints are formed, and the amount of motion permitted by each joint. Consider the inconvenience we would experience if we had no joints.

What kind of joint have we at the shoulder, elbow, hip, knee, fingers, between spinal column and skull?

Why are these joints so named?

What kind of joint fastens the different parts of the skull together?

Summary.

A joint is a place where two or more bones are joined. There are three kinds of movable joints, — ball and socket joint, hinge joint, and pivot joint. We have a ball and socket joint at the shoulder and the hip. We have hinge joints at the elbow, knee, wrist, ankle, and knuckles. The skull and spinal column are joined by a pivot joint. The ends of the bones in a joint are covered with a thin layer of gristle which is moistened by a fluid. This makes the joint move easily.

The seven bones of the skull are joined by fixed joints.

THE MUSCLES.

Conversational Lesson.

The structure and color of the muscles of the body can be understood by examining the muscle (meat) of other animals.

Consider the fact that all muscular action is the same. All muscles contract when they act, and draw together the bones to which they are fastened.

Muscles generally act in pairs. Bend the elbow joint. Where is the muscle that caused this motion? How did it act? Straighten the arm. What caused the action?

Where are the muscles that move a chicken's foot? How are they fastened to the foot? What does a tendon look like? Where are the muscles that move a bird's wings?

Are all muscles the same size? Why are some larger than others? Why are the muscles of the arm large? Why are the muscles of the eyeball small?

When a muscle shortens itself, or contracts, does it become thinner or thicker? Stretch a piece of rubber and permit it to relax. When is it thicker?

Consider how many muscles are used in the simplest movements; such as conveying food to the mouth, singing a song from the notes. Consider also the connection between the muscles and brain.

How can the muscles of the body be kept in a healthy condition?

What muscles have we inside of the body whose movements we cannot control?

Summary.

Muscles are the fleshy part of the body just under the skin. They are made up of fibers. They cover the skeleton and are fastened to the bones. Muscles are used to give motion to the various parts of the body. A muscle acts by contracting, or drawing up. When a muscle contracts it draws the bone with it. When it relaxes the bone goes back in place.

Muscles sometimes act in pairs. When one of these muscles contracts or shortens itself the opposite muscle lengthens.

Muscles grow thicker and stronger with the proper kind and amount of exercise.

THE SENSES.

Conversational Lesson.

How do we obtain information about the world around us? In how many ways do we get this knowledge? What is the connection between these organs of sense and the brain? When we receive a single impression of hearing or sight, etc., what is the effect on the brain called? From this term we get the word "senses" because it is through the senses that we receive sensations.

Why are the senses called "gateways of knowledge"?

What kind of information do we obtain with the eyes? the ears? the skin? the tongue? the nose? What protection do we owe to the sense of touch?

Of what special use are the tongue and the nose in preserving the health of the body?

Which sense do we first learn to use?

What forms the connection between each sense organ and the brain?

What do deaf persons use sometimes to take the place of hearing? What do blind persons use to take the place of seeing?

Who were Helen Keller and Laura Bridgman? How many senses did they each have? How much information were they able to acquire?

Information in reference to these people, and also in reference to the different parts of the body, can be found in many books in a public library.

Summary.

The brain is the organ of the mind by means of which every part of the body is regulated, and every action is controlled.

The brain is protected by the skull.

The brain and every part of the body are connected by nerves, through which the brain receives information of the condition of the body, and also knowledge in reference to the world outside. The ways in which the brain receives information of the world are called the five senses, or five gateways of knowledge.

Nerves also pass from the brain to the muscles in every part of the body, for the purpose of telling them how to act.

To be of use to us the brain must pay strict attention to the messages sent from the different parts of the body, and must remember this knowledge so as to use it in the future. The different organs must also do their work properly, and attend strictly to their duties, so as to send correct messages to the brain.

If we are looking at anything, the eye helps us to see the object, and the brain helps us to know a great deal about it, if we attend carefully, think about the object, and remember what we have seen and learned in reference to it. This is true of each of the five senses.

Close attention is always necessary. Unless careful attention is given by the ear to the sound, and by the tongue, nostrils, and skin to their special work, the brain will not receive exact information, and it cannot do its work properly. The more carefully we attend, the better will the brain do its work.

We have seen that the skin is made up of two layers; the outer layer called the scarf skin, and the inner layer or the true skin.

The true skin is made up of a number of tiny ridges. These are filled with minute blood vessels and nerves.

The sense of touch is in the skin all over the body. The nerves of touch are in the little ridges of the true skin. They are protected by the scarf skin. When the scarf skin is removed, the nerves of touch are exposed, and on this account pain is felt.

By this sense we are able to tell whether an object is hot or cold, rough or smooth, round or square, hard or soft, etc. The nerves of touch carry to the brain the impressions received at the surface of the body.

The sense of taste is in the tongue. The nerves of taste are in the little ridges all over the tongue. They are arranged in the form of a letter **V** with the point of the letter towards the back.

The nerves of taste receive impressions from substances placed on the tongue, and carry to the brain the information as to whether the substance is sweet, sour, bitter, salt, etc.

The nerves of smell are arranged on the skin which lines the nostrils.

All odors are made up of tiny specks of floating material. These are carried by the air to the nerves of smell.

The nerves of smell carry to the brain information in reference to the substance whose odor has reached them.

The senses of taste and smell are placed at the entrances of the passages to the stomach and lungs. By means of these senses we can guard against impure air and improper food.

STRUCTURE OF THE EYE.

Conversational Lesson.

If possible, dissect in the class the eye of a sheep or some other animal, and examine the different parts. Examine also pictures of the eye and its various parts.

Where is the eye placed in the human body? Consider its size, shape, and the various ways in which it is protected. What is the use of the bony socket, the lids, lashes, and eyebrows?

How are the eyes moved? Of what advantage is this power? Can a fly move its eyes? What takes the place of this power?

Photography follows the structure of the eye in the use of lenses, blackened box, etc.

The use of the lens will be understood by finding out the use of the lens in an opera glass. Why is the pupil always black?

Find out the position and use of the cornea, iris, pupil, tears, and the coats of the eye.

Compare the eye of a human being with that of a cat.

How is the eye connected with the brain?

Summary.

The eye is the organ of sight. It is a small ball, about one inch in diameter. It is placed in the eye-socket and moves about on a cushion of fat.

The eye-socket is made of seven bones in the form of a cone. The eye is protected by the eye-socket, eyelids, eyelashes, and eyebrows.

The eye has three coats or coverings. The outside coat is hard, so as to protect the delicate parts inside. This is called the white of the eye.

The middle coat is filled with blood vessels and nerves, and is black on the inside.

The inner coat is the most important of all, because it is made up of a network of nerves which are connected with the brain by means of the nerve of sight.

These three coats cover the entire eyeball, except the anterior, or front, part. The cornea covers the front part of the eye. Inside of the cornea is the iris, which gives color to the eye. In the iris is the pupil, which regulates the amount of light entering the eye.

The eye has two cavities or chambers separated by a transparent circular lens.

The nerve of sight passes from the inside of the eye through an opening in the eye and the eye-socket to the brain.

The light passes through the cornea, pupil, and lens, and strikes the nerves spread out on the inside of the eye. The nerve of sight carries the impression to the brain and then we know that we see.

CARE OF THE EYES.

Conversational Lesson.

What is the reason for each of the following statements?

Summary.

We should not use the eyes in a dim light. The eyes should not be used too long at a time. Reading when lying down is very injurious to the sight. We should never read in a moving car or a rocking-chair.

The eyes should be given the aid of the proper kind of glasses as soon as they begin to fail in any way.

STRUCTURE OF THE EAR.

Conversational Lesson.

Pictures and drawings of the various parts of the ear should accompany the consideration of this subject.

What is the proper name for that part of the body usually called the ear? Of what is this made? Could we hear if this were removed? Of what use is it? Hold a shell to the ear, and see how much more sound is collected.

What causes the sounds that we hear? What is meant by "vibrations"?

What is the use of hairs and earwax in the ear?

What is the drum of the ear? Why is it so called? What would happen if all the air were removed from the inside of the musical instrument called the drum?

What is the use of the opening which passes from the throat to the ear?

Of what use is the ear?

Consider the value of the brain in reference not only to hearing, but in reference to remembering things that we have heard before, and connecting them with things that we hear later, and the amount of knowledge obtained by this means. Hearing a person speak in a foreign language does not give us any information; why? What is the use of the brain in reference to this point?

Summary.

The ear is the organ of hearing. It is divided into three parts, — the outer ear, the middle ear, and the inner ear.

The outer ear consists of a broad plate of gristle, shaped somewhat like a shell, and of a tube about one inch long. The tube is protected by earwax, and by a set of fine hairs. These are used to moisten the ear, catch floating dust, and keep away small insects.

The middle ear is called the drum of the ear. Between the middle ear and outer ear is a thin skin called the membrane of the drum. It is very delicate, and if it is once broken, it cannot be repaired, and deafness will follow.

In the drum of the ear are three little bones, the smallest in the body. An air passage leads from the throat to the drum of the ear.

The inner ear is made up of a number of winding passages cut through the skull to the brain. These passages are lined with a thin skin on which the nerve of hearing is spread out. Inside of this skin is a watery fluid in which float tiny grains of sand.

Waves of sound are collected by the outer ear and pass to the membrane of the drum, causing it to vibrate. When this membrane vibrates, it causes the three little bones in the middle ear to vibrate. This causes the fluid in the inner ear to wash the tiny grains of sand against the nerve of hearing; the nerve of hearing carries this impression to the brain, and we know that we hear a sound.

CARE OF THE EAR.

Conversational Lesson.

What is the reason for each of the following statements?

Summary.

We should never use earpicks of any kind, but the ear should be washed gently with warm water. A loud noise close to the ear is dangerous because it may break the membrane of the drum and cause deafness. The side of the head should never be struck, nor the ear pulled, as either may injure the hearing.

III. ANIMALS.

THE DOMESTIC ANIMALS AND THEIR USES.

Conversational Lesson.

Name a number of different animals.

What is an animal?

Name some domestic animals.

What is a domestic animal?

Examine as many live domestic animals as possible.

Name some beasts that are domestic animals.

Name some birds that are domestic animals.

What wild animal does each of our domestic animals resemble?

In how many ways are domestic animals of use to us?

Tell all the different kinds of food with which these animals furnish us.

Which of these animals are of value on account of their covering? their hoofs? their horns? Which are useful for carrying heavy loads? Which protect us against other animals?

Which of these animals furnish us with the following articles, or with materials for their manufacture, — veal, mutton, milk, eggs, beef, tripe, haircloth, glue, feathers, horns, woolen cloth, etc.?

Of all the domestic animals, which is the most intelligent? Of all animals, which is the most intelligent? Why? What domestic animals do people in other countries have that we do

not have? Of what use are the camel, elephant, ostrich, stork, etc.?

The hoofs, horns, bones, etc., of many of our domestic animals can be obtained for close observation.

In any public library will be found many books containing stories of these animals, their traits of character, and the uses to which they are put by people in other countries.

Look at the feet, horns, bills, and teeth of these animals, and make drawings of them.

Summary.

An animal is any living thing that has feeling and the power of voluntary motion, — that is, that can make a movement when it wishes.

Domestic animals are those that live with man and are useful to him.

Some domestic animals are the horse, cow, sheep, dog, cat, chicken, duck, goose, and turkey.

THE HORSE.

Conversational Lesson.

To what class of animals does the horse belong? Which wild animal does the horse resemble? How is the horse useful to man? Why does the horse have large and strong bones and muscles?

Describe the hoof of a horse. Why is the horse shod? What is the shape of the shoe? Who makes the shoe and puts it on? How is it fastened?

On what part of the foot does the horse walk?

Of what does the food of the horse consist?

What kind of teeth has the horse?

What movement have the jaws of a horse in chewing his food?

For what does the horse use its lips in eating? Of what use to a horse is its tail? its mane?

Of what use to man are the horse's hoofs, bones, hide, tail, and mane?

Summary.

The horse is useful to man as a beast of burden. Its feet are fitted to walk on firm ground. The toe-nail of the horse grows in such a way as to form hard, firm hoofs, on which he walks. To this horny hoof is nailed an iron shoe, which protects the hoof against the wear of travel.

The horse is fond of grass, hay, corn, and oats, which it grinds between its teeth. Its front teeth are sharp for cutting. Its lips and teeth are formed for eating the shortest grass.

It is one of the most intelligent animals. It is faithful and affectionate to its master, and will patiently endure long hours of toil and hardship, until its strength gives out. It often sleeps standing.

The hide of the horse is used in making leather. The hair is used in making plaster. Haircloth is made from the mane and tail. The bones and hoofs are used in making glue, and material for fertilizing the ground.

THE COW.

Conversational Lesson.

In how many ways is the cow useful to us? How many kinds of food do we obtain from the cow? What is meant by milk foods? Name some milk foods.

What is tripe? What other parts of the cow do we use for

food? What use do we make of the cow's bones? How do we use the hide? the hair? the horns? the hoofs?

What kind of food does the cow eat? How many stomachs has the cow? Of what use are the first two stomachs? Why is the cow a cud-chewer?

What kind of teeth have cud-chewers? Which teeth has a horse that a cow has not? What is the difference between the hoof of a horse and that of an ox? How many shoes does an ox wear? What means of defense has a cow that a horse has not?

Of what use to the cow are its horns? What differences are there between the horns of a cow and those of a stag? What difference is there between the tail of a horse and that of a cow? What wild animal does the cow resemble?

Summary.

Bovines may be divided into several classes which are useful to man in different ways. Some are used as beasts of burden. These are called oxen. Others are useful for providing us with beef, veal, tripe, and milk foods. The hide of the cow and ox is useful in making leather. The hair is needed in making plaster. Glue is made from the hoofs. Knife handles, umbrella handles, and buttons are made from the horns.

The cow is a cud-chewer and is fond of grass and hay. When a cow first swallows the food it passes to a large stomach, where it is well moistened; then into a second stomach, where it is rolled into balls. These form the cud which passes back to the mouth to be chewed. After it is well chewed it goes to the other stomachs to be further prepared for use in the body. The cow uses its tongue to place the food in its mouth.

The horns of the cow are round and hollow, with bone inside. They are used by the cow for defending itself against its enemies.

THE SHEEP.

Conversational Lesson.

In how many ways is the sheep useful to us? For what purpose do we use its wool? With what food does the sheep supply us? For what is its fat used? In what countries is its skin made into wine bottles?

What is meant by a flock or herd? What name is given to the man who looks after the sheep?

What kind of food does the sheep prefer? In regard to eating, does the sheep resemble the cow or the horse? In what other ways does the sheep resemble the cow?

Is the sheep fitted to live in hot or cold countries? Why do you think so? Over what kind of land is it particularly fitted to travel?

Summary.

The sheep is useful to man in furnishing wool for clothing and mutton for food. From its fat, tallow is made. Its skin is made into rugs, parchment, and leather.

Sheep are cud-chewers and are fond of green grass or hay. They are generally kept in flocks, and in each flock there is a leader. The leader is driven by a shepherd or a dog, and the rest of the flock follow. Sheep are very timid and unable to take care of themselves.

They are good climbers, and are found frequently in mountainous countries.

THE DOG.

Conversational Lesson.

Of what use is the dog to mankind? In what part of the world does it do the work of a horse? Why are not horses used in those countries? Of what use is the dog in sheep-raising districts? Which of the five senses are highly developed in the dog?

What kind of food does the dog prefer? What kind of teeth has it? Why does the dog gnaw a bone? What does it do with a bone that it no longer wishes to gnaw? Of what uses are the claws of a dog? What peculiarity have a cat's claws that a dog's do not possess?

How do dogs vary in size, covering, and traits of character? What wild animal does the dog resemble?

In any public library will be found books containing stories of dogs and the different uses to which they are put in different countries.

Summary.

The dog is useful to protect man and warn him of the approach of danger. It also destroys rats and mice. Some kinds of dogs are useful in hunting. In cold countries dogs are used as beasts of burden, and are harnessed to sledges. One kind of dog is useful in driving sheep. Some dogs are very intelligent and can be trained to do many things.

Dogs have very keen senses of smell, sight, and hearing. They eat many things that we do, but prefer raw meat. Dogs drink water by lapping it with the tongue. They are faithful to people that are kind to them.

THE CAT.

Conversational Lesson.

Describe the coat or covering of the cat. How many feet has the cat? How many toes has the cat on each of its fore paws? On each of its hind paws? What peculiar power does the cat possess in reference to its claws? For what purposes does the cat use its claws? Of what three uses are the cushions or pads on the cat's paws? What peculiarity have the eyes of the cat? What does this indicate? Do all animals that wander at night have eyes fitted to see in the dark? What peculiarity has the tongue of the cat? How does it drink? For what other purpose than eating and drinking does the cat use its tongue? What kind of teeth has the cat? Are its teeth all alike? Why does it need teeth of that character? Do all animals that feed on flesh or meat have that kind of teeth? Of what use are the cat's whiskers? How does the cat act when it is watching and catching its prey? How does it resemble the tiger in this respect? What is the difference in the coverings of a cat and a dog? Why has the cat so soft a covering? Of what use to us is the cat?

Summary.

The cat is useful to protect us against rats and mice. The cat is covered with fur. The paws of the cat are supplied with claws, which are used for climbing, for holding a bird or a mouse, and for defending itself against its enemies. The claws can be sheathed when they are not in use, and do not touch the ground in walking.

The cushions on a cat's paws cover its claws, permit it to walk silently, and prevent it from being jarred in jumping.

When trying to catch its prey, it creeps along and crouches before springing on it. It teases its victim usually before killing it.

The cat eats many foods that we do, but it prefers raw meat. It is fond of milk, and when drinking laps the liquid with its tongue. The mouth extends far back, so that it can use the tearing teeth easily.

BIRDS THAT ARE DOMESTIC ANIMALS.

Conversational Lesson.

Name some birds that are domestic animals. Why are they called domestic animals? Of what use to man are the chicken, turkey, duck, and goose? With what kinds of food do these animals supply us?

How does each of these animals move about from place to place? What is the difference between the feet of those that swim and those that do not? Why do ducks need to be fitted for swimming? Why do chickens have claws for scratching?

How many toes has each of these fowls? Where are the legs of each fastened to the body? Where are the muscles that move a fowl's feet? How are these fastened to the claws? What does a tendon look like?

What shaped bill has each of these fowls? What kind of food does each of them eat? Why is the bill of a duck supplied with nerves and saw-like edges on the inside? How do fowls drink? Have fowls teeth? Of what use is the gizzard to birds?

How are these fowls covered? Which of them has the lightest and softest feathers? Which has very oily feathers? Why are

the feathers of the duck supplied with more oil than those of other fowls?

How do the head and neck of a turkey differ from those of other fowls?

Which of the domestic fowls desert the young birds?

The head and feet of these fowls are easily obtained for the purpose of examining them. If possible, observe the fowl alive, and notice its various habits.

Summary.

Some fowls of the barnyard are the chicken, turkey, goose, and duck. These animals are useful to us on account of their feathers and their flesh. They also supply us with eggs.

These animals all walk on land, but ducks and geese can swim. The birds that swim are web-footed.

Ducks obtain much of their food from the bottom of streams by digging for it. They eat worms, frogs, tadpoles, and fish, as well as grain. When a duck wishes to capture some creature for food, it dives under the water. It passes the mud and water out between the saw-like edges of its bill, and retains the food.

The goose in swimming does not dive under water like the duck, but it thrusts its head and neck into the water while it is using its bill. The feathers of the goose are the best for pillows, because they are so light and soft.

Chickens scratch much of their food from the ground. They eat bugs, worms, and grain. When a worm is too large to eat the chicken tears it up with its claws and bill.

The turkey can run very fast because it has such long legs. The feet are partly webbed, so that it can swim a little. It has no feathers on its head and neck. Turkeys eat grain, nuts, and insects of various kinds.

Ducks and geese roost low, chickens and turkeys roost high.

MOVEMENTS OF DOMESTIC ANIMALS.

Conversational Lesson.

Mention some animals that move by walking.

Mention some animals that move by flying.

Mention some animals that move by swimming.

Mention some animals that wade.

Name some animals that can move in each of the first three ways.

Are the bones of the horse's leg large or small? Why? Why must the muscles that move the leg of the horse be large and strong? When a four-footed domestic animal walks, which legs move at the same time?

Where are the muscles that move a chicken's claws? How are they fastened to the bone? Which of the barnyard fowls walk the most awkwardly? Which can run the fastest? How may the wings be compared to the sails of a boat, when one of these birds runs? Why cannot these birds fly well?

Which parts of the body must be strong in animals that walk? In those that fly? In those that swim?

Do all animals use the same organs in swimming? What part of the body does the duck use? Why cannot beasts and human beings swim for so long a time as fish or ducks? What is the difference in position between the legs of a duck and those of a chicken? Why are a duck's so placed? What must all swimmers do in order to advance through the water?

Compare the size of a sparrow's wings with the size of its

body. Examine a pigeon or a chicken in the same way. Why cannot a chicken fly to any great height?

What must birds do in flying in order to advance through the air? Why cannot we fly? Where are the muscles that move the wings? Why can wild ducks fly farther than tame ones?

A fan that is somewhat scoop-shaped may be used to illustrate how a bird's wing pushes the air down.

What is the difference between walking and wading? What kind of legs are necessary to a wading bird? What kind of feet? Why do these birds wade?

Consider the fact that organs are given to animals as they are needed for moving about, obtaining food, defense, etc. These organs develop with use, but become weak and small, and finally disappear if they are not used. Name some animals which illustrate this.

All of these animals or pictures of them should be examined in connection with the consideration of the subject.

Summary.

Animals that walk have strong bones and muscles to form the legs. These form a support to the body. The muscles are fastened to the bones in such a way that they bend the legs and cause the body to move forward.

When a bird flies, it opens its wings in a rounded shape and raises them in the air. As the wings are raised the edges cut the air. The under side of the wing is hollow, and holds a large quantity of air. The feathers are lapped so that the air cannot escape. The bird pushes the air back and down with its wings and thus raises its body and moves forward. The bird keeps moving its wings in this way by means of its breast muscles, and thus forces its way through the air. The breast-bone of a bird has a ridge down the center, forming two large, hollow places for the attachment of the large breast muscles.

The wings of all birds that fly are very large in proportion to their bodies. When the wings of a bird are too small, it cannot fly well. If the breast-bone of a bird is flat, the breast muscles will not be sufficiently large to move the wings. Birds are supplied with wings so that they can escape from their pursuers.

An animal that swims forces its way through the water in the same way that a bird forces its way through the air. Fishes push the water back with their fins.

A bird that swims is web-footed. The bird pushes the water back with its feet and thus sends the body forward.

When a duck thrusts its foot forward in swimming, it folds it together so as to pass through the water easily. When it is ready to push it back again, it spreads the foot out in a sort of scoop-shape, so as to force back as much water as possible.

Horses and many other animals can swim short distances, but this is not the usual way in which they move from place to place. These animals cannot swim well because they cannot push away enough water to move the body forward rapidly. The muscles are not strong enough for this work, and they soon become tired.

Animals are supplied with organs for swimming so as to obtain the kind of food which they need and also to escape from danger.

Some birds, such as the stork, heron, sandpiper, and crane, are fitted not only to fly and walk, but also to wade. For this purpose the legs are long and the feet have straight, long, flat toes, upon which the bird can stand firmly in the mud at the bottom of a stream. They also have long necks and bills. They wade into the water and stand quite still, with the toes spread to avoid sinking in the mud. Then, as fish and frogs swim about the bird's legs, it bends its long neck down quickly and catches the animal, which goes down its long throat whole.

All movement of animals is caused by the contraction of muscles. Muscles that are used frequently become thicker and stronger and better able to do their special work.

THE SKELETONS OF ANIMALS.

Conversational Lesson.

Examine the bones of as many animals as possible. If possible, obtain all the bones of some animal and wire them together in the proper places.

In any public library will be found books containing pictures of the skeletons of animals. At the Academy of Natural Sciences, Philadelphia, can be seen skeletons of many different kinds of animals.

In which class of animals are the bones most easily bent? Why? Why are bones of this kind of use to fish?

Which animals have the heaviest bones? Why do they need such large, strong bones?

What peculiarity have the bones of birds? Of what advantage is this? Why do birds need bones that are light?

The backbones and ribs of a cat or a dog can often be felt on the surface of the body. Compare the backbone and ribs of beasts, birds, and reptiles.

Which animals have the most loosely jointed backbones? Which animals have a backbone in which the vertebræ or bones forming it are firmly joined? What is the reason for the peculiar formation in each case?

Compare the skulls and ribs of different animals as to size and shape.

Which animals have the most prominent breast-bone? Why do birds need a breast-bone of this kind? Why does a wood-

pecker or a parrot have a flatter breast-bone than other birds? Why cannot the ostrich fly?

What name is sometimes given to the collar-bone of a bird? to the fore leg of a chicken? How many collar-bones has a bird? How many have we? Compare the jawbones of beasts with those of human beings. Why do we not need such strong jawbones or such large teeth as beasts? Which animals have no teeth?

What organ in a bird takes the place of teeth in grinding up the food?

How many kinds of teeth have we? Of what use is each kind? Name some animals that have teeth for cutting and gnawing; for tearing; for grinding. What kind of food does each of these animals eat? Of what use are teeth to snakes?

To what parts of our body do the fore legs of a beast correspond? the hind legs? Compare the fore leg of a beast to the arm of man, and find the joints that correspond to the wrist and elbow. Also compare the hind leg of a beast with the leg of man, and find the corresponding joints.

How many toes has the dog? the cat? the horse? the pig? the cow? the bear? the monkey? Have the fore legs the same number of toes as the hind legs?

On what does each of these animals walk? Which walk on the toe-nails? on the toes? on the whole foot? on the four feet?

Which beast has four thumbs? Of what advantage to us is the thumb?

To what part of our body does the wing of a chicken correspond? Examine the bones in the wing, and find the bones and joints which correspond to the bones and joints of the arm and hand.

In what direction does the knee joint always bend? Where is a bird's knee joint? To what joint in man does the first joint from the toes in a bird correspond? On what does a bird generally walk?

At the Zoological Garden many beasts, birds, and reptiles can be seen. Careful observation will give much information in reference to the formation of their skeletons.

Summary.

The skeleton of an animal is of such a size, shape, weight, and arrangement as to suit the needs of the animal and the conditions of its existence.

Some beasts need large, heavy bones for the attachment of strong muscles. Birds need bones that are light in weight. For this reason their bones are hollow and are filled with air. Snakes need bones that can be quickly moved. This power is obtained by means of very loose joints. Most of the bones of fish are soft and flexible, so that they are easily bent. The bones of beasts are much heavier and stronger than those of human beings.

Every animal that has a skeleton inside of the body is supplied with a backbone. Most animals that have backbones are supplied with four limbs. In human beings these consist of two arms and two legs. Beasts have four legs. Birds have two wings and two legs. Fish have two pairs of fins which correspond roughly to the limbs of other animals. The tortoise and the crocodile have four legs. Some lizards have four legs and some have two legs. Some lizards and snakes have no legs.

The ribs of animals that feed on grass and grain form a foundation for a large, heavy body. These also have a long, narrow skull.

The ribs of animals that feed on flesh form a slender body, as they need to move quickly in seeking their prey. The skull of these animals is broad and short. Beasts of prey need large, strong bones in the fore legs and shoulders. The backbone of animals that crouch is so arranged that it is very flexible and can be bent and twisted in almost any direction.

The jawbones of beasts are heavier and stronger than those of man. As

man uses knives and forks to assist him in cutting his food, he does not need the large jawbones for this purpose. Neither does he need them as a means of defense.

Some animals, such as the bear, Cape ant-eater, sea-lion, etc., walk on four feet. Most animals walk on their toes or toe-nails, and the remainder of the foot between the toes and ankle consists of one long bone. This is of use in supporting the weight of the body and allowing the animal to move more lightly and quickly.

The toes of some beasts are supplied with claws. Their feet are called paws. The toe-nails of others cover and protect the toes, and these are called hoofs.

The arrangement of the bones and joints in the hand of man which permits freedom of motion to the thumb is of great advantage.

In a bird the bones forming the backbone between the neck and tail are firmly joined. The skull and backbone are so joined that the head can be turned almost completely round. In man and beasts these are so joined that the head can be turned from side to side and can be moved or nodded forward and back.

The breast-bone of man is flat, but a bird has a keel-shaped breast-bone, with a ridge of bone down the center. This forms large, hollow places for the attachment of the huge muscles which move the wings.

The lower jaw of a bird is joined to the skull by means of a small bone. This permits the jaws to be opened very wide. Reptiles also have this bone.

The two collar-bones of human beings are placed end to end and fastened to the top of the breast-bone. These are used for holding the shoulders back in place. The collar-bones of a bird are fastened together, forming one bone of a rounded **V** shape. This rests against the ridge of the breast-bone and the ends support the large bones of the wings.

The bones of the legs are almost entirely covered by muscles and feathers, so that the knee is out of sight. Birds walk on their toes, except the adjutant bird, or marabout. One bone forms that part of a bird's foot between the toes and ankle. A bird has but one bone in the lower leg, while man is supplied with two.

The bones and joints of a bird's wing correspond to those of the arm and hand of man. It consists of one long bone corresponding to the long bone

of the upper arm. Joining this are two bones corresponding to the two bones of the forearm. To these are joined two bones which correspond roughly to the five sets of bones forming the palm and fingers. The joints correspond to the elbow and wrist.

The backbone of the tortoise is composed of bones which are firmly fastened together. The ribs also are joined together and have no power of motion.

The backbone of the snake is made up of bones joined by a succession of ball and socket joints. For this reason it can glide swiftly from place to place. The snake has no breast-bone, as this would interfere with its active movements. All other reptiles have flat breast-bones.

The bones forming the backbone and tail of the lizard are so loosely joined that a part of the tail can be cast off without inconvenience.

The bones in the head of a fish are somewhat harder than its other bones. Its bones are light in weight and are very soft and gristly. This permits them to bend easily, and by this means the fish can twist its body in any direction in gliding through the water.

Some animals have no skeleton within the body. Some of these are protected by a covering on the outside. Among these are spiders, insects, shellfish, and starfish.

Some have neither a hard covering nor anything corresponding to a skeleton. Among these are worms and jellyfish.

COMPARISON OF THE BODIES OF ANIMALS.

Conversational Lesson.

Compare the eyes of various animals, such as the cat, the eagle, the mole, the fly, the penguin, the hen, the horse, etc. Compare, as to their shape and use, the tails of animals, such as the horse, the cow, the squirrel, the rat, the whale, the catfish, the alligator, the opossum, etc.

Which animals have a keen sense of sight, hearing, smell, or touch? Of what use is this to the animal?

How do the coverings of animals differ? Why are birds covered with feathers? Why are fish covered with a scaled armor? Why is the snake covered with a smooth skin? Why is it supplied with scales? Why is the hide of a rhinoceros in folds or wrinkles? Why is the bear covered with fur?

Compare the tongues of various animals, such as the snake, the frog, the woodpecker, the giraffe, the cat, the tiger, the horse, the lizard, etc. What is the advantage of the peculiarity in each case?

Examine various animals for the purpose of finding out how they obtain their food.

Of what uses are a crab's claws?

Of what use is the elephant's trunk?

Why has an owl such large eyes?

Of what use is a camel's hump? What causes it to increase or diminish in size? When is it smallest?

Of what use is the long neck of the giraffe? of the stork?

Why has the chamois double hoofs?

What takes the place of muscles in a fly's eyes?

Why have a cat's eyes power to change the shape of the pupils?

Of what use are whiskers to a cat?

Why have owls and bats such prominent ears?

Why has a tiger padded toes?

Why is the cow a cud-chewer?

Why is the beaver web-footed?

Why does the tail of the tadpole disappear?

Which has the softer covering, the cat or the dog? Why?

What is the color of the polar bear? Why?

Why can a fly walk on the ceiling?

Of what uses are a chicken's claws?

Of what uses are a sparrow's wings? Why cannot a chicken fly well?

Why does not a canary fall from its perch when it is asleep?

Of what use are nostrils to a fish?

Of what use are a snake's tongue and teeth? What takes the place of feet in a snake? Of what color is it? Why?

Why is not the whale a fish?

Why is not the spider an insect?

Why is not the bat a bird?

Of what uses is the lion's mane?

Why can a camel close its nostrils?

Of what use is the squirrel's tail? the horse's tail?

Name some animals that walk on their toes; some that walk on their toe-nails.

At the Zoological Garden many animals of all kinds can be examined for the purpose of ascertaining their peculiarities and the reasons for them. The climate in which they are fitted to live, the kind of food which they eat, the ground over which they are fitted to travel, and their means of protection or defense can all be discovered by close observation.

In any dictionary or encyclopedia, pictures of many varieties of animals can be seen.

Summary.

All animals have bodies that are fitted to the conditions of their existence. They are covered according to the climate in which they live and the mode of life which they lead. They are given organs for the purpose of obtaining

food. They have also some means to protect and defend themselves or else to escape from danger. The way in which they move from place to place is adapted to obtaining food or escaping from an enemy.

All organs grow with use. The more any organ is used, the better it will do its work. If an organ is not used it becomes weak and small, and finally disappears.

Some animals need a covering that is light in weight. Many beasts need a heavy, warm covering. Under some conditions a smooth covering is necessary to the animal to permit it to move easily and quickly. Birds need a covering as light in weight as possible. Beasts that live in warm countries do not need so heavy a covering as those of cold countries. Some birds change their homes on account of the scarcity of food. Some other animals lie dormant during the winter season when there is a lack of food. Animals that do not change their homes have power to change their covering with the change of seasons.

Animals that live in water either all or a part of the time have organs fitted to supply their needs. Fish have the scaled, oily body and head of such a shape that it can glide most easily through the water. In many cases a fish is also supplied with an air bladder, by means of which it can float.

Birds and reptiles that swim are web-footed. The hippopotamus, alligator, and frog can close their eyes, ears, and nostrils under water. These also have coverings suited to life in the water.

All animals have organs specially arranged to suit their needs.

The eyes of birds are supplied with three eyelids, one of which is a thin skin, with which the eyes can be shielded from the bright sun without interfering with sight. The eyes of the eagle and the hawk are supplied with bones arranged in such a way that they can see distant objects as well as those that are near. The eyes of insects are not supplied with muscles, but are many-sided instead.

When an organ is no longer used, it soon becomes powerless to act and finally is lost entirely. The blind fish of Mammoth Cave are blind because they live in darkness. The eyes of the mole are almost covered by thick fur. The tail of the tadpole becomes smaller and smaller, and finally disappears when it is no longer used.

The lion's mane protects its eyes from sand.

The camel's eyes are covered with a fringe of hair. It has power to close its nostrils. Its knees are cushioned for kneeling. Its feet will not sink in the sand. Its stomach can be used for storing food and water. Its hump also supplies it with food when no other can be obtained.

The polar bear has a growth of coarse hair on its feet, which enables it to walk on slippery ice and snow.

Beasts that climb in rocky and mountainous places have slender, nimble legs and double hoofs. Those that climb trees have sharp claws.

Animals that seek their food at night have eyes that can see in darkness. Their covering is soft and smooth, so as to make as little noise as possible. Tigers and cats are supplied with feelers or whiskers. Their padded toes also assist them to move quietly and prevent the body from being jarred when jumping. The bat's body is covered with soft hair and it has prominent ears.

Animals have organs of various kinds for obtaining food.

Beasts of prey have slender, agile bodies. They are supplied with teeth and claws with which they capture animals for food. They have also rough tongues and sharp teeth for tearing the flesh food. They have a keen sense of sight, smell, and hearing.

Birds of prey have sharp beaks and talons with which they seize and tear their food. In place of teeth a bird has a gizzard. In the gizzard the food is ground and crushed by means of the pebbles which are swallowed for that purpose.

Some animals that feed on grass and grain are cud-chewers. These animals could not, at one time, eat enough food and chew it properly to supply the necessary amount of nourishment for their large, heavy bodies. Among wild animals of this kind many are obliged to travel a long distance to obtain food. For these reasons they are supplied with stomachs in which they can store food for future use. These animals have fleshy tongues and broad, flat teeth for grinding their food. The giraffe has long fore legs and neck so as to reach the leaves of trees, on which it feeds. It has also a flexible tongue, which it can twine around the leaves in plucking them from the trees.

Beasts and reptiles that feed on insects have many small, sharply pointed teeth. Birds that feed on insects have long, slender bills with which they can obtain food from the flowers or the bark of a tree. The frog has its tongue

fastened to the front of its mouth. It can dart its tongue out quickly, catch an insect with the tip, and carry it to the back part of the mouth.

Ducks have bills with toothed edges. Through these they sift the mud and water, retaining in their bills only the food which they desire.

The broad snout of the hog is used for digging from the ground the roots on which it feeds.

Rats and mice use their hairless tails for obtaining liquid food which would otherwise be beyond their reach.

MEANS OF DEFENSE.

Conversational Lesson.

Examine various animals for the purpose of finding out how they protect themselves from attack.

Name some animals that have any of the following means of defense: stings, horns, fins, teeth, pincers, claws and beak, claws and teeth, tail.

How do the following animals defend themselves: cat? dog? horse? cow? mouse? squirrel? bee? fish? snake? hen? rabbit? tortoise? lobster? eagle? sparrow? What animals are enemies to these animals?

Which animals escape from their enemies by quick movement? Which have homes that their enemies cannot reach?

Of what use are a deer's antlers?

Why does a rabbit live in a hole in the ground?

Why is the tortoise covered with shell?

Why does an opossum pretend to be dead?

Summary.

Animals defend themselves in various ways.

Birds of prey attack other animals with talons and beaks. Other birds, when attacked, use their bills and claws to defend themselves. Beasts of prey use claws and teeth for the same purpose. Some of these strike an enemy with a heavy paw.

Animals that feed on grass or grain are supplied either with sharp front teeth or tusks, or else with horns with which to defend themselves. The tails of many animals are also used to defend them against attack or as a means of escaping from it.

The mane of the lion and the horse not only protects the eyes from dust, but also protects the animal from the teeth or claws of other animals.

Some beasts hug their victims until the breath is forced out of the body and the lungs collapse. The flat foot of the bear enables it to stand firmly on its hind feet while suffocating its victims. The kangaroo holds its prey in its fore legs and tears the body with the long middle claw of each hind foot.

Some snakes crush their victims by twining their long body round and round the captive. Others are supplied with poison fangs with which they kill an enemy. Other snakes and lizards seek safety in flight. The lizard can cast part of its body and thus escape from danger.

The tortoise cannot move rapidly and it protects itself from danger by withdrawing into its shell. It also uses its beak to defend itself. Snails also can withdraw into their shells at the approach of an enemy.

Oysters and clams have their bodies protected by a hard covering which they can close when in danger.

Fish use fins and tail as a defense. Nearly one half of the body is made up of backbone and muscle, with which a blow can be struck, as well as the body propelled through the water.

Lobsters and crabs are covered by shells. They are also supplied with pincers and claws with which they can capture their prey or injure an enemy. These animals can also drop off the whole or part of a claw and thus remove the remainder of the body from danger.

Insects are supplied with wings with which they can escape from danger.

Some are supplied with stings as a means of defense. Birds also find safety in flight from their natural enemies. Some animals climb for the same purpose. Monkeys use their four hand-like feet and their tails for escaping from danger.

Some animals have homes of such a kind that their enemies cannot reach them. This may be the nest of the bird, the burrow of the rabbit, or the squirrel's hollow tree. Animals build their homes so as to imitate the surroundings. To these homes they flee swiftly when they have no means to combat an enemy successfully.

Some animals have the power of sending forth an unpleasant odor which acts as a safeguard and prevents the approach of an enemy.

COLOR AS A PROTECTION.

Conversational Lesson.

Consider the color of animals in reference to where they make their homes and seek their food.

Of what use is it to many birds to be brown in color? Why are birds in tropical countries covered with brilliant plumage?

Why is the tiger striped? the leopard spotted? Why has the grasshopper its color? Why is the frog green?

Of what colors are bears? Why?

What is the difference in color between the oyster and the clam? Of what use is its color to each of these animals?

Name some other animals that live in the water. What is the color of each? Why?

Which animals seek their food at night? Of what color is each? Why?

Summary.

Animals are protected by their color, which is generally similar to the surroundings. This is of use whether the animal is seeking to attack or to escape from another.

Fish generally have bodies with the upper side dark. Those that live near the surface of sparkling water have brilliant, silvery bodies somewhat like the sunlit ripples. Those that inhabit the deepest water are of a color resembling the bed.

Lobsters and crabs are of the same color as seaweed. The snake and lizard are similar in color to the mossy ground. The brown feathered coats of birds resemble the bare branches of the trees. Those of more brilliant plumage are found among bright-colored grasses, leaves, and flowers.

Insects that hover near water have transparent wings. Those that live among leaves or on the stems of plants are green. Others that live among dried and faded grasses, on the bark of trees, or on the ground have bodies of a color to imitate the surroundings.

The tiger's striped body has the effect of the shadow and sunlight of the long grasses among which he roams.

The leopard's spots resemble leaf shadows. The sable and brown bear have coverings of a color similar to that of the bark of trees. The polar bear is white. Animals that live in sandy regions are of a tawny color, as the lion, the camel, the shrimp, and the clam. The bat is black in color, and the rat and mouse are of a dark color that cannot be seen easily at night when they leave their nests to seek food.

HOW DIFFERENT ANIMALS BREATHE.

Conversational Lesson.

Is our blood warm or cold? What is the temperature of the blood of the chicken? the tortoise? the catfish? the grasshopper? the frog? the cat? the whale?

What is the color of our blood? What is the color of the blood of each animal just mentioned?

What material do we use for breathing? What is used by birds? snakes? whales? crabs? oysters? flies? dogs?

Examine the body of a grasshopper for the purpose of finding the breathing holes. Have insects lungs? Why do insects and birds need air in every part of the body?

Why does a fish constantly open and close its mouth? Of what use are nostrils to a fish? Where are the gills of a fish? Of what color are they? Why? What becomes of the water after a fish has used it for breathing? How are the gills of a fish protected?

Where are the gills of the oyster? lobster? clam? What arrangement does a clam possess for sending water to and from the gills?

What organs do we use for breathing?

What other animals use lungs? What is the color of a chicken's lungs?

Summary.

All animals have organs of breathing suited to their modes of life. Some animals breathe air. Among these are human beings, beasts, birds, reptiles, and insects. Some animals breathe water, as fish and shellfish. The object of all breathing is to purify the blood.

Among those that breathe air, some animals have lungs for breathing, as man, beasts, reptiles. Reptiles breathe very much more slowly than we do.

The tortoise takes in air through the nostrils and swallows it. After it has been used, the lungs slowly collapse and the air is thus sent out. The lungs of the lizard are protected by movable ribs. The muscles attached to the ribs move them and thus help to pump the air in and out of the lungs. Snakes use but one lung and this is a very long, narrow bag. The hissing

noise which snakes make is caused by forcing the air quickly in and out of this air bag.

The crocodile has a valve in its mouth. This is used to separate the mouth from the air passages. The air is taken in through the nostrils and sent to the lungs. The nostrils are very far back on its head. By this arrangement it can hold a victim under water until it is drowned, without being deprived of air itself.

Birds breathe by means of lungs connected with air sacs. These air sacs are connected also with the hollow bones. There are nine air sacs altogether. Three are near the collar-bone, four are in the chest, and two are in the abdomen. This arrangement for breathing is also an advantage in making the body of the bird light and thus assisting its flight.

Insects have no lungs and no closed system of blood vessels. They breathe air by means of spiracles. Spiracles are tubes which open on the surface of the body. These openings are called breathing holes. The tubes extend to every part of the body, even to the ends of the legs and antennæ, and in this way the blood in every part of the body is purified. As these creatures move about very quickly, it is necessary that the spiracles or air tubes should be very flexible. If they were stiff they would interfere with the movements of the insect. Most tubes that are flexible will flatten if they are bent (as a piece of rubber hose). If this were the case with the air tubes of insects, they would be deprived of air whenever the tubes were bent. To avoid this danger, the air tubes have double walls, and between these two walls is wound a strong, hair-like thread in the form of a spiral.

Fish breathe water by means of gills. Gills consist of a number of folds of the skin. These are full of blood vessels, which cause them to have a red color. The gills are protected by a scaly cover. The fish takes in water through the mouth and passes it through toothed slits in the throat to the gill chamber. The blood is purified in the gills by means of this water. Then the toothed slits are closed and the water which has been used is forced out under the gill covers.

In fish the gills are attached to the sides of the head. In lobsters and crabs the gills are attached to the legs. In the clam and oyster the gills are along the edge under the mantle.

The clam has an organ for carrying water to and from the gills. This is a

bent tube called the siphon, that passes through the clam. The two ends of the tube are side by side on one edge of the body. It has power to extend this tube so as to obtain water when it buries itself in the sand.

The tadpole breathes water by means of gills, but when it becomes a frog it breathes air by means of lungs. It can also breathe water by means of its skin.

BEASTS.

Conversational Lesson.

Examine a number of beasts in reference to their covering. How are the following animals covered: the lion? the bear? the sheep? the horse? the dog? the cat? the whale? the bat? the hedgehog? the hippopotamus?

What is the reason for the kind of covering each of these animals has?

How do the feet of animals differ? Name an animal that walks on the toes; one that walks on the toe-nails; one that walks on its whole foot.

Which animals have paws? Which animals have hoofs? What is the difference between a paw and a hoof?

Name an animal that climbs by means of its claws. What does a monkey use for climbing?

Why is the beaver web-footed?

Why have the deer and chamois double hoofs?

On what kind of food do each of these animals feed: the horse? the cat? the dog? the pig? the cow? the rabbit?

What kind of teeth have animals that feed on flesh? What is the difference between the front and back teeth of these animals?

What kind of teeth have animals that feed on grain? What

teeth are missing in the mouths of cud-chewers? Why is the cow a cud-chewer? What movement have the jaws of a cow in eating? Why?

What kind of teeth have animals that gnaw? What teeth are missing in the jaws of these animals?

How do the following animals defend themselves: the cat? the dog? the cow? the horse? the rabbit? the opossum? the tiger? the squirrel? the monkey? the bear?

Which animals use their horns as a means of defense? teeth and hoofs? teeth and claws? the tail? flight?

Why does a rabbit live in a hole in the ground?

Compare the body of a tiger with that of a hippopotamus in reference to its shape. Which has the most nimble body? Which is the swiftest? Why?

Why do flesh-eating animals have more slender, agile bodies than grain-eaters?

Why has the lion a thinly covered body?

Why has the hippopotamus a tough, thick covering? Why is its hide in wrinkles or folds?

When do the cat's eyes have the largest pupils? What are they like in the light?

Why is the tiger covered with smooth, soft fur?

Of what use are the padded toes of the cat and tiger?

Why are the bat and rat dark in color?

Why is the tiger striped?

Why is the lion tawny?

Why has the squirrel its color?

Of what uses are the various animals to us?

Name some that are useful for their covering, teeth, horns, hide, hoofs, etc.

A visit to the Zoological Garden will be a means of gaining much information in reference to all kinds of beasts. Careful observation will reveal the climate of the country from which they come, and the kind of ground over which they travel. The kind of food which they prefer and the means by which they protect and defend themselves from danger can also be discovered.

Pictures of these animals can be seen in any dictionary or encyclopedia at any public library; other books also can be found containing information about these animals, their traits of character, how they build their homes, and many other interesting facts.

Summary.

Beasts are four-footed animals. They are warm-blooded, and breathe air by means of lungs. Their bodies consist of a bony skeleton covered with muscles. The outside covering varies with the climate and habits of the animal. Beasts vary in size from the mouse to the elephant.

Some animals are covered with thick hair or wool, as the bear and sheep. Some are covered with soft fur, as the tiger, cat, and rabbit. Others are covered with a tough, thick hide, as the hippopotamus, elephant, and whale. Others have a skin covered with hair, as the horse and giraffe.

Beasts have organs fitted to their needs, by means of which they move from place to place, obtain food, and defend themselves.

The teeth of beasts differ according to the kinds of food which they need. Flesh-eating animals have sharp teeth for tearing their food. These animals have also very rough tongues. as the tiger, cat, dog, wolf, and lion. Animals that feed on grain and grass have broad, flat teeth for grinding their food. Some of these animals have sharp front teeth for cutting their food, or sharp tusks for digging roots from the ground. Among these are the horse, elephant, hippopotamus, and pig.

Some grass-eating animals are cud-chewers. These have no front teeth in the upper jaw. These animals are supplied with horns. Among these are the cow, sheep, goat, deer, etc. The camel is the only cud-chewer that has front teeth in its upper jaw.

Animals that gnaw have two long, sharp, cutting teeth in the front of each jaw and grinding teeth on each side of the jaws at the back, with a space between the cutting and the grinding teeth. The teeth of these animals grow from deep sockets and continue to grow during the whole of the animal's life. The beaver, the rabbit, the squirrel, and the rat have teeth of this kind.

Animals that feed on insects, such as the hedgehog, the mole, and the bat, are supplied with a great many very small teeth with sharply pointed surfaces.

The feet of beasts are fitted for the kind of ground over which they travel. Some have hoofs for traveling over firm, compact surfaces, as the horse and buffalo. The toe-nail of these animals covers and protects the toe. The camel is fitted to walk on sandy soil.

Some beasts have paws, as the dog, cat, wolf, and panther. The feet of these animals are supplied with claws. The claws of animals like the tiger and cat can be sheathed or extended according to the animal's needs.

Some have feet adapted to rocky surfaces and mountain climbing, as the deer, chamois, sheep, and goat. Animals of the bear family walk on the whole foot. Most other animals walk only on their toes. Some animals have feet of such a kind that they can grasp firmly when climbing or swinging from branches, as the monkey, the opossum, and the bat. The feet of the mole and rabbit are also of use in burrowing through the ground. They make their homes so that enemies cannot reach them.

Beasts defend themselves in various ways. Beasts of prey are supplied with strong muscles and bones, and sharp teeth and claws with which they seize their victims.

Other animals defend themselves with hoofs, horns, or teeth when they are attacked. Some animals have solid horns that branch, as the deer. These fall off each spring and grow again, increasing in size each year. The cow has hollow horns that are fastened firmly to the head and never fall off.

Some beasts that are not fitted for combat seek safety in flight and have agile muscles and limbs to take them from danger. The homes of these weaker animals are generally of such a kind and location that they cannot be reached by other beasts that seek to injure them.

Some animals use their tails to defend themselves, as the horse and lion. Others use their tails to assist them in climbing, as the monkey and opossum.

The squirrel uses its bushy tail in balancing the body as it jumps from tree to tree. The whale uses its tail to defend itself from an enemy.

Animals are of a color that imitates their surroundings. This is of use whether they are seeking to attack or escape from another animal.

Beasts are useful to us in various ways. Some are used for carrying burdens, such as the horse, the elephant, the camel, the ox, and the mule. Some supply us with food. Among these are the cow, the deer, the buffalo, the rabbit, the giraffe, and the bear.

The coverings of some animals are of use in making rugs and fur garments. Among these are the buffalo, the bear, the marten, the ermine, the tiger, the squirrel, and the seal. The coverings of certain other animals supply us with materials for making clothing, as the camel, the sheep, and the alpaca. The hides of some animals are tanned into leather, as the ox, the chamois, the goat, and the kangaroo.

The horns and tusks of some animals are used in making combs, buttons, handles for knives and umbrellas, and other fancy articles. Among these are the cow, deer, and elephant. The bones and hoofs of the horse, cow, and some other animals are sometimes made into glue, and the hair is used in making plaster.

The seal, whale, and walrus supply us with oil. From another kind of whale we obtain a material known as whalebone. The whale of this class has no teeth. To the roof of the mouth is attached a substance consisting of many rows of hard fringes. This constitutes an immense sieve for obtaining its food, which consists of small marine animals. This arrangement is made of the material which we call whalebone.

BIRDS.

Conversational Lesson.

Examine as many birds as possible. A visit to the Zoological Garden will be a means of gaining much information in reference to the structure, size, shape, and coloring of these animals, as well

as the difference in the shape and color of their bills, claws, eyes, etc.

From these facts much can be discovered in reference to their manner of moving about, their means of defense, and their method of obtaining food. Much information can be obtained from a dictionary or encyclopedia. In any public library can be found other books about their habits and manner of building their nests.

How many legs have birds? Do they all have the same number of claws? Name some birds that scratch with their claws. What is the difference in position of the back toe of a scratcher and a percher? Why does not a bird fall from its perch when it is asleep? Name some birds that perch; some that swim; some that wade; some that climb; some that hop; some that run; some whose claws are a means of defense; some whose claws are used in obtaining food. How do the claws of animals differ? What peculiarity have the claws of a parrot? What are the claws of an eagle called?

Consider the fact that the claws of a bird are really its toes. The first joint from the toes, that bends backward, corresponds to the heel of human beings. The knee joint (which bends forward in all animals) is close to the body under the feathers.

Do all birds have the same kind of covering? Why are birds covered with feathers instead of fur? What is the difference between the feathers of a duck and those of a chicken? Why are the duck's feathers more oily? Why are the owl's feathers so soft and downy? Why has the eider duck such a close covering of down?

Of what use are feathers to a bird? As the feathers are sufficient covering to keep them warm, why do some birds migrate at

the approach of cold weather? What is meant by "birds of passage?"

Examine a bird's feather closely, under a microscope. A feather is fastened in the bird's skin by means of a tube. This tube forms a middle vein in the feather. On each side is a row of smaller stalks or veins closely planted. These also in some cases bear still smaller veins.

Of what advantage to a bird are hollow bones?

On what do birds feed? Do all birds eat the same kind of food? What kinds of food are preferred by the sparrow, the duck, the canary, the eagle, the sea gull, the parrot, the crow, the stork, the woodpecker, and the blackbird?

What kind of beak and claws have the eagle and the owl? Why have birds that eat insects long bills? Why have grain eaters strong bills? Why have birds of prey sharp hooked beaks?

What kind of a beak has each of the following: humming-bird, sparrow, raven, hawk, pelican, robin, bobolink (or rice-bird), crow, duck, lark, blackbird, and magpie?

Of what use are wings to a bird? Where are the muscles that move the wings? Of what use are wings to the ostrich and penguin? How does a bird use its wings in flying?

Consider how the sizes of birds vary, from the tiny humming-bird to the albatross, which measures from ten to twelve feet between the tips of its wings.

In how many ways are birds useful to us? Name birds that are useful in each of the different ways.

Summary.

Birds are two-footed animals. They have a bony skeleton covered with flesh and feathers. Their bones are hollow and filled with air; this helps to make the framework of the body very light. They are warm-blooded animals. They have no teeth, but crush their food by means of a gizzard. They feed on worms, grains, fruits, insects, and fish, and have a bill and claws fitted for obtaining the kind of food which they need. The bill of the bird is the horny covering of the jaws.

The eyes of birds are supplied with three eyelids, — an upper eyelid, a lower eyelid, and a skin or membrane attached inside the lower lid. This can be drawn over the eye like a curtain, and by means of it birds can look at the sun without inconvenience. The eyes of birds like the eagle and hawk are supplied with a set of bony plates which can be arranged for seeing objects that are distant as well as those that are near.

Birds of prey have strong, sharp beaks that are hooked, and sharp claws or talons. Among these are the eagle and the owl. Birds that feed on grain have short, strong beaks, as the lark, the bobolink, and the sparrow. Birds that feed on insects have long, slender beaks. The blackbird, humming-bird, and robin have bills of this kind.

Birds can move from place to place in different ways. Most birds move by flying. These have bodies that are light in weight, and wings and muscles of size and strength sufficient to raise them in the air. Some birds can run. Among these are the ostrich and sandpiper. The ostrich can run very swiftly for many hours, using its wings like sails, but it does not escape from its pursuers because it runs in a series of circles. Many birds that fly hop when they are on the ground.

The adjutant bird or marabout, which is found in Asia and Africa, is the only bird that walks on its whole foot. The first joint from the toes (which is really the heel) rests on the ground along with the toes. The legs of birds are covered with a scale-like skin.

The claws of birds are fitted for the particular needs of the bird. Some need claws for scratching, as the peacock, chicken, pigeon, and quail. Birds that scratch do not fly much and they have short wings. The parrot and

woodpecker have long, large feet, with two front toes and two back, with which they can climb along the bark of trees.

The lark and canary have claws with which they can grasp a twig firmly in perching. All birds that perch have a long hind toe.

The tendon that is used to bend the claws passes over the joint in such a way that when the bird is perching, the weight of the body, pressing downward, keeps the claws bent firmly.

Birds that swim are web-footed, and have broad bodies. Among these are the duck, goose, pelican, and sea gull.

Birds that wade have long legs, with long, flat toes, as the stork, heron, and sandpiper; but these birds can fly as well as wade.

All birds have bills or beaks fitted to obtain the kind of food that they need. They make their homes near places where this food can be most easily obtained.

Some birds go fishing for food. Among these are the duck, the pelican, the penguin, the sea gull, and the stork.

Some of these have webbed feet so that they can swim after their food. The wings of the penguin have no feathers. It uses them as fins for the purpose of swimming. The stork and heron have long legs and spread toes for the purpose of wading after frogs, lizards, etc. Other birds, such as the sea gull and the pelican, fly close to the water and seize the fish as it approaches the surface of the water.

The pelican has a skin-like pouch, or bag, in which it places the fish which is captured, to be eaten later. The sea gull and pelican are web-footed and have long, hooked beaks.

The fishhawk or osprey has claws like the eagle, with which it catches fish.

All birds of prey are solitary in their habits. The owl is a bird of prey that flies at night and feeds on other creatures that wander at night, such as rats, mice, bats, etc.

The flesh of some birds is useful for food to man and other animals. The eggs of some birds are also useful for food.

The feathers of some birds are used as decoration by both civilized and savage races.

Some birds are useful in destroying other creatures that annoy us, as worms, bugs, beetles, etc.

Some birds build nests; others do not. Nests are generally built so that the inside is soft and warm. Sometimes they are made of hay and straw. Some are lined with horsehair, feathers, thistledown, moss, or sheep's wool, which are found on bushes. The nest of the ostrich is simply a hole in the ground, in which it places the eggs. It sometimes wanders a long distance seeking food. If in its wanderings it finds another nest, it forgets its own and adopts the one it has found.

Some birds build their nests in high places. The eagle places its nest among the rocks. The sea gull builds its nest of seaweed on ledges of rock close to shore. The heron makes its nest in the tops of tall trees.

Other birds have their nests in low places. The lark's nest is built on the ground and is lined with dried grass and roots. The partridge scratches a hole in the ground among high grass or corn, and lays a few twigs across it. The peacock hides its nest on the ground among low bushes. It is made of a few sticks, twigs, and leaves closely put together.

Some birds build their nests in trees. The thrush uses either a tree or a low bush. The jay's nest is made of roots woven together like a basket, and is placed upon a kind of platform of birch and other small twigs put together very loosely.

The nest of the bobolink or reed bird is woven of broken reeds and grasses and pieces of moss. It fixes it among the tall reeds and grasses on the edge of a stream, using the reeds as pillars to support it.

The sparrow builds a nest either in a tree or under the eaves of a house. It will also steal the nests of other birds.

Birds build their nests so as to imitate the surroundings and thus protect the inmates from their enemies. Their nests are always so placed as to be near the kind of food which they prefer.

As a general thing, the smaller the bird and the more delicately formed its feet and bill, the more compactly will its nest be built.

REPTILES.

Conversational Lesson.

Examine some animals that are reptiles. These can be seen at the Zoological Garden, as well as in many damp places in meadows or woods. Examine each reptile in reference to its color, size, shape, covering, manner of moving from place to place, its means of defense, etc. Snake skins and tortoise shells should also be examined.

In what kind of climate are reptiles fitted to live? During which season are they inactive? What does "dormant" mean? What do they use for breathing? Why can some of them remain under water for a time? What kind of food does each of these animals eat? Which of these animals have no teeth? Which have beaks? What peculiarity have the teeth of snakes? the teeth of alligators?

Which of these reptiles have no feet? What kind of feet have the other reptiles?

Where are the nostrils of the crocodile?

How do the eggs of the tortoise and crocodile differ from those of the chicken?

Name some snakes that are poisonous. Name some that are not. Where does a snake carry its poison? How does a boa-constrictor treat its victims?

What use do we make of reptiles?

In what country is the crocodile considered sacred?

What peculiarity has the chameleon?

Many interesting facts in reference to the habits of these ani-

mals, as well as to their structure, color, etc., can be found in books in any public library.

Summary.

The lizard, tortoise, snake, crocodile, and alligator are reptiles.

Reptiles are cold-blooded, egg-laying animals that crawl along the ground. They all have backbones. Some have bodies covered with horn-like plates. Others are covered with scales. These scales are really folds of the skin, and are not separate like fish scales.

Reptiles breathe air through the lungs. Their eggs are deposited in mud and hatched by the heat of the sun. These animals live in or near water, but like to lie in the sun on land. They are of a sluggish nature.

During the winter they burrow in the mud of swamps and marshes or hide in some dark place and lie torpid until spring. All of these animals feed on other animals.

Some reptiles have an upper and a lower eyelid, in others there are no eyelids.

The body of the tortoise is protected by a box formed by two bony shells. The upper part is called the carapace and the lower one the plastron. When in motion the head and legs are thrust from the shell. The carapace is really composed of the backbone and ribs, which have grown together. This is covered by the bony plates of shell. Around the edge of the shell is a series of plates for binding the ends of the ribs together. The tortoise has two pairs of legs, fitted for either swimming or walking, although it walks very slowly. The jaws are toothless and are made of hard, bony material, which is extended to form a kind of beak.

The flesh of the tortoise is used for food, and its shell is made into combs and many other fancy articles.

Some tortoises live on land. Some live in fresh water or marshes and others live in the ocean and are called turtles. The land tortoise has a convex or rounded carapace and short legs. The sea tortoise or turtle has a flat carapace and long, flat legs for swimming. The fresh-water tortoise is of a shape between the other two. Land tortoises feed on plants. Sea turtles

feed on seaweed and jellyfish. Fresh-water tortoises feed on frogs and fish.

Crocodiles and alligators are very much alike. The crocodile has a longer head and tail, and its feet are more webbed than those of the alligator. It has two pairs of legs, the front pair being shorter than the back pair. The jaws contain sharp teeth, set in sockets. As the teeth wear out or are broken, new ones grow inside of the old ones. Crocodiles are supplied with a pair of thin valves at the back part of the throat in front of the passages from the nostrils. By closing these valves, the mouth can be opened in the water without danger of suffocation, as the animal can continue to breathe through the nostrils. These animals can hold their prey under water until drowning occurs and yet keep their own nostrils above water, thus being able to continue breathing. Their eyes are supplied with three eyelids, one of which is a skin which they can draw over their eyes from the side. They are covered with a thick scaly skin, which can be tanned into leather.

Snakes have no legs, but crawl along the ground with a rising and falling motion of the body. The backbone of the snake is made of bones which are joined together by a ball and socket joint. To each of these bones is joined a pair of ribs. The snake uses these ribs in place of feet, even though they are under the skin. The ribs of the snake can be moved backward and forward, and as these are moved the scales on the under side of the body catch on the surface of the ground and thus assist in moving the body.

The scaly skin of the snake is of different colors in the different kinds of snakes. At various times during the summer the snake changes its skin. It becomes dull and inactive, stops eating, and seeks a hiding place. When the old skin slips off, the snake leaves its hiding place and starts out in its new skin to seek food. Snakes have no movable eyelids. The eyes are covered by the skin, which has two transparent places directly over the eyes.

The jaws of the snake are joined together loosely by gristle, so that the mouth can be opened wide enough to swallow toads, frogs, and larger animals easily. The bones of the lower jaw are separate from the skull. The tongue of the snake is forked and is used for feeling, like a finger. The teeth of the snake curve backwards. The snake does not chew its food, but uses its teeth for holding and swallowing its prey.

Most snakes are poisonous. The fangs contain the poison. These are two

teeth longer than the other teeth. When at rest these turn backward like the other teeth. When they are in use they are thrown forward and thrust into the victim.

Some snakes kill their victims by winding their bodies closely around and crushing them.

The noise of the rattlesnake is made by rattles in the tail. These consist of a series of button-like plates. The age is indicated by the number of rattles, one for each year of its life.

The skin of snakes is tanned into leather. Indians cover their arrowtips with the poison from the fangs of a snake.

The lizard has a long, rounded body covered with scales, somewhat like those of a snake. Some have two pairs of short legs by means of which, together with the scaly skin, they can travel very quickly. Other lizards have no legs. The tail is very long, sometimes longer than the rest of the body. It tapers from the body to a point.

Some lizards are supplied with sharp teeth. Some have forked tongues and some have tongues that are club-shaped. They have very bright eyes, supplied with two or three movable lids. Lizards vary in color, but they are usually green. The skin of the lizard is sometimes tanned into leather.

FISH.

Conversational Lesson.

What is a fish? Where does it live? What do fish breathe? What are the organs of breathing called? How many gills has a fish? Of what color are they? Of what use are they? How are they protected? How many fins has a fish? Of what use are they? How do these differ in shape, size, and structure in different fish? To what parts of human beings do the fins of fish roughly correspond? Compare the bones of fish with those of other animals.

How are fish generally covered? Why is the covering thick? Why is it smooth? Why is it oily? Why is it composed of many scales instead of being in one piece? In what direction does the free edge of the scale extend?

What kind of covering do eels, mackerel, and catfish have?

Examine the mouths of fishes to find out the kind of food each is fitted to eat. What kinds of food are used by sunfish, catfish, trout, minnows, shark, shad, etc.?

What peculiarity has the mouth of a fish that feeds on other animals? Why has the shark several rows of three-cornered sharp teeth?

What fish wander in "schools" from place to place? Name some fish that live in one place.

Name some fish that live in salt water, and some that live in fresh water.

In what kind of water are the following found: trout, shark, herring, catfish, bass, bluefish, and cod? Why is not the whale a fish? Compare the color of fish that live in deep water with that of fish that live in shallow water. Why are some fish the color of sand?

What kind of blood have fishes?

Of what use are the nostrils of a fish?

Of what use are mackerel, sturgeon, menhaden, catfish, cod, etc.? Examine as many fish as possible in reference to their structure, size, color, etc. When the real fish cannot be observed, pictures can be found in a dictionary or encyclopedia. Many other books can be found in a public library, describing their food, homes, modes of life, etc.

Summary.

A fish is a cold-blooded animal. It has a backbone and lives in the water.

Fish breathe by means of gills, and use water instead of air for that purpose. Water is taken in through the mouth, and after the fish has used it for the purpose of purifying the blood, it is sent out through the gills. The gill cover opens and closes regularly for the purpose of letting out the water.

Some fish are covered with a tough skin, but most fish are covered with scales which overlap each other.

The scales of different fish vary in shape. Some are circular in shape, as those of the carp. Some are toothed, as those of the perch. Some are hard and polished, as those of the sturgeon. Some are flat, as those of the dog-shark.

The seven fins of a fish are used for propelling, balancing, and steering it through the water.

The fins vary in shape in different fish. Some fish have fins longer than they are wide. Among these are the flounder, halibut, carp. Others have fins wider than they are long, as the pickerel, cod, trout, and catfish. The fins of some fish are supplied with hard, bony rays, such as the rock, perch, bass, bluefish, etc. In other fish the rays of the fins are of tough gristle. Among these are the minnow, sardine, and herring.

The tails of fish vary in shape. In some the tails are cut in, in a sharp point, as the mackerel, sardine, shad, and herring. The tails of some have an almost straight edge, as the cod and catfish. In some fish the tails are slightly curved in, as salmon, halibut, haddock, perch, and black bass. In others, as the minnow and sea bass, the edge curves out slightly. The tails of the shark and sturgeon have the upper point much longer than the lower one.

Most fish are supplied with an air bladder, by means of which they can float in the water. Some fish have no air bladder and must swim all the time, as the shark.

The eyes of some fish are large. Those having small eyes are generally supplied with feelers.

The sense of smell is located in the nostrils.

The mouths of fish vary according to their habits and the kind of food which

they eat. Those that are flesh eaters need sharp teeth. Those that feed on insects have no teeth.

Some fish live only in salt water and others live in fresh water. Some inhabit quiet, shallow pools and lakes. Others prefer deep water or rapid streams.

Fish that inhabit shallow water are bright in color. Those that inhabit deep water are dull in color on the upper side.

Some fish wander from place to place in "schools," while others live in one place.

Some fish migrate from the sea to the river at certain seasons, as the shad and the sturgeon. Others migrate from the river to the sea, as the eel.

Fish vary in size from the tiny minnow to the large shark that is sometimes sixty feet in length.

A young minnow is almost transparent. If we examine it closely, we can see that the head, gills, heart, and stomach occupy the front half of the body. The remainder is made up of bone and muscle.

Fish are useful in various ways. Some are used for food. Others furnish us with oil, and from others material for fertilizing the ground is made. The covering of the air bladder of the sturgeon is used for making isinglass.

Most fish have nests of some kind in which to deposit their eggs. These sometimes consist of a hole in the ground or gravel. Two fish that follow this plan are the salmon and the trout. Many salt-water fish visit fresh-water streams for the purpose of depositing their eggs.

The lamprey eel builds a nest of stones. Many fish of this species combine to build a common nest. The mouths of these fish are capable of great power of suction. By this means they succeed in raising large quantities of stones and carrying them long distances for the purpose of building the nest.

The sunfish uses a hole in the sand under a leafy growth. The leaves and stems of the plant surround and protect the nest, which is made of stray twigs.

The stickleback makes a solid nest of grasses, twigs, etc., and then makes a hole in the solid nest to receive the eggs. These fish will work at nest-building in an aquarium, if they are supplied with materials.

SHELLFISH.

Conversational Lesson.

Examine some shellfish, such as the oyster, clam, mussel, crab, lobster, snail, shrimp, hermit crab, etc.

Compare the coverings of these animals in regard to size, color, shape, structure, hardness, and how the parts are joined.

Which of these are called mollusks? What does "mollusk" mean? Which are called bivalves? Why? Which are crustacea? Why are these so called?

To what part of other animals does the shell of each of these animals roughly correspond.?

What is the color of the crab and the lobster? Of what advantage is it to these animals to have the color of seaweed? Which of these animals are the color of sand? Why? Which of them have the hardest covering? Which of them in growing cast their shells? How do the others increase the size of their shells as they grow?

Which of these mollusks move from place to place? What organ do they use for that purpose?

Why is the flesh of the clam tougher than that of the oyster? Why is its shell smoother?

What furnishes food for the oyster? What does animalcule mean? Examine some of these little animals with a magnifying glass.

What happens to the valves when the oyster dies? What is the cause of this?

Find the lines of growth on the outside of the oyster shells.

Find the hinge which joins the two valves, and also find the ligament. Find the scar in the shell caused by the attachment of the muscle, and the line of scars made by the muscle as the oyster grew larger.

On what do each of the other shellfish feed? What is the difference in structure between those that feed on plants and those that feed on animals?

What is the shape of a snail's shell? What is the operculum? Of what use is it to the animal that has it?

Which of these shellfish do we use for food? Which do we not use as food? Which do we cook while they are yet alive? Which do we sometimes eat while they are still alive?

Which of these animals are found in salt water? in fresh water?

What means of defense has each of these animals? Of what advantage to the crab is its ability to cast a claw?

Consider the fact that all shells found on the shore of salt or fresh water have been at some time the homes of animals. Some shells are spiral in shape with an opening at one side. Examine a number of shells for the purpose of finding out whether the animal was covered by one or more shells.

As many shellfish as possible should be examined with the aid of a magnifying glass. Various kinds of snails can be observed in an aquarium. Pictures of many varieties of shellfish can be seen in a dictionary. At any public library can be found books containing much interesting information about these animals, — their homes, habits, etc.

Summary.

Shellfish may be divided into several classes, according to the nature and arrangement of their shells. Some shellfish cast their shells and grow new ones as they increase in size. In others the shell is a part of the animal, to which it is firmly fastened. The shell of an animal of this kind grows with it.

Animals like the oyster, clam, and mussel form one class. These are called mollusks. Animals of this class have no head.

Another class is composed of animals like the lobster, crab, shrimp, and barnacle. Those like the snail, conch, etc., form another class.

Some shellfish live in salt water and some in fresh water.

We use the lobster, crab, oyster, clam, and shrimp for food.

THE CLAM: The clam is covered by two shells joined together by a hinge and a ligament. The edge at which the two shells are joined is called the hinge margin. The ligament is inside of the shells.

The hollow places on the inside of the shells show where the animal has been attached to the shells. The hollow place around the edge is caused by the thickened mantle.

The shell increases in size as the clam grows, and the lines of growth can be seen on the outside. The beak is found on that side of the shell where the lines of growth are smallest.

Hold the shell with the edge on which is the ligament uppermost, with the ligament toward the body and the hinge away from it. The back of the clam will be next to the person holding it and the front of the clam will be at the edge furthest from the body. The siphon openings are at the back and the foot is at the front of the clam. The mouth of the clam is just above the foot.

The fleshy part close to the edge of the shell is called the mantle. The edge of the mantle deposits material for the growth of the shell in layers around its edge.

The mantle deposits the pearly material which sometimes forms the inner coating of shells. A tiny pebble or any other small particle that gets between the mantle and the shell becomes formed into a pearl.

The clam breathes by gills. These are four broad folds of the mantle. The water is carried to and from the gills by the siphon.

The siphon is a tube divided into two channels. The channel toward the free edge of the shell is the opening by which the water is admitted. The channel nearest the hinge carries the water out after it has been used by the clam. The siphon can be extended so as to obtain water when the clam has buried itself in the sand. The water thus obtained also supplies the clam with food.

The foot which is at the front of the clam (opposite the siphon openings) is the muscle by means of which the animal crawls or burrows.

The clam is joined to its shell by two muscles.

THE OYSTER: The oyster is enclosed in two shells. The left valve is larger and deeper than the right, and is the one which is fastened to the oyster bed. The shells are joined by a hinge and a ligament. The animal is attached to its shells by means of a muscle. This muscle is used to draw the shell together. The dark purplish mark on the inside of the shell shows where the oyster has been joined to it.

The mantle of the oyster is not thickened as in the clam, but the edges are separate. The gills by which the oyster breathes are four in number and are under the edges of the mantle. They can be seen by removing the mantle.

The oyster admits the water between its shells at one point and sends it out at another. It has no special tubes or canals for this purpose. The oyster uses this water for breathing and also feeds on the little animals (called animalcules) which the water contains.

The dark part of the oyster contains the stomach and liver, and the hardened part is the heart.

THE SNAIL: Animals like the snail, conch, etc., have one shell. Some snails live in fresh water and some in salt water, and some live on land.

Many of these have shells which are twisted in the form of a spiral. Some are in the shape of a long spiral and others in the shape of a flat spiral. Land snails generally have flattened shells.

The lines of growth in a spiral shell are parallel to the opening or aperture.

The part on which the snail rests is its stomach. It uses the stomach as a foot when it wishes to move.

A shellfish of this kind has a head. On the head are two feelers. It has four eyes. Two are on the head and look like tiny black dots, and two are on the ends of the feelers or tentacles.

Some snails are supplied with an operculum. When the snail wishes to withdraw into its shell it can close the opening by means of this scale-like covering.

Snails that have an operculum are supplied with gills, and use water for breathing purposes. All others have a lung, and breathe air. Those that breathe air and live in the water are obliged to come to the surface at intervals to send out the impure air which they have used, and get a fresh supply.

Snails that live on land have four feelers on the head which can be extended and drawn in.

Some shellfish of this class have a little notch in the edge of the opening. Shellfish having this notch feed on the flesh of other animals. Those that are not notched feed on vegetables, leaves, or seaweed.

Crustacea: Shellfish like the lobster and the crab belong to a class that have jointed feet or legs. They resemble seaweed in color.

Their bodies are covered with a crusty shell, not so hard as that of the oyster and clam. They are made up of rings or segments.

Their bodies consist of two parts. The head and the thorax (or chest) form one part, and the abdomen is the other part.

They breathe by gills. They have two pairs of antennæ or feelers, and always more than eight feet.

When the shell becomes too small, they cast it aside and a larger one grows in its place. Should a claw be lost or torn off, another grows. The blood of these animals is colorless.

The lobster: The lobster's body is somewhat cylindrical in shape. On the head are two pairs of antennæ and a pair of compound eyes.

It feeds on other fish. It has three pairs of jaws, — one pair for biting and two pairs for chewing.

Attached to the foremost section of the body are three pairs of jaw-feet, which it uses for catching its prey. On this part of the body are also five pairs

of legs. The first pair of legs are larger than the others and the right one is larger than the left. They are furnished with large pincers. One claw has a hook for holding its prey, and the other has sharp, tooth-like edges for tearing. The second and third pairs are also supplied with pincers. To the abdomen are attached six pairs of legs called "swimmerets," which are broad and flat, and in shape and use are somewhat like fins.

THE CRAB: The crab's body, instead of being longer than it is wide, like that of the lobster, is wider than it is long. The abdomen of the crab is very small.

The crab has a two-part body. The part consisting of the head and thorax is much larger than the other part. It has a groove on the under side into which the abdomen can be tucked. It has four eyes, — one pair simple and immovable, and the other pair compound.

It has five pairs of feet. In walking it uses one set for pushing, and the other for pulling. It can move backwards, forwards, and sideways.

The crab casts its skin several times in growing. When it is soft-shelled it remains buried in the sand with only its eyes and feelers exposed until the new shell is formed.

The oyster crab lives in the shell of the oyster, and has hooked claws so that it can cling.

Other animals of this kind are the shrimp, hermit crab, king crab, barnacle, etc.

INSECTS.

Conversational Lesson.

In studying about insects every pupil can obtain a large number of insects for the purpose of examining their structure with a magnifying glass.

Insects can be captured with a scoop-net, killed in a poison jar, fastened on a mounting block to dry, and then mounted on card-

board or in a case for future use and observation in a permanent collection.

In the poison jar insects can be killed without being either wounded or tortured. The jar is prepared as follows: —

Into a low, wide-mouthed jar drop a lump of potassium cyanide about one half the size of an egg. Cover this with a paste about as thick as molasses, made of plaster of Paris and tepid water. Always keep the jar air-tight. Raw cotton saturated with chloroform can also be used.

A collection of the different parts of the various insects (antennæ, legs, wings, etc.) should also be made for the purpose of comparison. These can be fastened to cardboard, and drawings of the separate parts, as well as of the whole insect, should be made from these real objects.

In order to study the habits of insects, how they move from place to place, how they eat their food, etc., it is necessary to observe them alive.

For this purpose a jar containing soft earth can be used. Keep the jar covered with net, and supply the insects placed in it with the proper kind of food.

Examine a number of insects with a magnifying glass, and find out how many parts make up the body, and the formation of each part or section. Of what advantage is it to the insect to have its body formed in rings or segments?

The word "insect" means "to cut in." Why was this name applied to insects? Are the three parts joined exactly alike in all insects? Are the rings seen equally well in all insects?

What organs or appendages are joined to the middle section or thorax? How many legs has each insect? On which part of the body are they? How are they arranged on the thorax?

Find out for what purpose they seem best fitted in the different insects, — walking, running, jumping, etc. Find out, also, what the surfaces are like, and what kind of legs each has. Name some that have thick legs; some that have long legs, etc.

Do all insects have the same number of wings? Name some that have no wings; some that have two wings; some that have four wings. On which part of the body are the wings placed? How do the wings of insects differ in structure, size, and shape?

Examine the mouths of insects. Mention some insects that have jaws and some that have a proboscis. Insects that feed on other insects have sharp jaws and also sharp claws. Examine the eyes and find out how many each has and of what kind.

Examine the antennæ of different insects. Where are they placed? Of what use are they? How do they differ in size and structure?

Examine the grasshopper. How many wings has it? Compare its wings in reference to structure, size, shape, and use. What other insects have wings similar to those of the grasshopper? How do these insects arrange their wings when they are not flying? Why are they called "straight-winged" insects? Are the legs of a grasshopper all alike? How many parts in each leg? For what does it use its different legs? How does it walk? Of what use are the back legs?

Examine roaches, crickets, katydids, walking sticks, etc. Which of these have no wings for flying? Examine their legs. Which are formed for running? which for jumping? Are the surfaces of their legs alike? Examine, also, the eyes, mouths, and antennæ carefully and find the breathing holes.

Consider the fact that their bodies are formed according to the means by which they obtain food, and that they are of a color

which is the greatest protection in their respective haunts. Those that make their homes on or near water are transparent. Those whose homes are in sand, grass, on stems of plants or branches of trees are colored accordingly.

Examine the cicada or harvest fly. Compare its wings with those of other insects just examined. What differences are there? How many rings can be counted in its body? Examine each part carefully.

Another class of insects are called "sheath-winged" insects. Among them are the ladybird, potato bug, squash bug, water beetle, etc. Why are they called "sheath-winged"? Examine the wings and wing covers, and all of the appendages. Are all three parts of the body free to move?

Notice how the thorax and abdomen are joined in different insects. Some become very narrow where they join, and others are broad.

Why are moths and butterflies called "scaly-winged" insects? What do the scales look like? Compare the mouth of these insects with that of other insects. What kind of food do they use? What happens to the proboscis when it is not in use?

What difference is there between the wings of a moth and those of a butterfly? between the feelers of a moth and those of a butterfly? Which of these insects flies at night? which flies in the daytime? which has a covered cocoon? which has a naked cocoon? Why does a moth cover its cocoon with a leaf?

How many wings has a fly? how many has a mosquito? Where are the wings of these insects? Are the rings of the thorax movable as they are in the butterfly? Examine the proboscis of a fly. It cannot be coiled up like that of the butterfly, neither is it a pointed beak like that of the cicada. What enables

the fly to walk on the ceiling? What takes the place of muscles in the eyes of the fly?

Examine the wings of bees and wasps. Why are insects of this kind called "transparent-winged"? How many wings have these insects? Are the wings of each insect all of the same size?

Examine the dragon fly. Compare its wings with those of other insects in reference to structure and position. Examine the feelers, legs, claws, mouth, and eyes.

If all of these insects cannot be obtained, examine as many of them as possible or examine any insects that can be obtained. Examine and compare the bodies of these insects in reference to structure, shape, size, manner in which the three sections are joined, and amount of motion of which the body is capable. Examine and compare wings, legs, antennæ, eyes, and mouth.

What is a cocoon? Who made it? Where did the caterpillar come from? How many legs has the caterpillar? Are they all used for walking? How are the legs arranged on the body? On what does the caterpillar feed? How many rings or segments in its body? how many in the thorax? How many breathing holes has it?

When the insect leaves the egg, what name is given to it? When the larva lives in the cocoon which it spins, in what stage of its life is it?

What names are given to the larvæ of flies, mosquitoes, and beetles?

Mention some insects that do not pass into the chrysalis or pupa state. What name is applied to this kind of insect from the time it leaves the egg until its wings are fully grown?

How many times does the nymph cast its skin?

Of what uses are insects to us? to plants? Of what uses are plants to insects?

Are the spider and daddy longlegs insects? Why?

In any dictionary or encyclopedia will be found pictures of many insects. In any public library are books containing interesting accounts of insects, — their habits, their homes, modes of life, etc.

Summary.

Insects are animals having a body which consists of three parts or sections. Each insect has three pairs of jointed legs.

The three parts are the head, the thorax, and the abdomen. Each part is protected on the outside by a case made up of rings or segments. It has no bones and no red blood. Some insects have no wings, some have one pair, and some have two pairs.

The thorax is made up of three rings or segments, and one pair of legs is fastened to each segment by means of a ball and socket joint. Insects in walking use the three pairs of legs alternately. The wings are fastened to the second and third segments of the thorax. The segment nearest the head never has wings attached to it.

The eyes of insects vary in number. They are sometimes simple and sometimes compound.

A compound eye has many sides or facets, and looks very much like a tiny jewel that has been cut.

Mouths of insects differ according to the kind of food which is eaten or the uses to which they are put. Insects that gnaw have two pairs of jaws. The mandibles are used for biting and the maxillæ are used for chewing.

The jaws of insects move from side to side. Those insects that feed on other insects have rather long, sharp jaws, supplied with a kind of toothed edge. Those that feed on vegetables have broad, blunt jaws.

Insects that suck have a proboscis.

Some insects that suck and also bite are supplied with a proboscis and jaws.

An insect passes through several stages before it becomes the adult insect. From the egg is hatched out the larva or caterpillar. The caterpillar sheds its coat several times and finally becomes the winged insect.

The larva or caterpillar, after casting its skin several times, spins a cocoon in which it remains quiet and inactive. From the cocoon comes the winged insect. Among insects of this kind are butterflies, moths, flies, mosquitoes, and beetles.

Other insects have no wings when they are young. They shed their skins several times, and gradually the wings develop. These insects do not spin a cocoon or pass through the inactive state. Among these are the grasshopper, katydid, dragon fly, cricket, etc.

Many insects that do not spin a cocoon have two stages of existence,—the nymph and the winged.

Insects grow only while casting their skins, and cease to grow as soon as the wings have developed. During the time of growth when the old skin becomes too small, a new one forms underneath and the old one splits down the back.

The life of an insect that spins a cocoon is divided into the following stages after it leaves the egg: (1) larva, or caterpillar; (2) pupa, or chrysalis; (3) imago, or winged insect.

Scaly-winged insects: This class of insects includes moths and butterflies.

The butterfly passes through three stages of existence, as caterpillar, chrysalis, and winged insect or imago. The body of the caterpillar is composed of thirteen rings or segments. These are connected by tiny muscles. By alternately contracting and relaxing, the rings are drawn together and separated when the caterpillar crawls. It is supplied with two pairs of jaws. In addition to three pairs of legs on the first three segments, it is supplied with five pairs of false legs. Four pairs are on the middle of the body and one pair are on the last segment.

The caterpillar sheds its skin four times as it grows, and then it spins its cocoon. The inactive stage in the butterfly is called the chrysalis, in other insects it is called the pupa state.

The cocoon is spun from the body of the caterpillar. The spinnerets are

on the head. It turns its head round and round more than twenty thousand times in spinning the cocoon. The caterpillar eats enough food to last while it is in the chrysalis state, as no insects eat during the period of inactivity. The cocoon of the butterfly is naked, while that of the moth is covered.

The butterfly comes out of the cocoon. It has two pairs of wings. The wings and body are covered with tiny scales. These look like dust and can be easily rubbed off. When the insect is at rest one pair of wings is held erect. It has compound eyes and a proboscis.

The proboscis is really the lower lip extended into a tube. It can be coiled up when not in use. The moth and the butterfly are the only insects that have a mouth of this kind.

The two feelers of the butterfly have knob-like ends.

STRAIGHT-WINGED INSECTS: The grasshopper or locust has four wings. The back pair of wings are used for flying, and when not in use they are folded together like a fan and covered by the straight, narrow, parchment-like front wings.

It sheds skin five times and then the wings begin to appear. It becomes the complete insect supplied with wings when it casts its skin the sixth time.

It has a pair of compound eyes and also three simple eyes. It has two pairs of jaws for biting and chewing. These insects produce their peculiar noise by rubbing their legs against the wing covers.

In walking, the grasshopper uses the first right leg and second left leg together. Then it uses the first left leg and second right leg together. The third pair are dragged along in walking, but are used in jumping. They are straightened out when the insect flies.

When preparing to jump, the fore legs are straightened and the hind legs are bent, with the lower section resting on the ground.

Some insects in this class are the cricket, katydid, walking stick, praying bug, locust, and green grasshopper.

SHEATH-WINGED INSECTS: In another class of insects, the front pair of wings are hard and horny, and are used to cover the flying wings when these are not in use. In flight, the wing covers stand straight out from the body. These insects have jaws for chewing. Their legs are adapted for walking.

The larva is called a grub and the succeeding state is called the pupa. The potato bug, May beetle, firefly, and ladybird are insects of this kind.

TRANSPARENT-WINGED INSECTS: Bees, wasps, ants, and hornets belong to another class of insects. These insects have four wings, all of which are transparent. The front wings are larger than the back wings. The upper and lower wings on each side of the body are hooked together in flying. These insects have jaws for biting, but some of them have also a sort of proboscis.

The bodies of bees are supplied with hairs for the purpose of gathering pollen from flowers. The pollen thus gathered is placed in pockets on the back legs.

In the wasp there is a very slender connection between the thorax and the abdomen. In bees the connection is broad.

TWO-WINGED INSECTS: The fly, mosquito, and crane fly belong to this class. They have two stiff wings which cannot be folded. They also have a pair of balancers in place of the second pair of wings. The larvæ of the fly are called maggots. The fly has a short, stiff proboscis with knob-like ends, which it can open. The proboscis can be extended when it is being used, and drawn in when it is not in use.

The eggs of the mosquito are stood up on end, side by side in a cluster, which floats in the water. The larvæ are called wrigglers. These crawl from the lower end of the egg. The breathing tube, which is near the tail, is always kept above the surface of the water until the insect passes into the pupa state. When the winged insect is ready to leave the cocoon, it crawls out and uses the cocoon for a boat. The proboscis of the mosquito is a tube formed by the upper and lower lip. It contains a bristle-like sting.

Crane flies resemble mosquitoes. They can be seen in swarms usually at twilight. They are very tiny insects that can neither walk nor fly very far.

DRAGON FLY: Another insect with which we are familiar is the dragon fly. Its four gauze-like wings are of nearly the same size. It flies rapidly from place to place, hunting for insects, upon which it feeds. At times it stops flying and rests for a moment, but it does not walk. It has two

pairs of jaws for biting and chewing. Its thorny legs have long claws at the tip. It has large, compound eyes.

Like the mosquito, it places its eggs in water or on the stems of plants that are under the surface of the water.

The nymph has a large lower lip supplied with two hooks with which it catches its prey.

IV. NATURAL SCIENCE.

THE SUN.

Conversational Lesson.

Where is west? Why? Where is east? Why? Where is the sun at noon? In what direction do the shadows point at noon? At what time this morning did the sun rise? At what time this evening will it set? Does the sun rise on a cloudy day? Does the sun rise at the same time every day? On which day in the year does the sun rise earliest? On which day does the sun set latest? On the day after this does the sun rise earlier or later? Until which day of the year will it continue to rise a little later each day? Which is the shortest day of the year? Why? Does the sun rise earlier or later on the following day? Until which day of the year will it continue to rise a little earlier each day? Which is the longest day of the year?

Does the sun rise earlier in summer or in winter? When are the days longer than the nights? When are the nights longer than the days? When are they equal?

Does the sun rise in exactly the same place every day? In which direction does the sun appear to travel each day? When does it rise exactly in the east and set exactly in the west?

When does it rise furthest north? When does it rise furthest south? Where is the sun's path when the days are longest?

when they are shortest? when the days and nights are equal? What is twilight? What causes twilight?

What is meant by "noon"? When is it noon? How long is noon? Is the sun always at the same place at noon? In which season are the shadows longest at noon? Is it noon at the same time all over the world? Why?

What is meant by "A.M."? by "P.M."? Where is the sun at night? Which are warmer, long days or short days? Why? Which months are the hottest? Why?

Which side of the schoolhouse is the coldest? Why? Which side of the schoolhouse has the lightest rooms? Why?

When is it warmer, before sunrise or after sunset? Why? Which is warmer, autumn or spring? Why?

What actually happens when the sun appears to rise, move across the sky, and set?

If any one traveled from the earth toward the sun, at the rate of six hundred miles per day, how long would it take to reach the sun?

Of what use is the sun to plants? to animals? to the air?

How does moisture get into the air?

Summary.

The sun is a large ball of highly heated material. It is more than ninety millions of miles away from us and it is more than a million times as large as the earth.

The sun gives us light and heat. It causes vapor to rise from the surface of streams, thus making the air moist. Without the sun we would have no evaporation, no rain, no rivers, no plants.

The earth revolves on its axis once in twenty-four hours, or one day, and

the sun is shining on one half of the earth at a time. The sun rises in the east, travels across the sky with a southerly curve, and sets in the west.

The sun travels across the sky by a slightly different path each day. Starting at the close of autumn and the beginning of winter, the sun is traveling over its path furthest south. It then takes a path a little more to the north each day for six months. When spring ends and summer begins, it is traveling over the path furthest north. The sun travels over its middle path at the close of summer and at the close of winter.

The paths that are furthest north and south are directly over that part of the earth's surface indicated by the Tropic of Cancer and the Tropic of Capricorn.

The middle path is directly over that part of the earth's surface indicated by the equator.

THE MOON.

Conversational Lesson.

Where is the moon? Of what use is it to us? What causes it to give light? What is the shape of the moon? Does the moon always appear to us to have the same shape? What is meant by the phases of the moon? Where is the sun when we see the new moon? Are the ends of the crescent toward the sun or away from it? What is the length of time from one new moon until the next? Why was the name "month" given to that period of time? What does the full moon look like?

Where is the sun when we see the full moon? Which side of the moon is always light? What causes the moon to seem to change its shape?

Where do we first see the new moon? When does the new moon appear? Does the moon appear each evening in the same

place? Does it appear earlier or later each night after we see the new moon?

What are the dark places on the moon that seem to form a face? Is it hot or cold on the moon? Is there any rain on the moon? Why?

Does anything grow on the moon? What motion has the moon?

What is meant by an eclipse of the moon? In what positions are the earth, moon, and sun when there is an eclipse of the moon?

Watch the moon and make drawings to show its various shapes as we see them.

If the new moon is examined each night with opera glasses, the ragged edge formed by mountains can be seen.

Summary.

The moon is a ball or globe that moves around the earth once in twenty-nine days. It is about two hundred and forty thousand miles away from us. It has neither light nor heat. It is visible to us because of the sunlight that shines on it.

The moon appears to change its shape. These different shapes are caused by the moon's changing its position with reference to the sun in moving round the earth.

When the moon is in the shadow of the earth and when it is between the earth and the sun, we cannot see it. When it is a short distance toward one side of the sun, it looks like a crescent or curved line of light. When this first makes its appearance it is called the new moon.

The half of the moon that is toward the sun is always light; when the moon is "new," we can see only the narrow arc of light that is nearest to us.

The new moon is seen in the west just after the sun sets. It appears far-

ther toward the east and a little later each night. For this reason we see more and more of the light surface until we see the whole of the light half. It is then called the full moon, and it rises in the east directly opposite to the place where the sun sets.

As it continues its travels round the earth we see less and less of the lighted surface until no part of it is visible.

These different shapes of the moon are called its phases. Some of the names applied to the different phases are new moon, first quarter, full moon, gibbous moon, etc.

STARS.

Conversational Lesson.

What becomes of the stars in the daytime?

What are the differences between planets and fixed stars?

Which are farther from us, clouds or stars?

How can the North Star be found?

In what season does the sun seem to get nearer to the North Star each day?

Of what use is the North Star to mariners?

Why is it used instead of the other stars?

On what part of the earth would the North Star be directly overhead?

How many stars are in "the Dipper"?

What motion does the Dipper seem to have?

Which of the stars in this group are called "pointers"? Why?

Is the Dipper always in the sky at night?

In which season does the Dipper appear above the North Star?

What effect on the stars has the rising and setting of the sun?

Summary.

All the stars that we see in the sky are fixed stars except the planets.

The eight planets are worlds, one of which is the earth. Like the earth, they all move round the sun. They all shine with a steady light. The planets receive their light from the sun.

The fixed stars do not change their places. They are really other suns very far away from us. The fixed stars twinkle. Light travels at the rate of one hundred and eighty-six thousand miles in a second, and it takes three years for the light from the nearest star to reach us.

The fixed stars are balls of highly heated material, like the sun. The materials of which they are made are in a molten state, something like the iron in a rolling-mill when it is taken from the furnace.

If the sun and the planets that revolve around it could be looked at from the nearest star, the sun would look like a star and the eight planets would look like a tiny cloud of silvery light.

The reason that the stars appear to us to move is because the earth is changing its position daily in its journey round the sun.

The North Star, or Pole Star, is always seen in the same place. It is directly over the North Pole on the earth's surface. The other stars and star groups appear to move from east to west across the sky.

All of the stars that are seen in the north appear to move round the North Star. In twenty-four hours they complete the circuit and travel a little beyond.

The Dipper, so called on account of its shape, is a group of seven stars that appears to move round the North Star. The two stars that are farthest from the handle are called "pointers," because they always point toward the North Star.

The Milky Way is an irregular band of silvery light which passes across the sky. It is made up of myriads of stars.

As the earth moves round the sun, we look at the stars from one place one night and from a place farther along in the earth's journey the next night. It takes one year for the earth to travel round the sun. For this reason, the stars which we see at nine o'clock to-night, we shall not see again in the same place at the same time for one year. Six months after the stars are

seen rising in the east, they will be seen at the same hour setting in the west.

If we observe the stars on different nights, we shall notice that they appear at a given point a few minutes earlier each night. For instance, on October 1, at ten o'clock, we see the stars in the same positions that we do at four minutes of ten on October 2. On October 3 we shall see them in the same positions at eight minutes of ten. On October 5 they will be seen in the same positions at 9.45. This difference in time amounts to one hour in two weeks, or two hours in one month.

Some of the stars and star groups are the Pole Star, the Dipper, Cassiopeia, Andromeda, Pegasus, Perseus, Orion, Sirius, Gemini (Castor and Pollux), Taurus, Capella, Vega, and the Milky Way.

To find the stars in the sky: With a compass find north. Facing the north, the North Star or Pole Star will be found at a point almost one half of the distance from the horizon to the point directly overhead (zenith).

The North or Pole Star will always be found in that part of the sky directly opposite to the place where the sun is at noon.

Near the Pole Star is the Dipper. The Dipper is composed of seven stars. The two stars farthest from the handle are called the pointers, because a line drawn through them and continued across the sky (about five times the distance between them) will reach the North Star.

The Dipper is a part of a larger group of stars called Ursa Major (the Great Bear).

The Pole Star is the tail star in another group called Ursa Minor (the Little Bear).

If a line be drawn from the middle star in the Dipper through the North Star and continued the same distance on the other side of the North Star, it will reach the group called Cassiopeia. This group is somewhat in the form of

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If this line be extended still farther, it will reach a row of three stars forming a group called Andromeda.

The end star of this group is the corner star in a group of four stars forming a square. This latter group is called Pegasus.

If this line be crossed by another at right angles to the first at the North Star, it will join two star groups, Lyra and Auriga. The main star of Lyra is called Vega, and the main star of Auriga is called Capella. In many groups only the main stars can be seen with the naked eye.

Stars can be located with the aid of the charts on the following pages. Place the chart in a horizontal position overhead, with the directions toward the proper points of the compass.

STARS ON OCTOBER 15 AT NINE O'CLOCK.

These stars will be seen in the same places on November 15 at seven o'clock, and on September 15 at eleven o'clock.

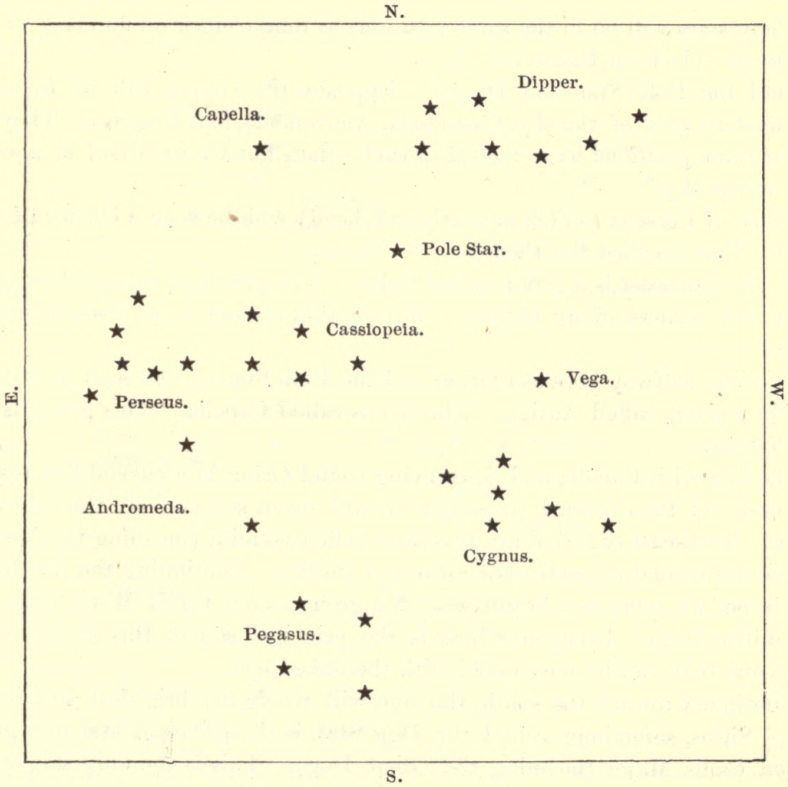
The group called Cassiopeia is nearly overhead, slightly to the northeast.

The groups of Andromeda and Pegasus are southeast of Cassiopeia.

Cygnus (the Swan) is a group in the form of a cross. This group is also nearly overhead, slightly toward the west.

If a line be drawn from Cygnus through Cassiopeia, it will reach another group called Perseus, which is northeast of Cassiopeia.

Vega and Capella can also be found according to directions given above.



STARS ON OCTOBER 15 AT NINE O'CLOCK.

STARS ON FEBRUARY 15 AT SEVEN O'CLOCK.

These stars will be in the same positions at nine o'clock on January 15 and at eleven o'clock on December 15.

Find the Pole Star and Dipper. Opposite the Dipper will be found, in the western part of the sky, Cassiopeia, Andromeda, and Pegasus. They are in the same positions with regard to each other, but we see them in another part of the sky.

South of Perseus (which is nearly overhead) will be seen a cluster of tiny stars. This is called the Pleiades.

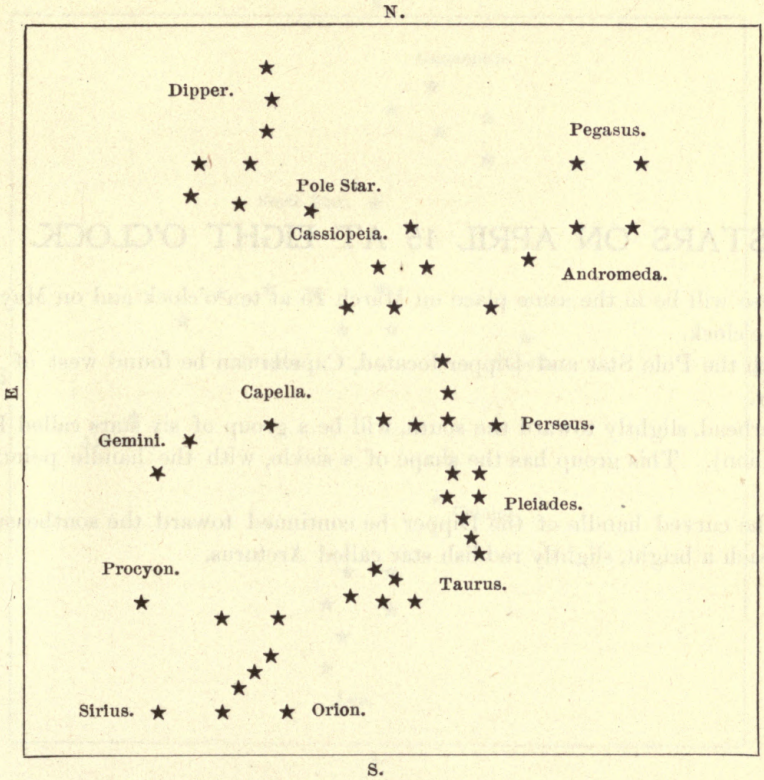
In the southeast is a group called Orion. The principal stars of this group form the corners of an oblong. Within this oblong is an oblique line of stars.

In a line halfway between Orion and the Pole Star can be seen a brilliant star in a group called Auriga. The star is called Capella. This group is east of Perseus.

Starting with Capella and journeying round Orion in a curved line toward the east and then toward the south we will reach successively the following stars. Northeast of Orion are two stars called Gemini (meaning the Twins). These are named respectively Castor and Pollux. Continuing the line to the southeast, we come to a bright star in a group called Canis Minor (meaning the Little Dog). Procyon, which is the principal star of this group, is the only one that can be seen easily with the naked eye.

Continued toward the south, the line will reach the brightest star in the sky. Sirius, sometimes called the Dog Star, is the principal star in a group called Canis Major (meaning the Great Dog). This is the only star of the group that can be readily seen by the naked eye. Dog days are so called because at this time Sirius rises with the sun.

Between Orion and the Pleiades is a bright star called Aldebaran. It is the principal star in a group called Taurus (the Bull).



STARS ON FEBRUARY 15 AT SEVEN O'CLOCK.

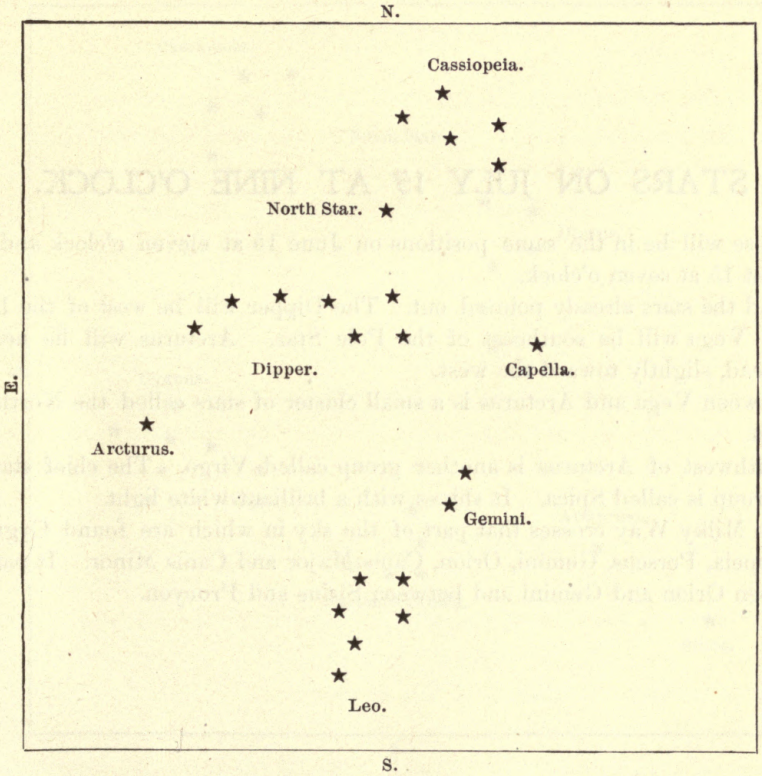
STARS ON APRIL 15 AT EIGHT O'CLOCK.

These will be in the same place on March 15 at ten o'clock and on May 15 at six o'clock.

With the Pole Star and Dipper located, Capella can be found west of the Dipper.

Overhead, slightly toward the south, will be a group of six stars called Leo (the Lion). This group has the shape of a sickle, with the handle pointing south.

If the curved handle of the Dipper be continued toward the southeast, it will reach a bright, slightly reddish star called Arcturus.



STARS ON APRIL 15 AT EIGHT O'CLOCK.

STARS ON JULY 15 AT NINE O'CLOCK.

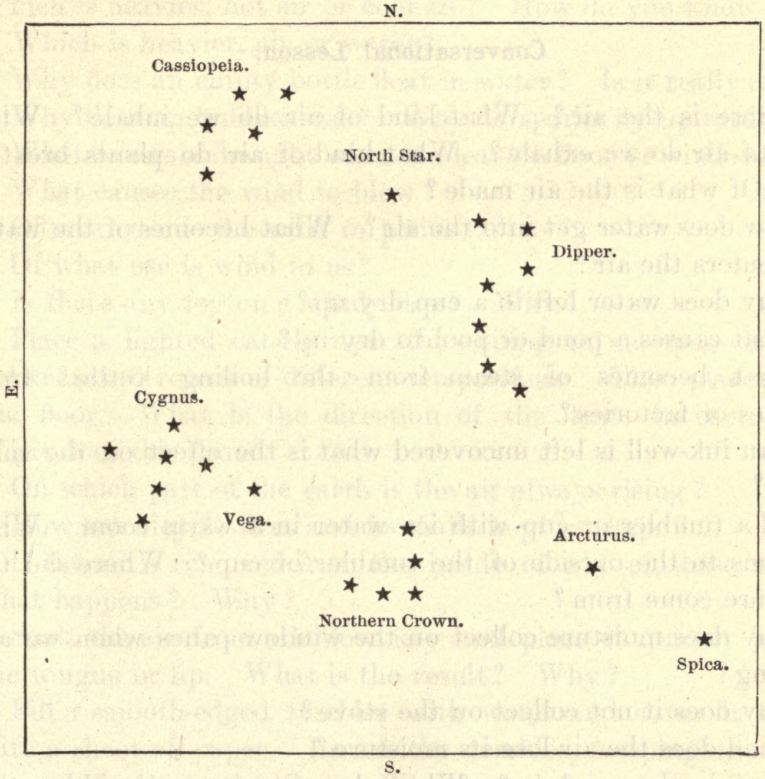
These will be in the same positions on June 15 at eleven o'clock and on August 15 at seven o'clock.

Find the stars already pointed out. The Dipper will be west of the Pole Star. Vega will be southeast of the Pole Star. Arcturus will lie nearly overhead, slightly toward the west.

Between Vega and Arcturus is a small cluster of stars called the Northern Crown.

Southwest of Arcturus is another group called Virgo. The chief star of this group is called Spica. It shines with a brilliant white light.

The Milky Way crosses that part of the sky in which are found Cygnus, Cassiopeia, Perseus, Gemini, Orion, Canis Major and Canis Minor. It passes between Orion and Gemini and between Sirius and Procyon.



STARS ON JULY 15 AT NINE O'CLOCK.

THE AIR.

Conversational Lesson.

Where is the air? What kind of air do we inhale? What kind of air do we exhale? What kind of air do plants breathe in? Of what is the air made?

How does water get into the air? What becomes of the water that enters the air?

Why does water left in a cup dry up?

What causes a pond or pool to dry up?

What becomes of steam from the boiling kettle? from engines or factories?

If an ink-well is left uncovered what is the effect on the ink? Why?

Fill a tumbler or cup with ice water in a warm room. What happens to the outside of the tumbler or cup? Where did the moisture come from?

Why does moisture collect on the window panes when we are cooking?

Why does it not collect on the stove?

When does the air lose its moisture?

What is the rainbow? When does it appear in the east? When do we see it in the west?

Where does the air obtain its heat?

Where does the surface of the earth obtain its heat?

Place some lumps of coal or pebbles in water. What happens? Is the water or the mineral heavier? How do you know?

Place some shavings in water. What happens? Which is heavier? Why?

Which is warmer, air near the ceiling or air near the floor? Which is heavier, hot air or cold air? How do you know?

Which is heavier, air or water?

Why does an empty bottle float in water? Is it really empty?

Why do soap bubbles rise? Why do sparks fly upward?

What causes a draught when we leave a door or window open?

What causes the wind to blow?

Of what use is the wind to plants?

Of what use is wind to us?

Is there any fog on a windy day? Why?

Place a lighted candle near the ceiling in an open doorway between two rooms of different temperature. Then place it near the floor. What is the direction of the flame in each case? What does this prove?

On which part of the earth is the air always rising?

How are bicycle tires and footballs kept in shape?

If the air is removed from the inside of any of these articles what happens? Why?

Suck the air from a hollow key and place it quickly against the tongue or lip. What is the result? Why?

Fill a smooth-edged tumbler with water and cover it closely with a sheet of paper. Invert the tumbler, keeping the paper pressed closely to the glass. Why does the water remain in the tumbler?

What would happen if the air were removed from inside of a drum?

Lift a brick by means of a piece of soaked leather attached to a string. Why is it possible to do this?

What causes the cork to fly from a pop-gun?

What causes the water to enter a squirter?

When a person is drinking lemonade through a straw or tube of any kind, what causes the lemonade to rise in the tube? When does it begin to rise?

Place a bucket of water on the table. Insert in it both ends of a rubber hose (three or four feet in length). Fill the hose with water and then turn one end quickly into another bucket on the floor. What happens? What is the cause of this?

If only one end of the tube be placed in the water, why does not the water run out?

A siphon generally has the shape of a goose-neck, — a curved tube with the ends unequal in length. Place the shorter end in some water, exhaust the air from the tube by means of suction. Remove the lips from the tube as soon as the air is exhausted. What is the result? What causes it?

What is a vacuum?

Use a glass tube that is curved or U-shaped. Partly fill it with water and closely cover one end. Tilt the tube so that the water will flow into one arm of the tube toward the closed end. Then hold the tube so that the two ends are again upright. What happens to the water? Why?

Summary.

The air is all around us. It is composed of several gases. It also contains some moisture. The principal gases in the air are oxygen and nitrogen.

The sun heats the surface of the earth. From the earth's surface the air receives its heat. Hot air is lighter than cold air. For this reason the cold

air is always pushing the warmer air up and taking its place. The warm air floats on the cooler air in the same way that chips float in water.

The rising of the warm air and the flowing in of the cold air causes wind. Wind is air in motion.

The sun causes the water on the surface of the earth to evaporate. This vapor enters the air.

Wind carries moisture to places that need water, in the form of rain, snow, etc. It also carries to plants and animals the kind of air which they need. It carries the pollen of flowers to other flowers that need it. It is also of use in scattering seeds of plants and carrying odors of various kinds.

The air receives its moisture from the surface of the ocean, streams, lakes, ponds, etc. It also obtains moisture from the leaves of plants and the lungs of animals. This moisture becomes visible in the form of clouds and fogs.

The air loses its moisture in the form of rain, hail, snow, dew, and frost.

Were it not for the moisture in the air we would have no twilight. When the sun is below the horizon (either just before sunrise or after sunset) it shines on the moisture in the atmosphere and this light is reflected to the earth. If there were no atmosphere the change from daylight to darkness would be sudden.

Air has pressure, or weight. The pressure of the air serves to raise water in pumps, siphons, fountains, etc.

If all of the air is removed from a siphon the water rises in it. This is because the air is pressing on the water that is around the tube while no air presses on the water within it. The water enters the empty tube and flows out at the other end.

As long as there is air in the tube, the pressure is the same all over the surface of the water. As soon as the air is removed from the tube the water rises at the part on which there is no pressure.

SOUND.

Conversational Lesson.

If a bell is rung what happens to its surface?

What happens to a tuning fork when it is sounded?

What is meant by vibration? In what way do vibrations reach us?

Make a string telephone in the following manner: Remove the bottoms from two cylindrical tin boxes. Cover one end of each with a piece of moist paper. When the paper is perfectly dry, connect the boxes by passing a string through the center of each and knotting it on the inside. The string may be twelve or fifteen feet in length. When the boxes are held so that the string is perfectly straight, a whisper in one box can be heard in the other held close to the ear. What carries the sound?

If the end of a log is scratched with a pin, the sound can be heard distinctly at the other end. What carries the sound?

What causes an æolian harp to produce sounds? What causes the sound in any stringed instrument? What connection is there between the length of the string and the pitch of the sound?

Which vibrates more rapidly, a long or a short string?

A whisper in one end of a rubber hose can be heard at the other end. Why? Of what use are speaking tubes? How do they carry sound?

What causes the noise of a tin horn? What is the effect of covering one or more of the holes in a toy whistle or a flute?

What connection is there between the length of the column of air and the pitch of the sound?

When a book falls to the floor what causes the sound?

When a cannon is fired what causes the sound?

What makes the noise when the pencil scratches the slate?

How is the human voice produced?

Summary.

When a sounding body vibrates, these vibrations cause the air around to vibrate also. The vibrations of the air are carried to the drum of the ear. The more rapidly a sounding body vibrates, the higher will be the pitch of the sound.

The lowest sound that we can hear is caused by thirty-two vibrations in a second. The highest sound that we can hear is caused by seventy-six thousand vibrations per second.

When the vibrations are regular, the sound will be pleasant or musical. When the vibrations are irregular the sound will be a noise.

The more air that is displaced with each vibration, the louder or more forcible will be the sound.

WATER.

Conversational Lesson.

What is the difference between river water and ocean water?

Where does the ocean get a new supply of water?

Where does the ocean get its salt?

Of what uses are the minerals in ocean water to marine animals?

What animals live in salt water?

What animals live in fresh water?

Examine some water under a magnifying glass. What does it contain? What name is given to these tiny creatures?

Does fresh water ever have any particular flavor? What causes it?

In what direction does water always flow?

Why do some streams flow more rapidly than others?

Are streams found in level countries?

Of what use is water to plants?

Is high land or low land more fertile? Why?

How are rivers supplied with water?

What is the source of supply of underground springs and streams?

Where does rain come from?

How does moisture get into the air?

Hold a wet handkerchief in front of the fire or where the wind blows on it. What happens? What causes wet clothing to dry?

If water is exposed in a saucer what happens? What becomes of the water?

Why do ponds dry up?

What becomes of escaping steam from an engine or boiling kettle?

What is vapor? What is evaporation?

Why does there appear to be a vacant space between the escaping steam and the spout of a tea kettle in which water is boiling?

How are clouds formed?

On a cool day stand under steam that is escaping from an engine. What happens? What causes this to happen?

When do clouds empty themselves?

When water is boiling in a room why does moisture collect on the window panes? Why does it not collect on the outer surface of the window?

If a pitcher of ice water is carried into a warm room, what happens to the outside of the pitcher? Where does the moisture come from? Why does it form on the pitcher?

What causes dew to form?

What always causes air to lose its moisture?

Why does frost sometimes form on the window pane?

What effect on the temperature of the air has the moisture which it contains?

Is it warmer or cooler after a rainstorm? Why?

Weigh an empty tin cup. Fill it with water and weigh it again. What does this prove?

Which is heavier, a cup that is full of water or one that is full to the brim with ice? Of what advantage is it that ice is lighter than water?

Place each of the following substances in water for the purpose of finding out which are heavier and which are lighter than water: wood, stone, mercury, cork, oil, ice, glass.

What happens to a bottle that is full of water or other liquid when the liquid which it contains becomes frozen? Why? Why do water pipes burst when the water in them freezes?

Why does the lid of the tea kettle rise when the water is boiling?

What causes the bursting of the boiler connected with an engine?

Of what uses are rivers and oceans to man?

Of what use to us is water in the atmosphere?

What other uses has water for us? Of what use is water to beasts? birds? reptiles? fish? shellfish? insects?

Of what use to plants is water in its different forms, — rain, snow, dew, and frost?

Summary.

Water is a transparent liquid, without odor, flavor, or color. It is necessary to the life of plants and animals.

On the earth, water forms springs, streams, and oceans.

Streams on the surface of the earth are kept supplied by means of underground springs and also by means of moisture from the atmosphere.

Springs and streams carry various materials, such as salt, lime, iron, sand, and other substances, which they obtain from the soil through which they flow. It is by this means that the ocean is furnished with mineral substances for the use of marine animals.

Vapor is constantly passing into the air from the breath of animals, the leaves of plants, and from the surface of the ground and streams.

When the air is full of moisture, this becomes visible in the form of clouds, fogs, steam, etc.

When this moisture comes in contact with a cold current of air, it condenses and returns to the earth in the form of rain, snow, or hail. When the surface of the earth is colder than the air above it, the moisture of the air becomes visible in the form of dew.

Water when heated beyond boiling point becomes invisible and passes into the air in the form of vapor. When this vapor comes in contact with cooler air it condenses and becomes visible in the form of steam clouds.

Heated water expands, that is, it takes up more room. Steam is used to move machinery and engines.

Water that is frozen occupies more space than when it is in the form of a liquid.

Water is of use to plants and animals in various ways.

Plants absorb their food from the ground through the roots by means of water in the soil.

Rain moistens the ground. Snow keeps the ground warm during the winter, and when it melts it moistens the ground. Frost in the ground breaks up the soil and makes it softer.

Some animals have their homes in the water. Many of these animals are used for food by man and by other animals.

Moisture in the air modifies the temperature. Rain and snow purify the air by carrying the impurities back to the earth.

Water is also useful to animals for drinking and bathing purposes.

MAGNETIC ATTRACTION.

Conversational Lesson.

Procure a magnet. Place some needles near it. What is the result? What is this power of attraction called?

Mix some sand, sawdust, steel filings, and chalk. Pass the two ends of the magnet over the mixture. What is the result? What does this prove?

Pass the blade of a knife through some steel filings. Has it any power to attract them? Rub the point of the knife-blade on the ends of the magnet. Pass it again through the filings. What happens? What does this prove?

Pass the middle of the magnet through the steel filings. Does the end or the middle have the more attraction for the steel?

Why is a magnet generally made in the shape of a horseshoe?

Place a magnet on the table and lay a pane of glass on it. Sprinkle some iron or steel filings on the glass. Tap the edge of the glass lightly. What happens to the filings?

Place a needle on one surface of a pane of glass or a sheet of

cardboard and a magnet on the other. What is the result? What does this prove?

Magnetize a long knitting needle. Float a piece of cork in water. Lay the magnetized needle on it. In which general direction will it point?

On a cloudy day or night, how can a sailor discover the direction in which he is traveling?

Why is the needle of the compass so carefully covered?

Why is no iron or steel permitted near it?

Summary.

A certain kind of iron ore was discovered in ancient times by the people living near a town called Magnesia. This material, called loadstone, was found to possess the power of attracting iron. On account of the place of its discovery, the name magnet was applied to it.

A magnet may have any shape, but it is usually made somewhat in the shape of a horseshoe. It is made in this shape because the greatest power of attraction is found in the ends, or poles, of a magnetic bar, and this shape permits the two poles to act together. If a magnetic bar be broken, the broken ends will be found to have the same power of attraction. A magnet can hold about twenty-five times its own weight of iron.

If we magnetize a slender steel bar or needle and then suspend it so that it can move freely in all directions, it will take the direction of north and south. This fact was made use of for the benefit of sailors.

The mariner's compass is an instrument containing a magnetized needle. This needle is carefully protected so that wind cannot affect it. The presence of iron or steel, even at a distance, will attract the needle. Any of these things would influence the needle and cause it to point in some other direction than the exact north.

OUTLINES IN HISTORY.

STORY OF COLUMBUS.

Conversational Lesson.

Where was Columbus born? Find Italy on a map. Find Genoa on a map. In what direction from the schoolhouse is Italy? What is the appearance of an Italian? What led Columbus to wish to be a sailor? Consider the following points: —

Belief of the people as to the shape of the earth. — Trade with India and desire for a more direct route. — Opinion of Columbus as to the shape of the earth. — His poverty and difficulties in obtaining assistance. — His wanderings through different countries. — His appeals to different governments for aid. — Queen Isabella's offers of assistance. — *Pinta, Nina,* and *Santa Maria.* — The length of the voyage. — Terror and mutiny of the sailors. — Signs of approaching land. — Discovery of San Salvador. — Reason for being so named. — Reason for name "West Indies." — Strange inhabitants. — Reason for name "Indians." — Visits to other islands. — His return to Spain. — His reception. — Columbus and the egg. — Another voyage. — Treachery of his companions. — Columbus in chains. — His poverty and death. — His ignorance of the greatness of his discovery. — His present burial-place. — Reason for names "Columbia," "America."

Summary.

Christopher Columbus was born in Genoa, a seaport town in Italy. When he grew up he became a sailor. At this time people thought that the earth was flat, but Columbus believed it to be round. He wanted to prove this by sailing around the earth, but he had no vessels. He visited kings and queens of different countries, asking them to supply him with vessels, but they all refused.

At last the queen of Spain fitted out a fleet of three vessels for him. The one in which Columbus sailed was called the *Santa Maria.*

For many weeks these vessels sailed without seeing land. The sailors became frightened and wanted Columbus to return home, but Columbus refused. Then the sailors were going to put him in chains and return home, but one evening they saw lights ahead and knew that land must be near.

The next morning, October 12, 1492, they saw a beautiful island before them with strange-looking people on it. These people were Indians, and the island was one of the West Indies.

Columbus had discovered a new land, which was afterward called America.

THE INDIANS.

Conversational Lesson.

Appearance of the Indians, — hair, complexion, painting the face. Clothing, — skins of animals, blankets, moccasins, leggings, head dress of feathers, articles of decoration, such as beads, teeth and claws of animals, scalps of victims.

Houses or wigwams, — variation in size and structure. — Mud huts, hide tents, lack of windows and furniture. — Blankets or skins of animals for beds. — Indian cradle. — Food, — how ob-

tained and cooked. — Cooking utensils. — Open fire. — Canoes, — materials and manner of making various kinds. —Warfare, — implements and methods of warfare. — Cruelty and treachery. — Form of government. —Wandering life. —Work of braves, work of squaws. — Religious belief. — Mode of curing the sick. — Indian dances.

Why did Columbus call them "Indians"? How did they greet Columbus?

Origin of the use of tobacco among white people. — The story of Hiawatha in Longfellow's poem tells us much about the life of Indians.

Summary.

When the white men first came to America they found the Indians here. The Indians have a copper-colored skin, with high cheek bones and straight black hair. They are divided into tribes, and each tribe has a chief. They live in wigwams made of skins of animals and boughs of trees. They wander from place to place, carrying these wigwams with them.

They spend their time in hunting, fishing, and warfare. The squaws are obliged to do all the work, — till the ground, plant the crops, and gather the harvest. When they move, the squaws look after the wigwams and all of the household goods, as well as the papooses. The men carry only their hunting knives, tomahawks, bows and arrows.

Indians are treacherous and cruel. They think that the bravest man is the one who kills the greatest number of people and takes their scalps. In war they never fight openly, but shoot their arrows from a hiding place.

The braves are fond of gay colors and like to dress themselves in bright blankets, feathers and beads, and decorate their faces with colored paints.

They worship the sun, moon, stars, thunder and lightning, rain and wind. They believe that the Great Spirit always watches over them, and that when they die they will go to a place called the "happy hunting-grounds," where they will hunt and fish forever.

STORY OF POCAHONTAS.

Conversational Lesson.

Settlement of Virginia. — Captain John Smith. — Starvation of colony. — John Smith captured by Indians. — Showed them compass, letter writing. — Became friend of Pocahontas, daughter of Powhatan. — Pocahontas saved Smith's life. — Smith set free. — Trouble between Indians and colonists. — Indians plan to kill the white people. — Pocahontas warns the English and saves the colony. — Pocahontas captured by the English. — She became a Christian. — Was baptized and changed her name to Rebecca. — Married John Rolfe. — Received at the Court of England as Lady Rebecca.

Summary.

Captain John Smith was living with white people in Virginia who were very poor. While hunting food for them he was captured by the Indians, who would have put him to death, but his life was saved by Pocahontas, to whom Smith had been very kind. Pocahontas often visited the white people after Smith returned to the colony. She taught them the language of the Indians and told them much about the different tribes and the surrounding country. During the hard times she often supplied them with food. Afterwards the Indians planned to kill the white people, but Pocahontas went through the woods at night and warned them of their danger. She afterward lived among the white people, became a Christian, and took the name of Rebecca.

THE PILGRIMS.

Conversational Lesson.

Religious intolerance in England. — Puritans go to Holland. — Reason for name Puritan. — Dislike of Holland. — Poverty of Pilgrims. — Reason for name "Pilgrims." — Number of Pilgrims. — Reason for their wanderings. — *Speedwell* and *Mayflower*. — Size of the vessels. — Length of voyage. — Where they landed. — Reason for names New England, Plymouth, Pilgrim Fathers, Plymouth Rock. — Sufferings during winter.

The story of Captain Miles Standish in Longfellow's poem tells us a good deal about the Pilgrims in America.

Consider their manner of living in their new home. — How they were clad. — Their relations with the Indians. — Their meeting houses. — Their amusements, etc.

Summary.

Many years ago people were expected to accept the religion of the country in which they lived. In England there were people called Puritans who did not like the Church of England. So they left England and went to Holland; but they were not happy there, and they decided to come to America, where they could worship God as they pleased. On account of their wanderings they were called Pilgrims.

They started for America in the *Mayflower*, and after sailing for two months they landed in December, 1620, on the coast of Massachusetts, and called the place Plymouth. A large rock, known as Plymouth Rock, is supposed to be the place where they first stepped ashore. This event is spoken of as the "Landing of the Pilgrim Fathers."

THANKSGIVING DAY.

Conversational Lesson.

Sufferings of Pilgrims from hunger and cold of the northern winter.— Sickness and death. — Planting of crops. — Lack of rain. — Prayer for rain. — Abundant harvest. — Thankfulness of Pilgrims. — Governor Bradford appointed a day of thanksgiving. — Services in the meeting house. — Rejoicing lasted three days. — Custom spread to all parts of New England; to all parts of the country. — Who appoints Thanksgiving Day at present time? — What is the usual date? — How is it celebrated?

Summary.

In the fall of 1621 the Pilgrims celebrated the first Thanksgiving Day. They had suffered a great deal from cold, sickness, and lack of food, but they had planted Indian corn and potatoes in the spring and in the fall they gathered in a large harvest.

The Pilgrims felt that they had so much to be thankful for that Governor Bradford appointed a day on which to give special thanks. The men went out hunting and fishing and brought home wild turkeys and deer. The women made pumpkin pies and corn-meal bread.

After a thanksgiving service in the meeting house they went to their homes and held a great feast.

In time, Thanksgiving Day came to be celebrated all over the country. The day is appointed now by the President. It is usually the last Thursday in November.

STORY OF WILLIAM PENN.

Conversational Lesson.

His birthplace and boyhood. — The religious belief of his parents. — His change of religious belief. — General objection in England to the Society of Friends or Quakers. — Dress of most people at that time. — Dress and form of speech of Quakers. — His father's anger. — William Penn's imprisonment. — His father's forgiveness. — His riches inherited from his father.— The king's gift. — Penn's colony. — The ship *Welcome.* — Voyage to Pennsylvania. — What is the meaning of sylvan? — Reason for the names Pennsylvania, Philadelphia, Kensington. — Was the site of Philadelphia well chosen? Why? — Penn's treatment of the Indians. — His treaty with them under the "Treaty Tree." — Purchase of land. — Laying out the town. — How did he name the streets? — Penn's views of government and education.

Summary.

William Penn was an Englishman. He was born in 1644 and died in 1718. The king of England gave Penn a tract of land west of the Delaware River, in payment of a debt he owed his father. The first settlers arrived in 1681. Later Penn and a number of other Quakers sailed for America in the ship *Welcome.*

They landed November 8, 1682. He founded a town and gave it the name of Philadelphia, which means "Brotherly Love," because he hoped that all would live together peacefully.

Penn was very kind and just, and made a treaty with the Indians under an

old elm tree. The spot on which this elm tree stood is now marked by a marble monument, and the tract of land surrounding it is called Penn Treaty Park.

The house in which Penn lived in Philadelphia now stands in Fairmount Park.

STORY OF INDEPENDENCE DAY.

Conversational Lesson.

Many people had left England and other countries of Europe and come to America to live. Then there was a war in Europe between England and France. This war cost England a large sum of money. — Taxation of colonists without representation in the government. — Stamp Act. — Tea Act. — Boston Tea Party. — Indignation of colonists at the injustice of England. — Desire to be a separate nation. — Declaration of Independence. — What was it, when and where was it signed? — Where was it written? — Who wrote it? — The number of signers. — How was the news of its adoption proclaimed? — What followed its adoption? — How was the first Independence Day celebrated?

Summary.

Many years ago England owned a great deal of land in America, and the people who lived here were governed by England. England had a great many debts because of having been at war with other countries.

To obtain money to pay her debts England commenced to tax nearly everything that the people in America used. Although the people paid these heavy taxes, they were not allowed to help make the laws.

This was not just, so the people in America decided not to be governed

by England any more, but to declare themselves free from England and establish a government of their own.

On July 4, 1776, the Declaration of Independence was adopted in the State House in Philadelphia. This is the reason that we celebrate July fourth as Independence Day every year.

After this, England sent armies to America, and the Revolutionary War was fought. The Americans won the war and became a free and independent nation.

THE PENNSYLVANIA STATE HOUSE.

Conversational Lesson.

Location and appearance. — Reason for its being built. — Reason for the name "State House." — Later Philadelphia became the capital of the country. — Meaning of word "capital." — What is the present capital of Pennsylvania? — Of the United States? — Meaning of word "Congress." — Continental Congress met in the east room on the first floor of the State House. — Meeting of delegates in that room to consider England's treatment of the colonies. — Decision to adopt the Declaration of Independence. — Liberty Bell and its inscription, Leviticus 25 : 10. — Reason for names "Liberty Bell" and "Independence Hall."

At a later period it was used as the City Hall of Philadelphia until the erection of the present City Hall.

After a visit to Independence Hall, a description of many famous relics and documents can be given by the pupils.

Summary.

The State House is on Chestnut Street between Fifth and Sixth streets. It was at first a single brick building, two stories in height. Afterward two

other buildings were erected, one on each side of the first. These three are now joined by means of arches. Later a tower was built and in 1752 a bell was purchased in England and placed in it.

It had a large yard which extended to Walnut Street. This is now called Independence Square. On the pavement on Chestnut Street stands a statue of George Washington.

At first law-makers met there and made laws for Pennsylvania. Afterward Philadelphia became the capital of the whole country, and Congress met there.

The principal event that occurred there was the adoption of the Declaration of Independence. This took place on the Fourth of July, 1776. In this building also the Declaration of Independence was signed, although all the names were not signed on that day.

The people of Philadelphia gathered in the yard of the State House and waited for the news. At last the bell in the tower was rung. This was the signal which told them that the Declaration of Independence had been adopted.

This event brought on the Revolutionary War, by which we became a free and independent nation.

After this the State House was called Independence Hall and the bell was called the Liberty Bell.

The building at the corner of Sixth and Chestnut streets was called Congress Hall because Congress met there for ten years after Washington became President.

In Independence Hall there are many relics connected with the early history of our country. The old Liberty Bell is kept there, as well as portraits of many men famous in the history of our country.

The Liberty Bell was made in Whitechapel, in England, and brought to Philadelphia in 1752. It was cracked at the trial ringing before it was hung in the State House and was recast by Pass and Stow of Philadelphia. After it was repaired, it was hung in the tower of the State House in Philadelphia. In 1777 the bell was taken to Allentown to prevent its being captured by the British, who were about to take possession of Philadelphia. This was a very long journey in those days. After the British left Philadelphia it was brought back to the State House. The old tower being out of repair, it was

not considered safe to place the bell there. The framework on which the bell hung was placed lower down, where it was supported by the brick part of the tower.

The bell is three feet in height and the circumference of the base is twelve feet. It weighs 2,080 pounds. Around the crown of the bell is the prophetic inscription, "Proclaim liberty throughout all the land unto all the inhabitants thereof. Lev. xxv, X."

Immediately under this inscription is another, also in a line encircling the bell: —

By Order of the Assembly of the Province of Pennsylvania for the State House in Philada.

PASS AND STOW

PHILADA.

MDCCLIII.

STORY OF WASHINGTON.

Conversational Lesson.

His birthplace. — His boyhood and education. — His character. — His truthfulness. — Washington and the cherry tree. — French and Indian War. — His errand to Fort Du Quesne. — England's treatment of the colonies in America. — The Revolutionary War. — Washington appointed commander-in-chief. — Love of the soldiers for Washington. — Close of the Revolutionary War. — Washington elected President. — Death at Mount Vernon. — Reason for the term "Father of his Country." — Meaning of the term "First in war, first in peace, and first in the hearts of his countrymen." — Celebration of Washington's birthday.

Summary.

George Washington, who is called the "Father of his Country," was born in Virginia, February 22, 1732. His parents were rich, but this did not make him proud or lazy. His father died when he was quite young. He was educated by his mother, who taught him to be good and truthful. He grew to be a noble man.

When the Revolutionary War between the American colonies and England broke out, he was chosen commander-in-chief of the army. He was willing to serve his country. He was a wise and brave general.

When the war was over, England gave up all control over the colonies. After the colonies became free, they were called the United States of America and George Washington was chosen to be the first President. He served two terms, or eight years.

The people wanted him to serve another term. He refused because he did not think it was right for the same man to be President more than two terms. He died at his beautiful home at Mount Vernon in 1799.

Because he is considered the greatest American, and because the people wish to show how much they love and honor him for his services to his country, he is often spoken of as "First in war, first in peace, and first in the hearts of his countrymen."

THE FLAG.

Conversational Lesson.

Betsy Ross. — Her place of residence. — Her occupation. — Why she was chosen to make the flag. — Committee appointed to call on her. — Discussion in reference to the kind of star.

Why are there thirteen stripes in the flag? How many stars are on our flag now? Why? What is meant by "Star Spangled

Banner"? What does our flag signify, no matter where it is seen? On this account, of what service is it to Americans?

Summary.

Betsy Ross lived in Philadelphia at 239 Arch Street. She was noted for being a fine needlewoman, and had made ruffled-bosom shirts for General Washington. Congress appointed a committee to ask her to make a flag according to a design which had been adopted. General Washington, Robert Morris, and her uncle, Colonel Ross, formed the committee. The design for the flag contained six-pointed stars, but she thought that five-pointed stars would be better. The five-pointed star was the one used.

The first American flag was made by Betsy Ross at 239 Arch Street, Philadelphia. On June 14, 1777, Congress adopted a flag of red and white stripes with a blue field studded with white stars as the flag of the United States.

The first flag contained thirteen stripes and thirteen stars. Our flag now has thirteen stripes and forty-five stars. Each star means a state. Every time a state is admitted to the Union a star is added to the flag.

Each color in the flag has a meaning. Red means divine love, courage, and glory. White means purity and truth. Blue means peace and justice. The flag floats from public buildings and vessels, and insures the protection of the United States to all American people.

LYDIA DARRAGH.

Conversational Lesson.

Why were English soldiers in the house of an American? — Meaning of the term "headquarters." — Necessity for secret meetings of the English officers. — Why did Lydia Darragh

listen to the plans of the English and send the news to Washington? — Meaning of the word "patriotism." — Are there any patriots in our country to-day? — How can we show our patriotism?

Summary.

General Howe commanded the English army in Philadelphia during the Revolutionary War. He established his headquarters at the house of William and Lydia Darragh. Whenever he held meetings with his officers to consider plans for carrying on the war, he ordered every one in the family to go to bed.

One night they held a secret meeting for the purpose of planning a surprise attack to destroy the American army. Lydia Darragh listened at the door and heard all of their arrangements.

The next day she obtained permission to go to Frankford to buy some flour. While she was away from home she succeeded in sending to General Washington the news of the intended attack.

By this means the Americans were prepared for the attack and the British were defeated.

General Howe never knew how his plans were discovered by the Americans.

VALLEY FORGE.

Conversational Lesson.

Revolutionary War in progress. — Necessity for shelter during the winter season. — Encampment at Valley Forge on the Schuylkill River. — Hewing trees and building huts plastered with mud. — Poverty of the government. — No money or supplies for the army. — Sufferings and deprivations of the soldiers. — Lack of beds and bed clothing. — Lack of shoes, stockings, and

other clothing. — Lack of food. — Washington's prayers, and his encouragement of the army. — Bravery and patriotism of the suffering soldiers. — Their self-sacrificing devotion to their cause and country.

Summary.

As the fighting could not be continued during the winter, the American army under General Washington went into winter quarters at Valley Forge.

The soldiers marched to the woods, cut down trees, and built log huts, in which they passed the winter. They had no bedding of any kind and the little clothing which they had was in rags.

When they marched, the icy ground was tracked with blood from their bare feet.

They had little to eat, and nearly died of cold and starvation. Only love for their country and their desire to gain independence for the nation gave them courage to endure the terrible hardships.

At the close of this winter of suffering, news reached the camp that Benjamin Franklin had succeeded in persuading the king of France to assist the Americans in their struggle for liberty.

LAFAYETTE.

Conversational Lesson.

A youth of twenty at the time of the Revolutionary War. — His wealth and social position at the French court. — Position in the French army. — Desire to help the American colonies. — Objection of his family and the French government. — Disobedience would make him liable to punishment as a deserter. — Presented himself to the American agents (Silas Deane, Benja-

min Franklin, Arthur Lee) in Paris. — Terms of his contract, to serve as major-general without pay. — Difficulty in getting away from France. — Purchase of a vessel at his own expense. — Giving up his estates and position in France. — After a two months' voyage he landed in South Carolina, June, 1777. — Rode on horseback to Philadelphia and presented himself to Congress in the State House. — Service in American army. — Friendship between Washington and Lafayette. — Wounded in the leg at the Battle of Brandywine. — Visited America fifty years later when he was an old man. — Entertained at Independence Hall.

Summary.

Lafayette was a rich and titled Frenchman who came to this country when he was a young man to help the Americans in their war for freedom. He became an officer in the American army, and not only served without pay, but supplied a great many soldiers with fire-arms and clothing at his own expense. When he came to America fifty years later he was welcomed by all on account of his services to the Americans in the Revolutionary War.

BENJAMIN FRANKLIN.

Conversational Lesson.

His birthplace and boyhood. — Poverty of his father. — Two years of school. — Apprenticeship to his brother to learn printing. — His leaving home and going to New York and thence to Philadelphia. — His poverty. — His energy and hard work. — His thrift and economy. — Establishment of his printing house

and newspaper. — "Poor Richard's Almanac." — Interest in electricity. — Flying of his kite in the neighborhood of Ninth and Race streets, Philadelphia. — Invention of the lightning rod. — Journey to Paris as agent for the United States government. — His invention of the stove. — How were houses heated prior to this? — Mention some of the uses that electricity has at present. — His establishment of the first public library in Philadelphia.

Of what value is a public library?

Franklin's place of burial at the corner of Fifth and Arch streets. — His statue on the pavement near the Philadelphia post office.

Summary.

Benjamin Franklin was born in Boston. He was the son of a poor man who could afford to send him to school only two years. He learned to be a printer, and when he became a young man he left home and worked his way to Philadelphia. He read and studied early in the morning and late at night by the light of a candle. He worked hard and saved enough money to go into business for himself. He published a newspaper and also a little book called "Poor Richard's Almanac." This contained information about the time of sunrise, sunset and tides, predictions about the weather, and many short sayings which gave people good advice.

He became interested in the study of electricity. By flying a kite which he made after a great deal of thought, he found that lightning and electricity were the same thing. What he learned led him to invent the lightning rod. This was the beginning of all the wonderful uses which electricity now has.

He made the first stove. He also founded the University of Pennsylvania and started the first public library in Philadelphia.

STEPHEN GIRARD.

Conversational Lesson.

Birthplace. — Positions of father and grandfather in the French navy. — Entered merchant marine service. — Accident of storm drove his vessel into Delaware Bay, in 1776. — Howe's blockade. — Establishment of business on Water Street.

Yellow fever in Philadelphia, 1793. — Horrors of the disease. — Its contagious character. — Flight of the people leaving all their possessions and the sick of their families. — Awful number of deaths. — Manner of collecting the dead. — Effect on business and social life. — Lack of nurses in the hospital in the suburbs at Bush Hill (now Seventeenth and Spring Garden streets).

Girard's offer of his services. — Two months' constant attendance at the pesthouse. — Removing the sick to the hospital in his private carriage.

His purchase of all of the outstanding stock of the United States Bank, 1812. — Refusal of Congress to re-charter it. — Establishment of his private bank under the name of "Bank of Stephen Girard." This averted a financial panic.

On account of the war, the government attempted to raise five million dollars, 1815. — Only twenty thousand subscribed. — Girard pledged his fortune, thus saving the army from disbanding and the country from dishonor and defeat.

Government wished to re-establish the United States Bank. — Girard made it possible by subscribing three million dollars.

Consider his kindness to the poor. — His love for children and

dumb animals. — His bravery. — His generosity. — His energy and activity. — His charity. — His numerous bequests for the public good.

Summary.

Stephen Girard was born in Bordeaux, France. When he grew up he engaged in commerce and became captain of a vessel. He came to America and started in business in Philadelphia at the beginning of the Revolutionary War.

Nearly twenty years later yellow fever broke out in Philadelphia. For two months he took care of the sick people in the hospital at the risk of his own life.

He was patriotic and generous, brave and charitable, and very fond of children and dumb animals.

Several times he saved the credit of the country by loaning the government money. He left large sums of money in his will for the improvement of the state of Pennsylvania and the water front of Philadelphia.

He also willed a large amount of money to establish a home for orphan boys where they could receive an education. This is called Girard College, and occupies that part of Girard Avenue between Nineteenth and Twenty-fifth streets.

On account of his public services, a statue of Stephen Girard was placed on the pavement near the City Hall.

ABRAHAM LINCOLN.

Conversational Lesson.

His birthplace. — The poverty of his parents and their lack of education. — Removal to Indiana and later to Illinois. — His occupation as wood cutter and rail splitter. — His efforts to obtain

an education without having the advantage of schools. — How he purchased his first book ("The Life of Washington"). — His energy led him to walk miles for the purpose of borrowing books. — Occupation as store-keeper. — How he became a lawyer. — Election to the legislature of Illinois; later to Congress; and still later to the office of President of the United States. — Agriculture in the South required many laborers and led to the general practice of slavery. — Growing opposition to slavery. — South Carolina's attempt to leave the Union. — The Civil War. — Emancipation Proclamation. — His speech at Gettysburg. — Close of the war. — Assassination of Lincoln. — Why was he called "Honest Abe"? — A statue of Lincoln is in Fairmount Park, near the Green Street entrance.

Summary.

Abraham Lincoln was born February 12, 1809, in a log cabin in Kentucky. His parents were very poor. While he was still very young he was obliged to earn his living by chopping wood and splitting rails for fences. There were no schools near his home and his mother taught him to read and write. He had a few books, and these he studied over and over at night after working hard all day.

When he grew older he moved to Illinois and studied law. He was so successful and made such fine speeches that the people all over the country began to hear of him. Then he was elected to Congress by the people of Illinois. He was opposed to slavery and often spoke against it. In 1860 he was elected President of the United States.

While he was President the Civil War took place. He was a very wise and just President. He issued the Emancipation Proclamation, which declared all slaves to be free.

Some people did not like him because he was opposed to slavery. In 1865 he was shot by a man named Wilkes Booth. Lincoln was a good and upright man, whom we love to honor.

MEMORIAL DAY.

Conversational Lesson.

Who were some of the prominent officers of the army during the Civil War? — Why were the soldiers ready to answer Lincoln's call and join the army? — Bravery of the soldiers. — Readiness to sacrifice home, health, comfort, and life. — Sufferings of the soldiers during the war and after it was over. — Which day of each year is set apart for the purpose of honoring them? — Why is it called Memorial Day? — How do we celebrate it? — What is meant by G. A. R.? — Why do the soldiers take such an active part in these ceremonies? — Why is the flag of our country displayed on that day? — How can we show our love for our country?

Summary.

During the Civil War many soldiers lost their lives in the defense of the nation. Many others became ruined in health by wounds and exposure, and these also died for our country. To show that we honor and reverence them for their brave sacrifice, we strew their graves with flowers on Memorial Day of each year.

May 30 was appointed by General Logan for this purpose in 1868. Afterward it was made a legal holiday, and as such it is observed in many states.

TRAVEL BY LAND AND WATER.

Conversational Lesson.

Wild condition of the country and of the roads in early times. — Use of stage coach, emigrant wagon, sedan chair, omnibus, horses, and oxen. — Pictures of these can be seen in many books. — Toll gates, and reasons for them. — Omnibus routes.

First steam wagon built by George Stephenson.

Sailing vessels. — Length of time for an ocean voyage.

Present modes of conveyance for short distances; for long distances on land and water.

Summary.

In olden times people could not travel so quickly as they can now. They were obliged to walk or to use horses and wagons. Two people often rode on the back of one horse. When they wished to take a long journey, wagons drawn by oxen were often employed. The roads were very poor, and toll was collected to keep them in repair.

The first stage coach that ran between New York and Philadelphia took three days to make the journey. This coach was called "The Flying Machine." Later on there were omnibuses in the cities of New York and Philadelphia to carry people from one part of the city to another.

Travel on the ocean was also very slow. Before steam was used, it took sailing vessels two or three months to cross the ocean.

The first locomotive, or steam wagon, was constructed by an Englishman named George Stephenson. It traveled at the rate of from ten to fifteen miles an hour. At its trial trip it was raced against a fast horse.

At the present time the use of steam and electricity permits us to travel very rapidly. Locomotives are run by steam, trolley cars and motor wagons

are run by electricity. The distance between New York and Philadelphia can now be traveled in two hours.

Vessels crossing the ocean are run by steam and make the journey between Europe and America in one week.

MEANS OF COMMUNICATION.

Conversational Lesson.

Why is postage charged? Who receives the money? What does the postage stamp on a letter indicate? What is the advantage of having a systematic postal service? In what other ways can messages be sent to distant places?

In how many ways is steam of use in sending messages? Electricity? By what means does a message reach the greatest number of people?

Why is rapid communication between distant places more necessary now than in the time of William Penn?

Why are telegraph lines built beside railroads?

Summary.

In early times, when people wished to send messages, a man was employed to carry the letter. He either walked or used horses to make the journey.

After this, stage routes for carrying mails and people were established. These stages were wagons drawn by horses, and were called post-chaises. When the journey was a long one the horses were changed at different places along the road.

A stage route was established between Providence and Boston. Another ran between New York and Boston. The round trip on this route occupied one month. Another stage route was established between New York and

Philadelphia. This journey occupied three days each way. Two trips were made each week.

At a later date the colonies all united in the formation of a general post-office system. Benjamin Franklin was one of the first to take charge of this work. In order to make the system more satisfactory, he took a journey through the colonies. This occupied a period of five months.

Unless the mails were large they were carried in saddle bags by men on horseback. In places at a distance, mail was not taken until there was enough in postage on the letters to pay the cost of the journey.

When railroads and steam vessels were established, it became possible to deliver mail more rapidly.

In addition to the rapid mail service which extends to every part of the country, we can now send messages by telegraph and telephone. Both of these means of communication have been improved by Thomas Edison, although he did not invent them.

The telegraph was invented by Samuel Morse. This is an instrument which sends sounds by means of electricity from one point to another along a wire. Each word or phrase is expressed by a certain sound. These sounds are made at one point and received at another. Those who operate the instrument know what word each sound represents.

The first telegraph line was established between Washington and Baltimore. The first message that was sent by this means was: "What hath God wrought?" (Numbers 23 : 23).

At first only one message could be sent over the wire at a time. Edison has so improved this that at present three messages can be sent in each direction over a single wire, making six messages in all. Messages can also be telegraphed from moving trains by means of wires laid along the tracks. This is also due to Edison.

The telephone is an instrument so arranged that the vibrations of the human voice at one point are carried by an electric wire to a distant point and repeated so that the words can be distinctly understood.

Thomas Edison improved the telephone by inventing the transmitter and the microphone. The transmitter receives the spoken words which are to be carried along the electric wire. The microphone magnifies sound so that a very low sound can be heard distinctly at a distance.

In addition to sending messages in this rapid way in our own country, we can send them across the ocean by means of the Atlantic Cable. Cyrus Field formed a company to lay a cable across the Atlantic Ocean, and the *Great Eastern* was the name of the vessel that successfully accomplished this work in 1866.

A system of wireless telegraphy has also been invented recently. By this system messages can be sent through the air from one vessel to another. At present, messages can be sent by this system a distance of twenty-two miles.

In addition to these ways of sending messages, we have hundreds of newspapers printed daily all over the country.

When we think of the length of time that it formerly took to send messages to a distant place, we can easily see the great advantage we now have from the use of steam and electricity in sending messages quickly.

We must always remember that we owe the modern conveniences obtained from the use of electricity to Benjamin Franklin, who discovered that lightning and electricity were the same thing and that it could be of use to us.

PLACES OF HISTORICAL INTEREST IN PHILADELPHIA.

Betsy Ross House, 239 Arch Street, where the first American flag was made.

Carpenters' Hall, rear of 322 Chestnut Street, occupied by the First Continental Congress until the State House was ready for occupancy.

Chew House, Germantown Avenue and Johnson Street. The Battle of Germantown in the Revolutionary War was fought around this house, which was occupied by English soldiers.

Independence Hall, Chestnut Street, between Fifth and Sixth streets.

Penn Treaty Park, in the section of Philadelphia known as Kensington, on the Delaware River, at the foot of Hanover Street. In this is a monument erected to mark the spot where the elm tree stood under which Penn made the treaty with the Indians.

Gloria Dei (Old Swedes') Church, Swanson Street, below Christian Street.

Grave of Benjamin Franklin in Christ Church burying-ground at Fifth and Arch streets.

Girard College, Girard Avenue, near Twentieth Street.

Christ Church, Second Street, above Market Street. This church was attended by General Washington, Betsy Ross, and John Ross.

The following places are in Fairmount Park: —

General Grant's log cabin near Lemon Hill. This cabin was brought from the James River in Virginia, where it was used by General Grant as his headquarters during the last few months of the Civil War.

William Penn's House, west of Girard Avenue bridge. This house was built south of Market Street between Front and Second streets. As houses were built around it a street was made, which, in honor of Penn's daughter, was called Letitia.

Grant Monument and Mount Pleasant are east of the Schuylkill River drive, north of Girard Avenue. The mansion was once owned by Benedict Arnold. It is now used as a restaurant and is called "The Dairy."

Lemon Hill was originally the country seat of Robert Morris.

Lincoln Monument is near the Green Street entrance.

AMERICA.

My country! 't is of thee,
Sweet land of liberty,
Of thee I sing;
Land where my fathers died!
Land of the Pilgrims' pride!
From every mountain side
Let freedom ring!

My native country, thee,
Land of the noble free,
Thy name I love;

I love thy rocks and rills,
Thy woods and templed hills;
My heart with rapture thrills
Like that above.

Let music swell the breeze,
And ring from all the trees,
Sweet freedom's song;
Let mortal tongues awake;
Let all that breathe partake;
Let rocks their silence break,—
The sound prolong.

Our fathers' God! to Thee,
Author of liberty,
To Thee we sing;
Long may our land be bright
With freedom's holy light;
Protect us by Thy might,
Great God, our King!

SAMUEL FRANCIS SMITH, D.D.

HAIL, COLUMBIA.

Hail, Columbia, happy land!
Hail, ye heroes, heaven-born band!
Who fought and bled in Freedom's cause,
Who fought and bled in Freedom's cause,
And when the storm of war was gone,
Enjoyed the peace your valor won.
Let independence be your boast,
Ever mindful what it cost,
Ever grateful for the prize,
Let its altar reach the skies.

CHORUS.

Firm, united, let us be,
Rallying round our liberty!
As a band of brothers joined,
Peace and safety we shall find.

Immortal patriots, rise once more!
Defend your rights, defend your shore;
Let no rude foe with impious hand,
Let no rude foe with impious hand,
Invade the shrine where sacred lies,
Of toil and blood the well-earned prize;
While offering peace sincere and just,
In Heaven we place a manly trust
That truth and justice shall prevail,
And every scheme of bondage fail.

THE LANDING OF THE PILGRIM FATHERS.

The breaking waves dashed high
On a stern and rockbound coast,
And the woods against a stormy sky
Their giant branches tossed;
And the heavy night hung dark
The hills and waters o'er,
When a band of exiles moored their bark
On the wild New England shore.

Not as the conqueror comes,
They, the true-hearted, came;
Not with the roll of the stirring drums,
And the trumpet that sings of fame;
Not as the flying come,

In silence and in fear; —
They shook the depths of the desert gloom
With their hymns of lofty cheer.

Amidst the storm they sang,
And the stars heard and the sea;
And the sounding aisles of the dim woods rang
To the anthem of the free!
The ocean eagle soared
From his nest by the white wave's foam,
And the rocking pines of the forest roared —
This was their welcome home.

There were men with hoary hair
Amidst that Pilgrim band; —
Why had they come to wither there,
Away from their childhood's land?
There was woman's fearless eye,
Lit by her deep love's truth;
There was manhood's brow serenely high,
And the fiery heart of youth.

What sought they thus afar? —
Bright jewels of the mine?
The wealth of seas, the spoils of war? —
They sought a faith's pure shrine!
Ay, call it holy ground,
The soil where first they trod!
They left unstained what there they found, —
Freedom to worship God.

MRS. HEMANS.

THE STAR-SPANGLED BANNER.

Oh, say, can you see, by the dawn's early light,
  What so proudly we hailed at the twilight's last gleaming,
Whose broad stripes and bright stars through the perilous fight,
  O'er the ramparts we watched, were so gallantly streaming?
And the rockets' red glare, the bombs bursting in air,
Gave proof through the night that our flag was still there.

CHORUS.

  Oh, say does that star-spangled banner yet wave
  O'er the land of the free and the home of the brave?

On the shore dimly seen through the mists of the deep,
  Where the foe's haughty host in dread silence reposes,
What is that which the breeze, o'er the towering steep,
  As it fitfully blows, half conceals, half discloses?
Now it catches the gleam of the morning's first beam,
In full glory reflected, now shines on the stream.

CHORUS.

  'T is the star-spangled banner: oh, long may it wave
  O'er the land of the free and the home of the brave.

Oh, thus be it ever, when freemen shall stand
  Between their loved home and wild war's desolation;
Blest with victory and peace, may the heaven-rescued land
  Praise the Power that hath made and preserved us a nation!
Then conquer we must, when our cause it is just,
And this be our motto: "In God is our trust!"

CHORUS.

  And the star-spangled banner in triumph shall wave
  O'er the land of the free and the home of the brave.

FRANCIS SCOTT KEY.

COLUMBIA, THE GEM OF THE OCEAN.

O Columbia! the gem of the ocean,
  The home of the brave and the free,
The shrine of each patriot's devotion,
  A world offers homage to thee.
Thy mandates make heroes assemble,
  When Liberty's form stands in view;
Thy banners make tyranny tremble,
  When borne by the red, white, and blue,
  When borne by the red, white, and blue,
  When borne by the red, white, and blue,
Thy banners make tyranny tremble
  When borne by the red, white, and blue.

When war winged its wide desolation,
  And threatened the land to deform,
The ark then of freedom's foundation,
  Columbia, rode safe through the storm;
With garlands of vict'ry around her,
  When so proudly she bore her brave crew,
With her flag proudly floating before her,
  The boast of the red, white, and blue,
  The boast of the red, white, and blue,
  The boast of the red, white, and blue,
With her flag proudly floating before her,
  The boast of the red, white, and blue.

The star-spangled banner bring hither,
  O'er Columbia's true sons let it wave;
May the wreaths they have won never wither,
  Nor its stars cease to shine on the brave.

May the service united ne'er sever,
  But hold to their colors so true;
The army and navy forever,
  Three cheers for the red, white, and blue,
  Three cheers for the red, white, and blue,
  Three cheers for the red, white, and blue,
The army and navy forever,
  Three cheers for the red, white, and blue.

DAVID T. SHAW.

HURRAH FOR THE FLAG.

There are many flags in many lands,
  There are flags of every hue;
But there is no flag, however grand,
  Like our own "Red, White, and Blue."

Then hurrah for the flag! our country's flag!
  Its stripes and white stars, too;
For there is no flag in any land,
  Like our own "Red, White, and Blue."

I know where the prettiest colors are,
  And I 'm sure if I only knew
How to get them here, I could make a flag
  Of glorious "Red, White, and Blue."

I would cut a piece from the evening sky,
  Where the stars were shining through,
And use it just as it was on high,
  For my stars and field of blue.

Then I 'd want a part of a fleecy cloud,
  And some red from a rainbow bright;
And put them together, side by side,
  For my stripes of red and white.

We shall always love the stars and stripes,
And we mean to be ever true
To this land of ours, and the dear old flag,
The Red, the White, and Blue

THE BELL OF LIBERTY.

There was tumult in the city,
In the quaint old Quaker town,
And the streets were rife with people
Pacing restless up and down;
People gathering at corners,
Where they whispered each to each,
And the sweat stood on their temples,
With the earnestness of speech.

As the bleak Atlantic currents
Lash the wild Newfoundland shore,
So they beat against the State House,
So they surged against the door,
And the mingling of their voices
Made a harmony profound,
Till the quiet street of Chestnut
Was all turbulent with sound.

"Will they do it?" "Dare they do it?"
"Who is speaking?" "What's the news?"
"What of Adams?" "What of Sherman?"
"Oh! God grant they won't refuse."
"Make some way there!" "Let me nearer!"
"I am stifling!" "Stifle, then!
When a nation's life 's at hazard,
We've no time to think of men."

So they beat against the portal,
  Man and woman, maid and child;
And the July sun in heaven
  On the scene looked down and smiled.
The same sun that saw the Spartan
  Shed his patriot blood in vain,
Now beheld the soul of freedom,
  All unconquered, rise again.

See! See! The dense crowd quivers
  Through all of its lengthy line,
As the boy beside the portal
  Looks forth to give the sign;
With his little hands uplifted,
  Breezes dallying with his hair,
Hark! with deep, clear intonation,
  Breaks his young voice on the air.

Hushed the people's swelling murmur,
  List the boy's exulting cry!
"Ring!" he shouts; "Ring! grandpa,
  Ring! Oh, ring for Liberty!"
Quickly at the given signal
  The old bellman lifts his hand,
Forth he sends the good news, making
  Iron music through the land.

How they shouted! What rejoicing!
  How the old bell shook the air,
Till the clang of freedom ruffled
  The calmly gliding Delaware.
How the bonfires and the torches
  Lighted up the night's repose,
And from flames, like fabled Phœnix,
  Our glorious Liberty arose!

That old State House bell is silent,
  Hush'd is now its clamorous tongue;
But the spirit it awaken'd
  Still is living — ever young;
And when we greet the smiling sunlight,
  On the fourth of each July,
We will ne'er forget the bellman,
  Who, betwixt the earth and sky,
Rang out, loudly, "Independence,"
  Which, please God, shall never die.