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ABSTRACT

This curriculum guide contains an outline of the scope and sequence of science concepts to be developed in grades 1-4 in the schools of the Iberville Parish system, Louisiana. Concepts from the life sciences, earth sciences, and physical sciences are presented in the form of an individualized instructional program in which the material within each science area is grouped according to level of complexity. The guide was teacher developed and intended for use in lesson planning as well as for providing comprehensiveness and continuity for the science program. (PEB)

SCIENCE

SCOPE and SEQUENCE

GRADES 1-4

IBERVILLE PARISH SCHOOLS

An Individualized Instructional Program Organized With A Concept Philosophy by Levels for the Iberville Parish School System

Iberville Parish School Board
P. O. Box 151
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SCIENCE INTRODUCTION

Research for the materials in this guide was conducted by a specially formed committee of Iberville parish science teachers. The committee's responsibility was to outline a scope and sequence of science concepts to be developed in grades one through twelve.

Included in grades one through six are concepts taken from life sciences, earth sciences, and physical sciences. The seventh grade is devoted entirely to the life sciences, the eigtn grade to earth sciences, and the ninth grade to the physical sciences. Presented in the tenth, eleventh, and twelth grades are concepts from biology, chemistry, and physics, respectively.

It is hoped that the guides will be of help to teachers in preparing their plans, as well as providing a degree of comprehensiveness and continuity to the science program. Use of the guides will probably show a need for revision of concepts at some levels. Once this is accomplished, activities will be selected to implement the development of concepts at all levels.

LEVEL 1

I. Life Science

A. The characteristics of all living things are:

1. Living things grow.
2. Living things move in some way.
3. Living things reproduce their own kind.
4. Living things must have food and water.
5. Living things need air.

B. The ways in which living things can be compared are:

1. Size.
2. Shape.
3. Structure.
4. Color and markings.
5. Locomotion.

C. Plants

1. Structure
   a. Most plants we know have roots, stems, and leaves.
   b. At different times most plants we know also have flowers and seeds.
2. Classification
   a. Some plants grow on land; some, in water.
   b. Plants have many different kinds of stems.
   c. The stems of some plants help us tell one plant from another.
   d. Plants have many different kinds of roots.
   e. The roots of some plants can help us tell one plant from another.
   f. Plants have many different kinds of leaves.
   g. The leaves of some plants can help us tell one plant from another.
   h. Plants have many different kinds of flowers.
   i. The flowers of some plants can help us tell one plant from another.
   j. Plants have many different kinds of seeds and seed coverings.
      (1) We call some seeds and seed coverings fruit.

(2) We call some seeds and seed coverings vegatables.
(3) We call some seeds and seed coverings nuts.

k. The seeds and seed coverings can help us tell one plant from another.
l. Combinations of plant parts can help us tell one plant from another.

3. Life Activities
   a. Reproduction
      (1) Plants can reproduce their own kind through seeds that are planted.
      (2) Plants can reproduce their own kind through seeds that are dispersed.
      (3) Some plants can reproduce new plants from parts of old plants.
      (4) Some plants reproduce new plants from spores.
   b. Green plants make and store their own food.
   c. A plant grows in two ways: down (roots) into the soil and up into the light (stems and leaves).
4. Conditions for Life
   a. Different plants need different things in order to grow.
   b. Most plants need sunlight, air, and water to grow.
   c. Plants need good soil.
5. Change and Adaptations.
   a. The seasons make plants change.

D. Animals

1. Structure
   a. The size and structure of an organism is determined by heredity and environment.
2. Classification
   a. There are many different kinds of animals.
   b. Some animals live on land; some in water; and some in the air.
   c. Differences in general size are often distinguishing characteristics of animals.
   d. Differences in kinds and shapes of body parts are often distinguishing characteristics of animals.
   e. Differences in body covering are often distinguishing characteristics of animals.
   f. Differences in color and markings are often distinguishing characteristics of animals.
   g. The following animals have certain characteristics which distinguish them from other animals:

(1) Fish.
  a. Most fish have scales, live in water, and breathe by means of gills.
  b. Most fish lay eggs.
(2) Amphibians. (frogs, toads)
  a. Amphibians lay eggs in water.
  b. Tadpoles hatch from eggs and live a fishlike existence, breathing with gills.
  c. The tadpoles change, grow lungs, and move out of the water.
  d. They become adult amphibians, living on land.
(3) Reptiles. (snakes, turtles, lizards)
  a. Reptiles are covered with scales or scaly plates.
  b. Most lay eggs.
  c. They breathe with lungs.
(4) Birds.
  a. The bodies of birds are covered with feathers.
  b. Birds have two legs and two wings.
  c. Most birds fly.
  d. They lay hard-shelled eggs.
  e. They breathe with lungs.
(5) Mammals.
  a. Mammals have hair on their bodies.
  b. They breathe with lungs.
  c. They have legs and/or arms and have baby young.
  d. Man is a mammal.
(6) Insects.
  a. Insects have six legs and two feelers or antennas.
(7) Spiders.
  a. Spiders have eight legs.

3. Life Activities
  a. Reproduction
    (1) Some animals reproduce their own kind through eggs laid externally, and some animals pass through a cycle of change from egg to adult. (butterfly and frog)
    (2) Mammals bear their young alive and the offspring of mammals resemble the parents.
  b. Locomotion
    (1) Animals can move about.
    (2) Animals can walk, swim, run, crawl, and fly.
    (3) Some animals can use two or more methods of movement.
4. Conditions for Life
  a. Animals need food, air, water, and sunlight.
  b. Animals need shelter.

c. Animals need other animals. (Some animals need other animals for food.)
d. Man needs plants and animals.
e. Man needs food, plenty of rest, exercise, and proper clothing.
f. Man must have good health habits.

5. Change and Adaptations
   a. Animals have different kinds of shelter.
   b. Animals may be wild or tame.
   c. Tame animals are usually pets.
   d. There are helpful and harmful animals.
   e. Man must practice rules of work and play.
   f. Animals in the past are different from the animals of the present.
6. Conservation
   a. We protect some plants and animals from their enemies.
   b. Life in the past is reconstructed from fossil remains and preserved specimens.

II. Physical Science

A. Structure of Matter

1. Matter exists in various forms and states.
2. Matter exists as a solid, liquid, or gas.

B. Changes in Matter

1. The state of matter can change.
2. Changes in the state of matter are determined by heat.
3. Heat energy can be used to change a solid to a liquid.
   a. When ice is heated, it changes to water.
4. Heat energy is given off when a liquid changes to a solid.
   a. When water loses enough heat, it changes to ice.
   b. When water freezes, it changes from liquid to a solid.
5. When liquids evaporate, gases are formed.
6. Heat energy is needed for evaporation to occur.
   a. When water is heated, it changes to water vapor.
7. Matter changes in state as the temperature changes.
   a. We use a thermometer to find the temperature.
   b. Heat makes the line, or column, on a thermometer rise.
   c. Heat from the sun makes the temperature go up.

C. Energy

1. Energy must be used to set an object in motion or to alter its motion.
   a. Mechanical energy may be used to set an object in motion. (Food is a source of energy.)
   b. Electric energy may be used to set an object in motion.
      (1) Electricity gives heat and light.
      (2) It may be turned on or off.
      (3) Electricity travels through wires.
   c. Chemical energy may be used to set an object in motion. (Gasoline and other fuels are sources of energy.
   d. Heat is a form of energy. (Changes in the state of energy are determined by heat.)
   e. The energy in moving air or wind may be used to set an object in motion.
   f. The energy in moving water may be used to set an object in motion.
   g. Light is a form of energy.
      (1) The sun is a source of light.
      (2) Electrical energy can make light.
      (3) Light travels in straight lines.
      (4) Light passes through some things.
      (5) Light cannot pass through some things.
      (6) Light has many uses.
         (a) It helps green plants to grow.
         (b) We need light to see.
   h. Sound is a form of energy.
      (1) Sounds are all around.
      (2) Sounds are made by things that move.
      (3) Animals and other things make sounds.
      (4) We use sound to speak and listen.
      (5) Some sounds are walking, laughing, singing, and crying.
      (6) Sounds can be musical.
      (7) There are loud sounds and soft sounds.
      (8) There are low sounds and high sounds.
      (9) Some sounds are unpleasant. (noise)
      (10) Sounds, or the absense of sounds, tell what is happening.
      (11) Sound travels through all kinds of matter.
      (12) Sound is heard with the ears.
      (13) We have machines that help us to hear sounds.
2. When energy changes from one form to another, the amount of energy remains unchanged.

D. Forces and Motion

1. Energy is used to do work.
   a. Energy is used to overcome friction. (Friction is that which holds things back and also wears things out when they are dragged.)

b. More energy is needed to overcome sliding friction than to overcome rolling friction. (It is easier to move ourselves and other things on wheels than without wheels.)
c. The greater the amount of work done, the greater is the amount of energy being used.
d. The rate at which energy is used determines how fast the work can be done. (Going faster means more work is done per unit time.)

2. More work can be done in less time when machines are used.
   a. Fuel, used in a machine, supplies energy at a faster rate.
   b. Many large and small machines are used to make work easier.
      (1) The wheel and axle is a simple machine.
      (2) The pulley is a simple machine.
   c. Machines are used in the home and at school.
   d. We use machines to cut materials, and we ride in some machines.
   e. Machines can be used during work and play.
3. Work is a force acting through a distance.
4. Energy must be used to work against the pull of gravity. (Gravity is a force which pulls everything toward the center of the earth.)
5. Force is used to counteract force.
   a. We can overcome the force of gravity on some things when we lift them or when machines lift them.
   b. To make anything go up, some force must push or pull against the force of gravity with a greater force.
      (1) A force is necessary to make things move.
      (2) Force can be applied either to push or to pull.
      (3) Lifting is either pushing or pulling up.
      (4) It takes more force to lift heavy things than light things.
      (5) It takes less force to move things when wheels are used.
      (6) Different kinds of force can be used to make things move.
         (a) The force of animal muscles.
         (b) The force of engines.
         (c) The force of electricity.
         (d) The force of springs.
   c. Magnetic forces can be used to overcome the force of gravity.
      (1) A magnet attracts some kinds of metals--mainly iron and steel.
      (2) A magnet has a north pole and a south pole.
      (3) The strength of a magnet is greatest at the ends.

(4) Like poles repel; unlike poles attract.
(5) Magnets have different shapes.
(6) Magnets can make other metals magnetic.
(7) Some magnets are stronger than others.
(8) The pull of a magnet can act through thin sheets of many things.
(a) Paper.
(b) Thin wood.
(c) Cardboard.
(d) Glass.
(e) Aluminum cookie sheets.
(9) The needle in a compass is a magnet.
(10) Electricity gives rise to magnetism.
(11) Electricity and magnetism can be used.

6. The greater the force, the greater is the amount of work done.

III. Earth Science

A. Astronomy

1. The Stars
a. The stars give us light at night.
b. The stars look small because they are so far away.
c. Some stars are larger than the sun, and some are smaller than the sun.
d. We cannot see the light from the stars in the daytime because the sunlight is stronger.
e. Some groups of stars make paterns in the sky.
2. The Sun
a. The sun is a star that shines all the time.
b. The sun is big, round, very hot, and very far away.
c. The sun is a ball of hot gases which are so hot that they give off bright light.
d. The sun warms all things, especially the earth.
e. The sun is the star closest to the earth.
f. The sun is the source of our light energy.
g. The sun must shine for us to see shadows.
(1) A shadow is made by something that gets in the path of the sunlight and does not let the light through. (When clouds move, their shadows move across the earth.)
3. The Moon
a. The sun shines on the moon.
b. The moon sends out the light that comes from the sun.
c. It is seen mostly at night, but can sometimes be seen during the day.

d. The moon's movement around the earth sometimes brings it into our daytime sky.
e. The moon is closer to the earth than it is to the sun.
f. The moon moves around the earth about once a month.
g. In moonlight, things are much less easily seen than in sunlight.
h. It is safe to look directly at the moon.

4. The Planets
   a. There are nine planets in space.
   b. All the planets move around the sun.
   c. All the planets get light and heat from the sun.
   d. We live on the planet earth.
      (1) The earth is a great ball in space.
      (2) The globe is a model of the earth.
      (3) The earth turns around all the time.
      (4) The time it takes the earth to turn all the way around is 24 hours, or one full day.
      (5) Half of the earth is always in daylight while the other half is in darkness.
         (a) When our part of the earth is toward the sun, we have day.
         (b) When our part of the earth is not toward the sun, we have night.
      (6) The earth also moves around the sun.
      (7) It takes one year for the earth to go all the way around the sun.

5. Space
   a. An astronaut is a specially trained pilot who travels through space.
   b. An astronaut passes through the earth's atmosphere and enters space, where there is practically no air.
   c. The capsule is the part of the rocket in which the astronaut rides.
   d. He can look out of his window and see the earth as he travels around it in space.

B. The Earth

1. The earth is made of land, water, and air.
   a. There are four different kinds of land on our earth.
      (1) Rock.
      (2) Clay.
      (3) Sand.
      (4) Soil.
   b. All forms of land are continually changing as they react to weather, earthquakes, volcanism, water, and other factors.
   c. All forms of land begin with the breakdown of rock.

(1) There are many kinds of rocks.
(2) Some rocks are soft and many are hard.
(3) Freezing, thawing, heating and cooling, water, plants, and wind cause big rocks to break into little rocks.

d. Sand is formed by the breakdown of rock. (Wind plays an important part in the formation of sand.)
e. Rocks change into a fine powder called clay. (Volcanic rocks) (Water makes the powdered form of clay change into the doughlike form of clay.)
f. Soil is made of rocks, sand, clay and the decayed parts of plants and animals.
(1) Some soil is good and plants will grow in it.
(2) Some soil is not good and plants will not grow in it.
(3) Soil is the result of a long continuous process of change.
(4) Without soil man could not exist, for man is directly or indirectly dependent on soil for food.

2. Much of the earth is covered with water.
a. The bodies of water found on the earth are:
(1) Oceans.
(2) Seas.
(3) Lakes.
(4) Ponds.
(5) Streams.
(6) Rivers.
(7) Swamps.
b. The most familiar form of water is its liquid state.
(1) We drink water in its liquid state.
(2) We swim in water
(3) We wash clothes in water.
(4) We bathe in water.
(5) Water has many other uses.
c. When steam appears while boiling water, this is the gaseous state of water.
d. Water can appear in many forms in the solid state.
(1) Frost.
(2) Isicles.
(3) Snow.
(4) Sleet.
(5) Hail.
(6) Icebergs.

3. Our earth is made of air.
a. Air is real and all around us.
b. We cannot see air, but we can feel it.
c. Air is in soil and water.

d. Air takes up space.
   (1) We use air in such things as balloons and tires.
   (2) Air can keep water out of hollow things.
   (3) If air can leave a container, water can enter.
   (4) We know that air is leaving or entering a container by bubbles in the water.
e. The earth is surrounded by an enormous ocean of air called the atmosphere.
f. Moving air is called wind. (Wind can move things.
g. Airplanes fly in the air.
   (1) Airplanes fly over, under, and through clouds.
   (2) Air pushes on the underside of the wings of the airplanes.
   (3) Parts of the tail move.
   (4) Parts of the wings move.
   (5) Thrust is the force that moves the airplane forward.
      (a) A propeller provides the thrust on a piston-driven airplane.
      (b) A jet engine delivers thrust to the jet-propelled airplane.

C. Weather

1. There are many kinds of weather
   a. What we wear and what we do outdoors depend on weather.
   b. Some types of weather are:
      (1) Sunny.
      (2) Cloudy.
      (3) Rainy.
      (4) Windy.
      (5) Warm.
      (6) Cold.
   c. The sun is still shining on a cloudy day.
      (1) Clouds have different shapes.
      (2) The wind moves clouds across the sky.
      (3) Sometimes clouds hide the moon and stars at night.
      (4) On some days, clouds get darker and it rains.
   d. Clouds and precipitation result form the cycle of evaporation and condensation.
      (1) Heat from the sun helps to evaporate water.
      (2) Water is always evaporating.

(3) When water evaporates, it goes into the air and becomes a gas--water vapor.
(4) When air is cooled enough, some of the water vapor in it will change into water and form a cloud.
(5) Clouds, whether in the sky or near the ground, are made of tiny droplets of water.
(6) When the drops become big enough and heavy enough, gravity pulls them down to the earth as rain.

e. Wind is air in motion.
(1) Wind blows from different directions.
(2) Sometimes the wind has more force, and sometimes it has less force.
(3) Sometimes the wind helps us; sometimes it harms us.

f. We use a thermometer to estimate temperature.
(1) When the liquid in the thermometer goes down, the weather is colder.
(2) When the liquid in the thermometer goes up, the weather is hotter.
(3) Snow falls instead of rain if the weather is cold enough.
(4) The thermometer helps us to know how to dress. (People should wear warmer clothes in colder weather.)
(5) The thermometer helps us in taking care of plants and animals.

2. Climate
a. A desert is a place where there is very little rain.
b. Plants and animals that do not need much water live in the desert.
c. Most plants and most animals live in places where there is plenty of rain.

3. The four seasons are autumn, winter, spring, and summer.
a. Fall is another name for autumn.
(1) Fall begins on September 21, or 22.
(2) Leaves change colors and fall from trees.
(3) It is time to rake the leaves.
(4) It is harvest time for corn, hay, pumpkins, and apples.
(5) It is time to get ready for winter.
(6) Ducks and birds fly south.
(7) The days are cooler.
(8) We wear sweaters.
(9) It is time for fall flowers to appear. (goldenrod)
(10) Seeds are flying.
(11) Nuts fall and animals hide them.

(12) Grass turns brown.
(13) We see light frost on the ground.
(14) Frogs and turtles go to sleep.
(15) We see a full moon.
(16) The Big Dipper is very prominent.
(17) It is time for Holloween, Thanksgiving, and school days.
(18) Some animals have colors that help them hide in the leaves.
(19) It is time for football.

b. Winter begins on December, 21 or 22.
(1) It is cold in the winter.
(2) Sometimes we see snow.
(3) We must drive our cars with care on icy streets.
(4) We must walk carefully on icy walks.
(5) Some animals are asleep.
(6) Most trees are bare.
(7) We need to feed the birds.
(8) Evergreen trees stay green.
(9) Shadows are longer.
(10) The days are shorter and the nights are longer.
(11) Water freezes.
(12) If we have snow, we can make snowmen.
(13) It is the Christmas and the New Year season.

c. Spring is on March 21.
(1) Leaves grow again.
(2) Grass gets green.
(3) Flowers bloom.
(4) Trees bud.
(5) Birds return.
(6) It is time to plant seeds.
(7) Snow melts in the North.
(8) It is time to fly kites.
(9) Many baby animals are born.
(10) Mother birds lay eggs.
(11) Birds build nests.
(12) Warm days are here.
(13) Frogs lay eggs.
(14) We wear light clothes.
(15) It is Easter time.
(16) It is a good time for afternoon walks.
(17) Moths come out of cocoons.
(18) We can see tadpoles with long tails swimming about.
(19) Squirrels are running here and there.
(20) Baby ducks hatch from eggs.
(21) Good days to roller skate.
(22) The Big Dipper is high in the sky.

d. Summer is on June 21.

(1) Summer is vacation time.
(2) It is hot in the summer.
(3) We have picnics in the summer.
(4) Water in the brook is warm for wading.
(5) Leaves and plants are green.
(6) We go swimming.
(7) We can go boating.
(8) It is time to gather garden vegetables.
(9) Everything is in full bloom.
(10) The sun is very high in the sky.

LEVEL 2

SCIENCE

I. Life Sciences

A. Living things

1. Living things are made of cells.
2. Living things need food, water and air.
3. Living things are products of their heredity and environment.
4. There are different forms of living things.
5. Classification of living things is based on characteristics held in common within the group.
6. Living things are grouped according to common attributes.
7. Related living things reproduce in similar ways.
8. Living things are interdependent with one another and their environment.
9. Living things live and grow within limits of tolerance in their environment.
10. There is an interchange of material and energy between organisms and the environment.
11. Living things depend for their energy on a flow of materials from the environment.
12. Living things are specially adapted to special environments.
13. Living things change.

B. Plants

1. Structure
   a. Plants have flowers.
   b. Flowers make seeds.
   c. New plants grow from seeds.
   d. Seeds, leaves, stems, roots and fruit are parts of plants that we eat.
   e. Fruit contains seeds.
   f. Leaves and stems grow up.
   g. Roots grow down.
   h. Plants grow from seeds, bulbs, and parts of other plants.
   i. Roots make a root system.

2. Classification
   a. Algae are plants
   b. All plants are not green.
   c. There are many kinds of plants.
   d. An organism is a product of its heredity, and environment.
   e. Seed plants are complex organisms, having special adaptations to a land environment.
   f. There are different forms of living things.
   g. Classification of living things is based on characteristics held in common within the group.
   h. Plants belonging to the same family have common characteristics.
   i. Living things are grouped according to common attributes.
   j. A nut is a seed.
3. Life Activities
   a. Nutrition
      (1) Green plants capture the energy of sunlight and store it in food.
      (2) There are many nuts and seeds in the fall.
      (3) Some foods spoil, and some foods do not spoil.
      (4) Flour is made from seeds.
      (5) We can make many kinds of foods from flour.
      (6) Cereals are made from seeds. Sometimes these cereals are used whole and sometimes they are ground up.
      (7) Some of our food comes from plants.
      (8) Only green plants can make their own food by using chlorophyll.
      (9) Plants may store food, which is used by animals, in roots, stems, leaves, or fruits.
      (10) Some plants do not make their own food.
      (11) We eat foods that come from different parts of plants.
   b. Reproduction
      (1) New plants grow from seeds.
      (2) Plants come up as seedlings.
      (3) Seeds travel.
      (4) Living things are products of their heredity and environment.
      (5) Related living things reproduce in similar ways.
      (6) Plants must scatter their seeds in order to keep their kind alive.
      (7) New plants may be started from seeds, roots, bulbs, or cuttings.
      (8) Seeds are transported from place to place by various means.
      (9) Most plants make seeds in the fall. Many of these seeds lie in the ground until spring. Then they begin to grow.

(10) Every seed contains a tiny plant.
(11) Fruit contains seeds.

4. Conditions necessary for life
   a. The life and growth of a plant is affected by its environment.
   b. Living things are interdependent with one another and with their environment.
   c. Water and air are essential to the growth and developments of plants.
   d. Sunlight is essential to the growth and development of plants.
   e. Organisms live and grow within limits of tolerance in their environment.
   f. There is an interchange of material and energy between organisms and the environment.
   g. There are many kinds of soil.
   h. Most plants grow better in good garden soil than in sandy soil.
   i. Plants need water and light.
   j. People take care of some plants.
   k. Some plants grow without the care of people.
   l. Plants need food and water.
   m. Green plants must have light.
   n. Algae grow in sunlight.
   o. Living things depend for their energy on a flow of materials from the environment.
   p. Seeds protect themselves from being eaten by animals.
   q. The capture of radiant energy by green plants is basic to the maintenance and growth of all living things.
   r. Seeds can grow only where there is soil, moisture, warmth, and air.

5. Change
   a. Adaptation
      (1) Living things are specially adapted to special environments.
      (2) Plants grow in different places: each having its own environment.
      (3) Plants vary according to seasons.
      (4) Changes occur in leaves, growth, leaf seeds, and seeds during different seasons.
      (5) Living things are in constant change.
         (a) Forms of living things have become extinct.
         (b) Life forms change within their own life span.
         (c) Some life forms have adapted to a changing environment while others become extinct.
      (6) Plants and their seeds cannot grow in the cold.
      (7) Some plants do not live in the winter.
      (8) The seeds of these plants will stay in the ground until the next spring.

(9) In the spring they will grow.
(10) Plants change as seasons change.

b. Extinction
(1) Some plants live for many years.
(2) Plants have changed over the years.
(3) Fossil records provide evidence of prehistoric development.
(4) Changes in environment affect the life and growth and development of organisms.
(5) Organisms are products of heredity and environment.
(6) Living things are interdependent with their environment.
(7) Living things change.

6. Conservation
a. The seeds of plants stay in the ground until the next spring.
b. Plants and animals adapt to the changing seasons.
c. All green plants need water to grow. Plants need light to grow.
d. Plants and animals in an aquarium help each other.
e. Many things go together to make soil.
f. Earthworms help to make soil good for farming.
g. Water breaks rocks into soil.
h. Water carries away soil.
i. Wind carries aways soil.
j. The farmer protects his soil.

C. Animals

1. Structure
a. There are many different kinds of animals. They are different in some ways but in some ways they are all alike. They are born, they eat, and they grow up to have babies of their own.
b. The eyes are part of the body.
(1) Eyes differ in color and shape.
(2) All eyes work alike.
(3) We see with our eyes.
(4) We must care for our eyes.
(5) The iris and pupil are parts of the eye.
c. The ears are part of the body.
(1) The ears are part of the body. The ear has three main parts: outer ear, middle ear, and inner ear.
(2) The outer ear catches sound waves.
(3) The ear drum vibrates, or moves.
(4) Vibrations go to the middle ear.
(5) Vibrations move through the inner ear.
(6) The auditory nerve takes the message of sound to the brain.

d. The nose is part of the body
   (1) Air goes in and out of the nose.
   (2) We breathe through our noses.
   (3) We smell things with our noses.
e. Healthy bodies have healthy parts.
f. Permanent teeth replace baby teeth.

2. Classification
   a. Not all animals have bones.
   b. Insects do not have bones.
      (1) Insects must have food.
      (2) Insects follow definite cycles.
      (3) Most insects change in some ways as they grow.
      (4) Insects are aware of what goes on around them.
      (5) Some insects are helpful.
      (6) Some insects are harmful.
   c. Animals are classified according to many different things, bones, skin size, hair color, blood, etc. Amphibians live in stages.
   d. Not all animals are warm blooded.
      (1) Fish are cold blooded animals.
      (2) Snakes are cold blooded animals.
      (3) Some animals have shells.
      (4) Birds are animals with feathers.
         (a) Birds build nest
         (b) Each kind of bird makes its own kind of nest.
         (c) Some birds build very good nest.
         (d) Little birds hatch from eggs.
         (e) When little birds grow up they look like the mother or father bird.
         (f) Many kinds of birds are helpful to people.
         (g) People should protect and help feed birds.

3. Life Activities
   a. Nutrition
      (1) We must learn proper eating habits.
         (a) Good health requires a regularity in eating.
         (b) Milk and water are essential for good strong bodies.
         (c) We should eat wholesome meals.
         (d) Correct eating habits aid the digestion of food.
      (2) Food comes from many places in the world.
         (a) Food is kept clean in containers.
         (b) We should wash vegetables and fruits before we cook or eat them.
         (c) There may be germs in dirt on food.
         (d) Germs on dirty hands could make us sick.

(e) We should wash our hands in warm soapy water before we eat.
(f) Dirt can pile up in tiny folds in our skin.
(g) Some foods must be prepared before eaten.
(h) We use tools to get our food ready to eat.
(i) Teeth are tools that cut, tear, crush, and grind.
(j) Animals have the right for eating the kinds of food they need.
(k) We must clean our tools and dishes.
(l) We need many different kinds of food to keep us well and growing.
(m) We should rest after meals.
(n) We can do many things to keep well.

(3) Some animals eat plants.
(4) Some animals eat other animals.
(5) Each animal has its own method of getting food.
(6) Plants store food that can be eaten by animals.
(7) All animals need food to grow.
(8) Plants and animals in an aquarium help each other.
(9) People and animals store food.
(a) Some animals store nuts and seeds.
(b) We store and eat nuts and seeds.
(c) We store food so that we can have different kinds of food in the winter.
(d) We can dry food. We can put food in cans, jars, boxes or bags. We can keep food cold.
(10) Some of our food comes from plants and some comes from animals.
(11) The food requirement of living things may vary.
(12) Some animals feed their babies and some babies feed themselves. All animal babies are hungry and must have the right food to help them grow.
(13) Water is necessary for good health because it helps to keep things clean.

b. Reproduction
(1) Most animal babies are born in the spring. They have all summer to eat and grow.
(2) Some animal babies hatch out of eggs, and some are born from their parents.
(3) Some babies look like their parents and some do not. All look like their parents when they grow up.

(4) We should take good care of animals and pets.
(5) Human babies are born any time of the year.
(6) Parents use many things to take care of their babies.
(7) Parents take care of their babies for a long time.
(8) Babies grow and change and become grown ups.
(9) All animals grow and change.
(10) Mammals get milk from their mothers.

4. Conditions necessary for life.
   a. Good body health habits are necessary for life.
   b. Different animals and babies have different ways of getting about.
   c. Animals must have food and water in order to live.
   d. Animals live where they can get food and water.
   e. All animals depend on food from plants for energy and growth.
   f. All organisms depend on food substances for energy and growth, repairs and activity.
   g. Man and animals must have warmth and shelter to survive.

5. Change
   a. Adaption
      (1) Living things are specially adapted to special environments.
      (2) Living things are interdependent with their environment.
      (3) There is an interchange of matter and energy between organisms and their environment.
      (4) People and animals have to learn to adapt to the changing seasons.
         (a) The four seasons are summer, fall, winter and spring.
            1a. Leaves change color and fall to the ground and the birds fly away in the fall.
            2b. Leaves grow back and birds come back in the spring, etc.
         (b) There are many signs of the coming of each season.
         (c) Some birds fly away to warmer places where there is food for them.
         (d) Birds know when fall comes.
         (e) Some birds can find the food they need in winter. They do not fly to warmer places.

(f) In places where it is cold in the winter, the ground is hard. It is hard for birds to find worms and insects.
(g) We can help the birds which do not fly away in the winter by putting food out for them.
(h) In the winter people in the warm places see many of the same birds that people in the cold places saw in the summer.
(i) Man does not have to move to warmer places in the winter to find his food
(j) We have found the ways to bring the food to us.
(k) Some animals go to warmer places in the winter.
(l) Other animals stay and store food to use when no more food is growing.
(m) Some animals do not store food in the winter.
(n) They eat a lot in the fall and grow fat. Then they sleep most of the winter and use their fat for food.
(o) Animals that sleep in the winter, make a bed in the ground, in caves, or in hollow trees or logs.
(p) Animals that sleep in the winter wake up in the warm spring and look for food.
(q) People and farmers give some animals food and warmth.
(r) Farmers get some of the things they need from these animals.
(s) We have many ways of keeping our homes warm in the winter.
(t) We burn wood, coal, oil, and gas to keep us warm.

b. Extinct
(1) Animals have changed over the years.
(2) Fossil records provide evidence of prehistoric development.
(3) Changes in environment affect the life, growth, and development of organisms.
(4) Living things change.

6. Conservation
a. All animals need food to grow.
b. Plants and animals in an aquarium help each other.
c. Many things go together to make soil.
d. Earthworms help to make soil good for farming.
e. The farmers protect their soil.
f. Some rocks are made of animal shells.

II. Physical Science

A. Structure of Matter

1. States of Matter
   a. Solids
      (1) Anything that is not a fluid and having a definite shape and volume is a solid.
2. Liquids
   a. Water can exist as a liquid that is wet, as a vapor that is a dry gas, or as a solid, as ice.
   b. Water can support certain kinds of objects.
   c. Many things will dissolve in water.
   d. Animals must have water to live.
   e. Ordinary water is a liquid.
3. Gases
   a. Air is real.
   b. Air is an invisible gas.
   c. There is air in water.
   d. There is air in soil.
   e. There is air in rocks.
   f. Water evaporates or condenses.
   g. Condensed water forms rain, snow, sleet hail, dew, or frost.
   h. Carbon dioxide and oxygen are gases necessary for life.
   i. A gas is invisible mater.
   j. We cannot see a gas but we can see what it does.
   k. Ice is a solid form of water.
   l. Steam is a gaseous form of water.
   m. You use air to speak into sentences.
   n. You take in oxygen and give off carbon dioxide as you breathe.
   o. Air is everywhere..
   p. Wind is moving air.
   q. Wind can be helpful and harmful.

B. Changes of Matter

1. A change in the state of matter is determined by molecular motion.
   a. Matter is made of very small particles called molecules.
   b. A molecule is the smallest part of a substance that retains the chemical properties of that substance.
   c. There is a relationship between changes in temperature and the motion of molecules and changes in the state of matter.
2. Matter changes from one form to another.
3. Living things are in constant change.

4. Physical changes
   a. Heat changes ice to liquid water.
   b. Heat changes liquid water to steam.
5. Chemical changes
   a. Heat changes sugar to caramel.

C. Energy

1. Radiation from the Sun.
   a. The sun radiates heat.
   b. Heat from the sun warms the earth.
   c. Light and heat from the sun are necessary for plants and growth.
2. Relationship of matter
   a. When energy changes from one form to another, the total amount of energy remains unchanged.
      (1) Energy may be transferred from one place to another.
      (2) Forms of energy are interchangeable.
   b. When matter changes from one form to another, the total amount of matter remains unchanged.
3. Heat Energy
   a. Heat is a form of energy.
   b. Heat changes things.
   c. Heat does work.
   d. We use heat.
4. Light energy
   a. Light is a form of energy
      (1) Chemical energy can be converted to light energy.
      (2) Electric energy can be converted to light energy.
   b. Matter on the sun is converted to energy, including light energy.
      (1) The sun is a star; stars give off light.
      (2) The sun is the Earth's chief source of light.
   c. Light is a form of energy.
      (1) Light travels in a straight line.
      (2) Light may be transmitted, reflected, or absorbed.
   d. Light is a form of energy transferred as a wave.
      (1) Light may be reflected.
   e. Sight is a physiological response to the stimulus of light energy.
      (1) The eye receives light and transmits light sensation.
5. Sound (Energy of Motion)
   a. Vibration or movement, makes sound.
   b. Sound travels.

c. Sound travels only through a medium, or thing.
d. Sound travels through such things as air and water.
e. We hear sound when parts of the ear vibrate.
f. Sound waves cause parts of the ear to vibrate.
g. Sound can be made underwater.
h. Even fish make sounds.
i. Energy can be transferred through the molecules of solids, liquids, or gases.
   (1) Sound is a result of vibration.
j. Sounds vary in pitch, they may be high or low.
   (1) The greater the frequency of vibration, the higher the pitch of sound.
k. Sound travels through solids, liquids, or gases.
   (1) Sound wave patterns vary according to their origin; their speed varies according to whether they travel through solids, liquids or gases. They spread in concentric circles from their source.
   (2) Sound travels in a wave pattern through molecules of solids, liquids, or gases.
l. Sound results from the vibrations of molecules in solids, liquids, or gases.
   (1) Speech is the result of sound patterns made when the vocal chords vibrate molecules of air.
m. Sound waves travel through molecules of solids, liquids, or gases.
   (1) Sound waves may be reflected.
n. Sound is a transfer of energy in a wave pattern through molecules of solids, liquids, or gases.
   (1) Hearing is the result of a transfer of energy through sound vibrations.
o. Sound does not travel through a vacuum.

D. Forces and Motion

1. Machine
   a. We use machines to do work easier and faster.
   b. The inclined plane is a machine.
   c. The screw is a machine.
   d. An inclined plane helps to lift things.
   e. A screw can lift things.
   f. A screw can hold things together.
   g. There are several kinds of screws.
   h. The screw is a special kind of ramp.
   i. There are many kinds of machines.
      (1) Some have wheels.
      (2) Some have levers.
      (3) Some have pulleys.
   j. Machines use different kinds of fuel, coal oil, wood electricity.

2. Work
   a. We do work when we move things.
   b. Men use their hands and muscles to move things.
   c. It is hard to carry heavy things.
   d. Wheels make work easier.
   e. Ramps make work easier.
   f. Wheels and ramps together make work still easier.
   g. A pulley helps us to do work.
   h. Wheels and ramps make the work of building a house easier.
3. Moving Objects
   a. Some animals have been trained to do work.
   b. Fires release energy that can be used to move trains and automobiles.
   c. Objects may be moved easily when wheels are used.
4. Pipes
   a. There are many kinds of pipes in the house.
   b. Pipes come from under the street, into the cellar, and up in the house.
   c. Water goes from the main water pipes through other pipes to the faucets in the house.
   d. Dirty water goes through the waste pipes and out of the house into a large sewage pipe.
   e. Cooking gas comes into the house through gas pipe.

E. Gravity

1. Gravity is the name of the force that causes water to flow from a high place to a low place.
2. Gravity is a force.
3. Gravity is the force that holds or pulls everything to earth.
4. Gravity pulls things down.
5. We can feel the gravity.
6. We can measure gravity.
7. Down is toward the earth.
8. Up is away from the earth.

F. Forces of Fluids

1. Air will hold up heavy objects if they move and are shaped right.
2. An object will float if it is lighter than the weight of the air that it will push out of the way.

G. Electrical and Magnetic forces

1. Electricity
   a. We need electricity for lights and many other things.
   b. We get electricity in our houses from wires in the street.

c. We use wires to carry electricity.
d. We need two wires to carry electricity.
e. The electricity in a big house is very strong.
f. It is not safe to play with electricity in a house.
g. The electricity comes from a powerhouse.
(1) The machines in the powerhouse make electricity.

2. Magnets
a. Magnets can be used to make work easier.
b. Magnets will pick up things made of iron or steel.
c. Color, shape, and size do not make a difference in the kinds of things magnets can pull.
d. We can use a magnet to make other magnets.
e. A magnet can push things and pull things made of iron.
f. We can turn an electric magnet on and off.
g. We can use electric magnets in many ways. We can use them in bells, chimes, clocks and telephones.
h. Magnets are used in electric motors.
i. The strength of the magnet determines the weight of the object that the magnet will pick up.
j. Strong magnets can move some objects without touching them.
k. When a magnet needle is free to turn, one end will always point north. This kind of magnet needle is called a compass.
l. A compass contains a small magnet that is free to turn.
m. A compass is helpful for finding the way.
n. A compass is one useful application of a magnet.
o. We can have fun with magnets.

H. Heat

1. Thermal
a. A thermometer tells us about hot and cold temperatures.
b. A thermometer measures temperatures.
c. We dress and adjust some of our work and play to suit the temperatures.
d. The temperature is high when the air is warm, and it is low when the air is cold.
e. We can see and feel the differences in temperatures.
f. The height of the red line in the glass tube of a thermometer shows temperature.
g. When a cold thing touches the thermometer, the red line goes down.

h. When a warm thing touches the thermometer, the red line goes up.
i. The red line goes up or down because the material in the thermometer is heated or cooled.
j. Different places in a room may have different temperatures.
k. Things give off heat when they cool.
l. Heat waves and light travel in straight lines.
m. Water boils at a temperature of 212°F.
n. Heat can change a solid to a liquid, it can change a liquid to a gas.

III. Earth Science

A. Astronomy

1. Universe
   a. The Universe is in constant change.
      (1) There are regular movements of the Earth and Moon.
      (2) Many kinds of changes take place throughout the Universe.
      (3) Some changes are due to motion of bodies in space.
      (4) Some changes are due to motion of molecules.
      (5) Some changes take millions of years.
      (6) Matter changes from one form to another.
      (7) Energy changes from one form to another.
2. Solar System
   a. Solar means having to do with the sun.
   b. The solar systems consist of the sun, planets, moons, comet, meteroids.
   c. The solar system may have gotten started about five or ten billion years ago.
   d. Meteroids are pieces of rocklike material that move through the solar system in all directions.
   e. Meteors are bright streaks of light in the sky.
   f. The path on which an object moves through space is called its orbit.
3. Sun
   a. The sun is the biggest and heaviest object in the solar system.
   b. The sun is much larger than the earth.
   c. Sunlight contains many colors mixed together.
   d. Heat from the sun warms the earth.
   e. It rises in the east and sets in the west.
   f. Earth travels around the sun.
   g. The sun is a yellow gas filled star.
   h. The sun is a daytime star.
   i. The sun shines all the time, giving out its light in all directions.
   j. The sun gives the light and heat of the day.
   k. We depend on warm sunlight for our food.
   l. The sun is shining all the time.

4. Moon
   a. The moon is smaller than the earth.
   b. The moon has different shapes.
   c. The moon moves around the earth in the sky while the earth moves around the sun.
   d. The moon is the nearest in the sky to the earth.
   e. The moon shines by reflected light.
   f. The moon always hold the same face toward the earth.
   g. The moon is dark and cold by night and very cold by day.
5. Stars
   a. A star is a huge ball of white-hot gases.
   b. Stars do not seem to be always in the same places because the earth turns.
   c. Stars appear to be smaller than the earth or sun, but they are usually larger than the sun.
   d. Stars differ in color because of temperature.
   e. Stars give light to the earth.
   f. Stars form pictures in the sky.
6. Planets
   a. A planet is different from a star.
   b. A planet is a cooled down ball of material.
   c. The material of a planet, at one time, may have been part of the sun.
   d. Nine main planets move in orbit around the sun at different rates of speed.
   e. The planets are smaller than the sun and vary in size.
   f. Planets do not shine by a light of their own.
   g. Some of the planets have moons that revolve around the sun.
   h. Small planets are called asteroids.
   i. We live on the planet earth.
      (1) The earth is an object in space.
      (2) The earth rotates from west to east.
      (3) The earth is round.
      (4) It moves through space and keeps moving all time.
      (5) We cannot feel the earth move.
      (6) The earth belongs to the sun's family.
      (7) The earth rotates on it's axis.
      (8) Rotation of the earth causes night and day.
      (9) North is toward the North Pole.
      (10) East is on your right when you face north.
      (11) The earth is shaped like a very large ball.
      (12) We cannot see or feel the roundness of big balls.
      (13) It is difficult to see the roundness of balls that are very close.
      (14) If we could go very far away, we could see the roundness of the earth.

(15) We can see the roundness of the sun and moon because we are very far away from them.

7. Time
   a. Rotation of the earth causes night and day.
   b. When it is daytime on one side of the earth it is nightime on the other side.
   c. The sun lights up the day side of the earth.
   d. The shadow of the earth causes nightime darkness.
   e. The earth takes 24 hours to rotate one time.
   f. The earth revolves around the sun in 365 days.
   g. The planets revolve around the sun in differdent time limits.
   h. We work and play during the day.
   i. The turning of the earth causes day and night.
   j. Night and day always follow each other.

B. History of the Earth

1. Fossils Records
   a. A fossil is the trace or remains of our animal or plant that lived long ago.
2. People
   a. Long ago, people believed the earth was flat.
   b. Greeks thought the earth was like a sphere or like a ball.
3. The history of the earth is divided into periods.
4. The history of the earth stretches back further than 600 million years ago.
5. There were many different kinds of prehistoric animals.

C. Earth--the earth consist of land, water, and the air around them.

1. Land
   a. The seven major land areas on the earth's surface are called continents.
   b. Islands are bodies of land that are completely surrounded by water.
   c. Soil
      (1) Soil and rocks cover the surface of the earth.
      (2) Soil comes from rocks and living things.
      (3) The remains of animals decay into soil.
      (4) Earthworms make the soil loose and workable.
   d. Rocks
      (1) Rocks break and wear away.
      (2) Ice breaks rocks.
      (3) Plants break rocks.

(4) Rocks are made of minerals.
(5) There are thousands of different kinds of rocks.
(6) Rocks may be worn away by running water.
(7) Some rocks are formed in layers when small grains of sand or clay settle to bottom of bodies of water.
(8) Some rocks have been made hard by cooling after heat had melted them.
(9) Some rocks have been changed to other kinds of rocks by means of heat pressure.
(10) Some rocks are made of animal shells.

2. Forces that change the Earth
   a. External
      (1) Erosion
         (a) Running water wears away the land.
         (b) Wind and water can carry the soil away.
         (c) Farmers protect soil against wind and water.
         (d) There are many kinds of erosion.
            (1) Swiftly running streams and rivers are important.
            (2) Rain washes away soil.
            (3) A sea coast is a battle line of erosion.
            (4) Wind erosion breaks away and wears away.
            (5) Plants and their roots help prevent erosion.
      (2) Weathering
         (a) Weathering causes rocks to break.
      (3) Glaciers
         (a) Glaciers and other natural forces break up and remove parts of the earth's crust.
         (b) Slowly moving glaciers carve the land.
         (c) Icebergs are large chunks of ice floating in the ocean.
   b. Internal
      (1) Mountain building
         (a) Mountains are the highest lands of the earth.
         (b) Mountains are formed in several different ways.
      (2) Earthquakes
         (a) Earthquakes are shakings of the earth's crust.
         (b) Earthquakes are caused by pressures building up deep within.
      (3) Geysers
         (a) Geysers are hot jets of water and steam that erupt into the air.

(4) Volcanoes
(a) Volcanoes are openings in the earth's crust through which hot liquid rock and gases are blown out.

3. Air
a. Wind
(1) Wind is moving air.
(2) Wind can be helpful and harmful.
(3) There are many different names for wind
b. Atmosphere
(1) The layer of air all around the earth is called the atmosphere.
(2) The atmosphere is made up of a number of gases all mixed together.
(3) There are several layers of air.

4. Water
a. Bodies of Water
(1) There are five large bodies of water called oceans.
(2) Smaller bodies of water are called rivers, lakes, streams and brooks, gulfs, swamps and seas.
b. Salt water
(1) The large bodies of water all contain salt water because they have salt beds on the ocean floor.
(2) The earth's oceans are really a large single body of water.
(3) Fresh water
(a) The smaller bodies of water contain no salt because of the absence of salt beds.
(b) We can filter fresh water and make it suitable for drinking.
(c) We use water for many things.

D. Weather

1. We have many kinds of weather.
2. The weather changes often.
3. We change our clothes and plans to suit the weather.
4. We cannot change the weather.
5. We need many kinds of weather.
6. Clouds
a. Clouds are formed when water vapor that is in the air turns into liquid when it gets cool.
b. There are different kinds of clouds.
c. The clouds help us to forecast weather.
d. Shapes of clouds change.
e. Weather clouds bring rain, or snow depending on the temperature.

f. Heat makes water evaporate into the air.
g. A fog is a cloud near the ground.
h. When tiny drops of water are cooled, they come together and make large drops.
i. In a cloud the large drops of water are heavy and they fall to the ground as rain.
j. When a cloud gets very cold, snowflakes, instead of raindrops, form in the cloud.
k. The same water keeps going up and down from the ground to the clouds and back again. It is used over and over again. (water cycle)
l. Lightning is a sudden discharge of electricity from a cloud to the ground or from one cloud to another.

7. Hurricanes
   a. Hurricanes are large storms formed in tropical regions with wind speeds of at least 175 mph.
   b. Hurricanes form when warm, moist, air rises rapidly.
8. The boundary line between different air masses is called a front.
9. Climate
   a. The average weather in an area over a long period of time is called the climate.
   b. There are many different kinds of climates.
      (1) Some are hot, some are cold.
      (2) Some are dry, some are wet.
   c. Some places on the earth are very cold.
   d. Some places on the earth are very hot.
   e. Most places on the earth are neither very hot nor very cold.
10. Seasons
   a. Seasons bring changes in weather.
   b. Fall is a cool-off time.
   c. Winter is cold.
   d. Spring is a warm-up time.
   e. Summer is hot.
   f. Seasons differ in different places.
   g. The revolving of the earth around the sun causes the different seasons.
11. Time
   a. A year is made up of seasons.
   b. The turning of the earth causes day and night.
      (1) When our part of the earth turns toward the sun, we are in daylight.
      (2) When our part of the earth turns away from the sun, we are in night.

E. Aviation

1. Scientist use balloons to study air and weather.
2. A dirigibibe is one kind of balloon.
3. Balloons have carried scientists high into the atmosphere.

4. A helium balloon rises in the air.

F. Space

1. Space
   a. Space is everywhere.
   b. Outer space begins about a hundred miles above the earth.
   c. NASA is a government agency for the exploration of space.
2. Space Travel
   a. A space capsule is part of a space craft where the crew and instruments are carried.
   b. A capsule carrying astronauts is sometimes called a command module.
3. Space Probe
   a. A vehicle for exploring space outside the atmosphere and sending back information is called a space probe.
   b. Lunar probes gather information on or near the moon.
   c. Planetary probes explore the planets.
4. Space Law
   a. All countries are asked to give notice of space craft launchings.
   b. Flags are put up to let explorers know who has already explored certain parts of space.
5. Satellite
   a. A satellite is any object that moves in an orbit around a heavy object.
   b. Satellites are used to help us study the solar system.

LEVEL 3

SCIENCE

Area I: Life Sciences

I. Plants

A. Structure of plants

1. Cellular structure
2. Parts of green plants
   a. Roots
   b. Stems
   c. Leaves
   d. Seeds
   e. Flowers
   f. Fruits

B. Classification of plants

1. Algae
2. Bacteria
3. Fungi
4. Mosses
5. Ferns
6. Green Plant
7. Flowering and cone bearing plants
8. Vascular plants (with tubes)
9. Nonvascular plants (without tubes)

C. Life Activities of Plants

1. Photosynthesis
2. Transpiration
3. Respiration
4. Digestion
5. Circulation, assimilation, and growth
6. Excretion
7. Reproduction
8. Locomotion

D. Conditions Necessary for Plant Growth

1. Air
2. Water
3. Temperature

4. Energy and sunlight
5. Soil
6. Chemicals
7. Cutting or trimming
8. Climate and seasons

E. Conservation of Plants

1. Careful planning
2. Planting
3. Education programs
4. Importance of plants to man

CONCEPTS TO BE DEVELOPED

I. Plants

A. Structure of Plants

1. Cellular Structure
   a. All plants are made of one or more cells.
      (1) Cells are the smallest living parts of plants and animals.
      (2) Some tiny plants such as bacteria are made of a single cell.
      (3) Cells carry on all the activities that plants must carry on in order to live.
      (4) Many cells have special work to do.
2. Parts of the green Plants
   a. The parts of green plants are the roots, stems, leaves, seeds, flowers, and fruits.
      (1) Roots
         (a) The roots are the part of the plant that grows downward into the ground
         (b) The roots hold the plant firmly into the ground.
         (c) The roots take in water and mineral from the soil and sends them to the stem and up into the leaves of the plant.
         (d) Many roots store food for the plant
         (e) Some roots, such as carrot, turnip parsnip, radish, beets, and sweet potato are used for food.
         (f) Some roots, such as horseradish, are used for seasoning food.
         (g) Some roots, such as sassafras, ginger, licorice, and mandrake are us for medicines.
         (h) Some roots, such as licorice and ginger are used in making candy.
         (i) The roots of the madder and yellow root trees are used.
      (2) Stems
         (a) The stem of a plant is the part of the plant between the roots and the leaves.

(b) Stems may be found above the ground below the ground, or both above and below the ground.
(c) The trunk of a tree is actually the stem of the plant.
(d) Stems conduct water and dissolved minerals upward from the roots to the leaves.
(e) Stems also conduct food from the leaves downward to the roots.
(f) The stem produces and displays the leaves so that they receive the sunlight they need.
(g) Most stems support the plant and hold it straight.
(h) Some stems, like the potato, store food for the plant.
(i) Green herbaceous stems can make food for the plant.
(j) Most underground stems can grow new plants.
(k) Some aerial stems such as the strawberry philodendron, and black raspberry, can grow new plants.
(l) The potato, asparagus, and celery are used for food.
(m) The sap of the maple tree and the juices of the sugar can can produce sugar.
(n) Cinnamon bark is used to make spice for flavoring.
(o) Rubber is made from the sap of the rubber tree.
(p) The stem of the flax plant is used to make linen.
(q) The chinchona bark produces quinine which is used to treat malaria.
(r) The bark of the cherry tree is used for cough syrup.
(s) Camphor comes from the laurel tree, and witch hazel comes from the witch hazel shrub.
(t) Turpentine from the pine tree is used in paint and varnish.
(u) Ropes and all kinds of string are made from the fibers of hemp and other plants.

(3) Leaves
(a) A leaf has two main parts: the blade and the petoile.

(b) The blade is the flat, thin, green part of the leaf. The blade of a leaf has veins.
(c) The petoile is the stalk of the leaf and is attached to the stem of the plant at a node.
(d) Leaves have different kinds of edge:
(1) Some edges are smooth, like the leaves of the willow, redbud, and magnolia.
(2) Some edges are toothed like the leaves of the elm.
(3) Some leaves have loves or fingerlike projections, like the leaves of the maple.
(4) The main function of the leaf is to make food for the plant.
(e) Only green plants are able to make their own food.
(1) Green Plants have a green material in the leaf call chlorophyll.
(2) Chlorophyll gives the leaf its green color.
(3) Chlorophyll also makes it possible for the leaf to make food for the plant.
(4) The leaf uses two materials to make food: water and carbon dioxide.
(f) The leaf helps the plant digest the food and change the food into the energy it needs to life and grow.
(g) The leaf helps the plant remove waste materials.
(h) Some leaves change color in the fal
(i) Some leaves such as the lettuce, cabbage, spinach, endive, and parsley are used for food.
(j) Tea leaves are used to make a bever age.
(k) The leaves of spearmint, peppermint sage, and thyme are used for spices and flavoring.
(l) Tobacco leaves are used for smoking
(m) Leaves, such as palm and grass are used to cover the roofs of the homes of natives in the topics.

(4) Seeds
(a) A seed is the part of a plant that grows into a new plant of the same kind.

(b) All seeds have three parts: a seed coat, stored food, and the embryo.
(c) The seed coat protects the seed.
(d) The stored food helps the young plant grow until it can make its own food by photosynthesis.
(e) The embro is a tiny young plant inside the seed.
(f) The most valuable source of food in the world comes from the fruits and seeds of the grasses such as wheat, corn, oats, rice, and barley.
(g) Beans and peas are used throughout the world for food.
(h) The peanut is used for food and its oil for cooking.
(i) Chocolate and cocoa are made from the coffee bean.
(j) Cotton seeds are used to make cooking oil and the fibers that stick to the seed are used to make cotton cloth.
(k) Oil from the seeds of the coconut tree is used to make soap, candles and butter substitutes.
(l) The soybean is used for food in China but in the U.S. it has many uses in industry.

(5) Flowers
(a) The flower is a special part of a plant that produces new plant of the same kind.
(1) The flower lives for a short time only and then part of the flower becomes a fruit.
(2) Most flowers have four parts: sepals, petals, stamen, and pistil.
(3) Sepals are the thin green leaflike parts on the outside of the flower.
(a) They cover and protect the flower bud.
(b) When the bud opens, the sepals separate and fold back.

(c) All together the sepals are called the calyx of the flower.

(b) Inside the sepals (calyx) are the petals of the flowers.

(c) The petals are usually larger than the sepals and are seperately brightly colored.

(d) All together the petals are called the corolla of the flower.

(e) At the base of the petals there are usually little pockets or cups of a sweet liquid called nectar.

(f) Inside the petals and usually grouped in a ring around the center of the flower, are the stamens.

(1) The stamens are the male part of the flower.

(2) There are two parts to the stamen: The filament and the anther.

(3) The filament is the thin stalk or stem of the stamen.

(4) The anther is on top of the filament, and is usually knobby or boxlike.

(5) The anther produces a yellow or reddish powder called pollen.

(g) In the center of the flower, usually surrounded by the stamens, is the pistils.

(h) The pistil is the female part of the flower.

(i) There are three parts to the pistil: the stigma, the style, and the ovary.

(j) The stigma is the sticky top of the pistil.

(k) The style is the thin stalk or stem of the pistil.

(l) The ovary is the large or swollen bottom of the pistil.

(m) Flowers are used for decorative purposes.

(n) Flowers are used in making perfumes.

(6) Fruits

(a) A fruit is the ripen ovary of the flower.

(b) Fruits are classified into two main groups: fleshy fruits and dry fruits.

(1) Fleshy fruits are soft and fleshy when ripe.
(2) Dry fruits are dry when ripe.

(c) A fruit protects the seeds inside of it.
(d) A fruit helps to scatter the seeds.
(e) Some fruits do not have seeds.
(f) Seedless oranges, grapefruits and grapes are produced by joining (grafting) parts of seedless trees onto the roots and stems of ordinary trees that produce these fruits with seeds in them.

B. Classification of Plants

1. Algae
   a. The entire body of many algae is only one cell.
   b. Algae are very simple plants with no roots, stems, or leaves.
   c. Algae have chlorophyll and can make their own food.
   d. They usually grow in water and are colored.
2. Bacteria
   a. Bacteria are often called microbes or germs.
   b. They are the smallest living things in the world.
   c. Only a few bacteria have chlorophyll.
   d. Bacteria grow in three shapes: round, rod-like, and spiral.
3. Fungi
   a. Fungi are the largest groups or plants without flowers.
   b. Fungi do not have chlorophyll so they cannot make their own food.
      (1) They get their food either from living or dead plants or animals.
      (2) Some fungi are colorless and others have a variety of colors.
4. Mosses
   a. Mosses have simple leaves, but no true roots and stems.
   b. The have root like and stem like parts.
   c. They have chlorophyll, are colored green, and can make their own food.
   d. They live mostly on land.
5. Ferns
   a. Ferns have true foots, stems, and leaves, and conducting tubes.

b. The leaves are compound.
c. Many ferns have stems underground, with only the leaves above the soil.

6. Green plants
   a. Green plants contain chlorophyll.
      (1) All food comes from green plants.
   b. Green plants have characteristics in common.
      (1) It has roots that take in a solution from the soil.
      (2) It gets the minerals and water it needs to make food from the soil.
   c. It has stem, leaves, flowers, fruits, and seeds, which are common only to green plants.
   d. Only green plants can make their own food.
7. Flowering and cone-bearing plants.
   a. These plants reproduce from seeds.
   b. All trees, shrubs, crop, plants and vegetables, garden and wild flowers, weeds and grasses are seed plants.
   c. Seed plants grow in soil and in fresh water.
   d. The smallest seed plants are tiny floating duckweeds which are about 1/4 inch across.
   e. The largest seed plants are the giant sequoias (or redwood trees) of California which can grow more than 300 feet tall.
8. Vascular Plants
   a. Vascular plants are those with tubes through which liquids are conducted.
9. Non-Vascular plants are those plants without tubes.

C. Life Activities of Plants

1. Photosynthesis
   a. Green plants are different from animals because they can make their own food.
   b. The making of food takes place mostly in the leaf of the plant.
   c. The leaf uses two materials to make food: water from the soil into the roots, up the stem and into the leaf.
   d. The water together with dissolved minerals passes from the soil into the roots, up the stem and into the leaf.
   e. The carbon dioxide in the air enters the leaf through tiny openings called stomata.
   f. Making a food by the plant is called photosyntheisi.
   g. In the leaf a green colored material called chlorophyll makes it possible for the plant to produce its food.
2. Transpiration
   a. A plant usually takes in more food than it needs.

b. This excess water passes through the leaf's stomata into the air as water vapor.
c. This evaporation of excess water from the plant is called transpiration.

3. Respiration
   a. Plants as well as animals need energy to live.
   b. They get this energy by using oxygen from the air.
   c. The process by which plants take in oxygen is called respiration.
   d. Respiration is a food using process.
   e. Respiration sets energy free.
   f. Respiration uses oxygen from the air and gives off carbon dioxide.
   g. Respiration goes on day and night.
4. Digestion
   a. Plants, like animals prepare their food so that it can be taken in by the cells.
   b. This process of preparing or getting food ready is called digestion.
   c. In plant digestion the food is broken up into very small pieces and then dissolved in the plant fluid which called sap.
   d. After it has been broken up and dissolved, the food is able to pass through the cell membranes into the cell where the food can be used.
   e. Digestion takes place mostly in the leaf.
5. Circulation, Assimilation and Growth
   a. When digested food is carried through tubes to the cells in all parts of the plants, this is called circulation.
   b. When food is changed into protoplasm, this process is called assimilation.
   c. Plants use the process of assimilation to grow in size.
6. Excretion
   a. Getting rid of waste products is called excretion.
   b. In photosynthesis the waste product is oxygen.
   c. In respiration the waste product is carbon dioxide.
   d. These waste products leave through the stomata of the leaf.
7. Reproduction
   a. The process by which plants are able to make new plants of the same kind is called reproduction.
   b. Some plants like potatoes will grow from pieces cut from them and planted.
      (1) Each peice must have an eye.

c. Other plants like strawberries send cut trailing ground stems, which take root to produce new plants.
d. Grafting of various kinds will result in the growth of new plants on old stems.
e. Some plants grow from seeds.
f. Some plants grow from spores.
g. Spores are cells produced by many plants.

8. Locomotion or tropism
a. Plants are able to bend or turn in different directions.
b. This movement helps the plant to get the things it need to live.
c. Light water, heat or gravity will affect the way a plant will move.
d. Plant movement is called tropism.

D. Conditions Necessary for Plant Growth

1. Air
a. Plants need air to grow.
(1) They use carbon dioxide from the air to make food.
(2) They use oxygen from the air to burn their food and set energy free.

2. Water
a. Plants need water to grow.
(1) The water contains dissolved minerals that plants need for making new plant parts and for growing taller.

3. Temperature
a. Plants need the right temperature to grow.
(1) Each kind of plant has a certain temperature at which it grows best.
(2) Plants may die if the temperature rises and falls too quickly.

4. Energy
a. Plants need the energy of sunlight to make food and to grow.

5. Soil
a. Land plants need soil to grow.
(1) Most plants grow best in loam, which i a mixture of sand, clay, and humus.
(2) Some plants grow best in sandy soil an others grow best in clay soil.

6. Chemicals
a. Plants need chemicals in the soil to grow b
b. Plants need nitrogen, phosphorus, potassium calcium, magnesium, and other chemical eleme

c. Some plants grow best when the soil is acid.

7. Cutting or Trimming
   a. The cutting or trimming of dead or dying branches from trees and shrubs will help keep the trees and shrubs healthy.
   b. This cutting and trimming is called pruning.

8. Climate and Seasons
   a. The climate plays an important part in the kinds and amounts of plants that will grow in a certain region.
   b. Plants grow all year round in the tropics.
   c. There are many plants in the tropics because of the high heat and heavy rainfall.
   d. Very few plants grow in the cold Arctic Circle and Antarctic regions.
   e. Not many plants grow in warm desert regions because of so little rainfall.

E. Conservation of Plants

1. Careful Planning
   a. Wise farmers add chemicals and natural fertilizers to the soil to maintain the food supply needed by growing plants.
   b. Lumber companies are cutting trees more wisely.
      (1) They are cutting down only part of the forest and planting new trees in their place.
      (2) They are moving weed trees, crowded trees, crooked trees, damaged trees, and diseased trees.
      (3) The U.S. Forest service fights and prevents forest fires.
         (a) It develops and recommends better lumber habits.
         (b) It finds ways of controlling harmful fungi and insects.
      (4) Education Programs have been developed to lessen man's carelessness in starting forest fires.
      (5) Some states are trying to protect their wild flowers by passing laws that forbid the picking of the flowers.

II. Animals

A. Structure of Animals

1. One celled animals
   a. Ameba
   b. Paramecium

c. Euglena
d. Spore-forming protozoans

2. Simple many-celled animals
a. Sponges
b. Hydra
c. Jellyfish
d. Sea anemone
e. Coral

3. Worms
a. Flatworms
b. Roundworms
c. Segmented worms

4. Spiny Animals
a. Starfish
b. Sea urchin
c. Sand dollar
d. Sea cucumber

5. Shellfish
a. Mollusk

6. Animals with jointed legs
a. Lobster
b. Crawfish
c. Crab
d. Spider
e. Millipedes
f. Centipede
g. Insects

7. Animals with soft bodies and hard shells
a. Snails
b. Garden slugs
c. Clams
d. Squids
e. Oysters
f. Octopus

B. Classification of Animals

1. Invertebrates
a. Animals with one cell
b. Sponges
c. Jellyfishes
d. Worms

2. Vertebrates
a. Fishes
b. Amphibians
c. Reptiles
d. Mammals
e. Birds

C. Life Activities of Animals

1. Respiration
2. Circulation

3. Digestion
4. Assimilation
5. Excretion
6. Growth
7. Motion
8. Reproduction
9. Adaptation
10. Defense Mechanism

D. Conditions Necessary for Animal Growth

1. Air
2. Food
3. Water
4. Energy

E. Conservation of Animals

II. Animals--Concepts to be Developed

A. Structure of Animals

1. One-celled Animals
   a. One-celled animals are the simplest animals known.
   b. One-celled animals can only be seen with a microscope.
   c. The protozoans are tiny one-celled animals.
   d. These animals can eat, breathe, move and reproduce just as larger animals.
   e. Examples of protozoans include the ameba, paramecium, euglena, and volvox.
   f. Some protozoans live in colonies, but each in the colony is an idependent animal.
2. Simple many-celled Animals
   a. Most animals are made up of many cells rather than single cells like the protozoans.
   b. The cells in these many-celled animals are not alike but are different and have special functions.
   c. Some very simple many-celled animals have their cells arranged in just two layers.
   d. Examples of many celled animals are the sponge, hydra, jellyfish, sea anemone and coral.
3. Worms
   a. Not all worms are the same.
   b. Scientists divide worms into three large groups: flatworms, round worms, and segmented worms.
      (1) Flatworms
         (a) Flatworms are the simplest of all the worms.

(b) Their bodies are flat and ribbon-like.
(c) The bodies are made up of only three layers of cells.
(d) Examples of flatworms are the planaria, malaria and tapeworms.

(2) Roundworms
(a) Roundworms have thin, round, smooth bodies that are not divided into rings or segments.
(b) They have a complete digestive system with a mouth at the front and an opening called the anus at the rear end.
(c) Examples of roundworms are the vinegar eel, hookworms, and hairworms.

(3) Segmented Worms
(a) Their bodies are divided into many rings or sections called segments.
(b) Segmented worms have many well developed organ systems.
(c) They have a digestive system.
(d) They have a circulatory system with blood and blood vessels.
(e) They have an excretory system with blood and blood vessels.
(f) They have nervous and reproductive systems.
(g) Examples of segmented worms are the earthworms rotifer and melicerta.

4. Animals with Spiny Skins
a. They have a hard shell-like kind of skeleton, which is on the outside of their bodies.
b. Almost all of them have some kind of spines on their bodies.
c. The parts of their bodies usually radiate out regularly like the spokes of a wheel.
d. Examples of spiny animals are the starfish, sea urchin, sand dollar and sea cucumber.

5. Shellfish
a. Shell fish are animals with soft bodies and hard shells.
b. These animals are not fish.
c. Shellfish are divided into three large sea groups: hatchet footed, belly footed, and head footed.
(1) Hatchet footed shellfish
(a) They live inside two shells that are connected by a muscular hinge which can open and close the shell.

(b) Examples of them are the clam, oyster, scallop, and mussel.

(2) Belly footed shellfish
(a) The belly footed shellfish has one shell or valve, which is usually shaped in a spiral.
(b) These include the snail, slug, periwinkle conch, and abalone.

(3) Head footed shellfish
(a) They have the same parts or organs as the other shellfish, but they are arranged differently.
(b) Its shell is not on the outside of its body.
(c) Examples of the head footed shellfish are the squid and the octopus.

6. Animals with Jointed Legs
a. They have an outside skelton made of a tough material called chitin, which covers their bodies and has joints that can bend.
b. The crayfish, lobster, shrimp, waterflea, sow bug, and pill bug are all members of this group.
c. The muscles of the body are attached to the inside of the skelton.
d. Their legs and the other parts that are attached to the body, all of which are called appendages, are also jointed and can bend.
(1) Crustaceans (lobster, crab, shrimp) Besides having the characteristics of all jointed leg animals, crustaceans have these special features.
(a) They have two pairs of feelers called antenna.
(b) Their outer skeleton has a chemical called lime in it.
(c) They all have two distinct body regions.
(d) Almost all of them have special breathing organs called gills.

(2) Insects
(a) Insects have three parts to their bodies.
(b) The three body parts are the head, thorax, and abdomen.
(c) They have one pair of feelers called antennae attached to their heads.
(d) They have three pairs of legs all attached to the torax.

(e) Most insects have one or two pairs of wings also attached to the thorax.
(f) Most adult insects have both simple eyes which are made up of just one lens, and compound eyes which are made up of many single lenses.
(g) They breathe through branching tubes, which are tiny outside openings.

7. Animals with soft bodies and hard shells.
   a. These animals have soft fleshy bodies with no segments.
   b. They have a protective shell made of lime.
   c. Because of this shell these animals are often called shellfish.
   d. They have a muscular foot and a special sheet of tissue called the mantel which produces the shell.
   e. The snail, garden slug, clam, squid, oyster, and octopus belong to this group.
8. Vertebrates
   a. All vertebrates have a central nerve cord.
   b. Most vertebrates have a backbone.
   c. Their skeletons are inside their bodies.
   d. They all have two pairs of limbs attached to their bodies.
   e. There are five important classes of vertebrates: fish, amphibians, reptiles, birds, and mammals.
      (1) Fish
         (a) Fish are cold-blooded.
         (b) They have bony skeletons and their bodies are covered with scales.
         (c) They breathe by gills and they have an air bladder that helps them rise or sink in the water.
      (2) Amphibians
         (a) Amphibians are cold-blooded.
         (b) When they are young they live under water and breathe by gills.
         (c) Later they change and develop lungs for breathing.
         (d) They have a smooth skin without scales.
         (e) Examples of amphibians are frogs, toad and salamander.
      (3) Reptiles
         (a) Reptiles are cold-blooded animals.
         (b) They breathe by lungs and usually have a rough, dry, thick, scaly skin.
         (c) Examples of reptiles include the snake, lizard, alligator, crocodile, and turtle.

(4) Bird
- (a) Birds are warm-blooded.
- (b) Their front limbs are called wing and they are covered with feather
- (c) Their legs are scaly.
- (d) Their skeleton is light, hollow a streamlined for flying.
- (e) They breathe with lungs.
- (f) Their bodies are covered with feathers.

(5) Mammals
- (a) Mammals are warm-blooded.
- (b) They breathe by lungs.
- (c) Their young are born alive.
- (d) All mammals have hair on their bodies.
- (e) All mammals have seven neck bones, but these bones are not the same size for all mammals.
- (f) They feed milk to their young.

B. Classification of Animals

1. Invertebrates
   a. Animals with one cell
      (1) The Ameba
      - (a) The ameba is the simplest protozoa
      - (b) It can be found in the slims on th bottom of ponds and rivers.
      - (c) It can be found on the surface of leaves of water plants.
      - (d) Under the microscope it looks like a blot of grayish jelly with no definite shape.
      - (e) The shape of the ameba keeps chang ing as it moves.
      - (f) The ameba eats tiny plants, such a algae and bacteria.
      - (g) The ameba reproduces by dividing into two equal parts forming two new cells.

      (2) The Paramecium
      - (a) The paramecium is a larger one-celled animal than the ameba.
      - (b) It can be found in quiet ponds whe a scum has formed on the surface.
      - (c) It has a definite shape, and looks like a slipper or the sole of a shoe
      - (d) The paramecium can move forward or backward and can spin from side to side like a top.

(e) The paramecium eats algae, bacteria, yeast and other protozoan.
(f) The paramecium reproduces like the ameba by splitting in two.

(3) The Euglena
(a) The euglena is especially interesting to scientist because it behaves both like a plant and an animal.
(b) It lives in fresh water ponds and streams.
(c) It has a shape like a pear with one end rounded and the other end pointed.
(d) It eats bacteria and other tiny bits of plants and animals.

b. Simple Many Celled Animals
(1) Sponges
(a) Most sponges live in the ocean, but there are also some freshwater sponges.
(b) Sponges may be colored white, red, orange, yellow, brown, black, purple, and green.
(c) A sponges body is a hollow tube with many pores or openings in it.
(d) Water is always flowing into and out of the hollow tube.
(e) Sponges eat tiny plants and animals.
(f) We use the skeleton part of the sponge for cleaning.
(g) Sponges can reproduce from cells called gametes.
(h) Sponges can also reproduce by a procell called budding.
(i) A bud develops near the base of the sponge and grows into a new sponge.

(2) The Jellyfish
(a) Jellyfish live only in seawater or salt water and most of them are transparent.
(b) Some jellyfish are very tiny whereas others can be as wide as seven feet across.
(c) The body of the jellyfish is shaped like an open umbrella or parchute.
(d) It eats small fish and other sea animals.
(1) These animals have poison in their long, winding arms.
(2) They sting small animals and use them for food.

(3) Animals in this group usually lay eggs.
(4) They reproduce by budding.

(3) Worms
(a) The flatworms
(1) Most flatworms lay eggs.
(2) Flukes and other worms cause disease.
(3) The flatworm is usually found under stones in ponds and streams.
(4) The tapeworm is the most well known parasite flatworm.
(5) As a parasite, it lives in and gets its food from an animal which is called its host.
(6) Man sometimes has a tape worm because he has eaten meat that has not been cooked thoroughly.
(b) Roundworm
(1) Some roundworms are free living (non-parasite).
(2) They live in the soil, fresh water or salt water.
(3) Free-living roundworms are very tiny and are harmless.
(4) Some roundworms cause disease.
(5) They usually reproduce by laying eggs.
(c) Segmented Worms
(1) Segmented worms can be found in fresh water, salt water or in the soil.
(2) The earthworm is a common segmented worm that lives in the soil.
(a) The earthworm has no respiratory system, but absorbs oxygen and gives off carbon dioxide through its thin skin, which must be kept moist.
(b) The earthworm lays a batch of fertilized eggs in the soil, which eventually hatch and becomes young earthworms.
(c) The earthworm eats dirts, digesting the decayed plant and animal matter from the dirt and eliminating the rest.

(d) Earthworms are valuable to man because they bore holes and loosen the soil so that air and water can help plant roots grow.

(4) Spiny Animals
- (a) Spiny animals live in the sea.
- (b) They reproduce by laying eggs mostly.
- (c) The starfish eats clams and oysters.
- (d) The starfish can crawl in any direction.
- (e) Starfish can grow new parts.
- (f) The starfish move about mostly at night.
- (g) If a starfish is chopped into three or four pieces and if each piece has at least one arm and also part of the center of the body, each piece may grow into a new starfish.

(5) Shellfish
- (a) They all live in the ocean, but the clam can be found in salt water and fresh water.
- (b) In the ocean the oyster and many kinds of clams do not move at all, but are attached to a rock or some other object.
- (c) The adult squid and octupus do not have shells.
- (d) The shells disappears as they grow. Clams, oysters, scallops, snails, and abolones are eaten by man.
- (e) The inner surface of clam and oyster shells are used to make buttons and mother-of-pearl.
- (f) Shells are also ground up and sold to farmers for chicken feed because the lime in the shells is needed by the chicken for making eggshells.

c. Animals with jointed legs
- (a) There are many kinds of animals that have jointed legs.
- (b) They reproduce by laying eggs.
- (c) Some live in sea water.
- (d) Others live in fresh water.
- (e) Some live on land.
  - (1) The crayfish
    - (a) The crayfish is a fresh water animal, living at the bottom of lakes, ponds and streams.

(b) It eats plants and any live or dead animal material it can grasp.
(c) The crayfish breeds just once a year.
(d) The crayfish breathes through a special feathery organ called a gill.

(2) The lobster
(a) The lobster is built like the crayfish except the lobster lives in salt water and is much larger.

(3) The Crab
(a) The body of a crab is wide and round rather than long and narrow like the crayfish and the lobster.
(b) Crabs move by walking sideways.

(4) The shrimp
(a) The shrimp has five pairs of walking legs and a large muscular abdomen.
(b) The shrimp can swim very fast, moving backward like the crayfish and lobster.
(c) When the shrimp is frightened it buries itself in the sand, with only its antenna and eyes exposed.
(d) Crayfish, lobster, crab, and shrimps are widely used for food.
(e) They are also useful as scavengers because they eat dead animals.

(5) Insects
(a) Insects make up the largest class in the animal kingdom.
(b) All insects develop from eggs.
(c) All insects pass through stages of development.
(d) Insects like the grasshopper, cricket, dragonfly, true bug, aphid and termite pass through these stages.
(e) These stages are egg, nymph and adult.
(f) Insects like the butterfly, mot bee, ant, beetle, fly and mos- pass through four stages of development.
(g) These stages are egg, larva, pupa, and adult.

(h) Some insects live together in large groups or communities called colonies.
(i) Social insects live together in large groups or communities called colonies.
(j) Bees, ants, and wasps are social insects.
(k) Many insects have colors or appearances that protect them from their enemies.
(l) Some insects are harmful to man.
(m) Some insects are helpful to man.

6. Vertebrates
   a. Fish
      (1) Fish live only in water.
      (2) Most fish are found in the ocean, but there are many fish in lakes, ponds, rivers, and brooks.
      (3) Some fish live near the surface of the water, and others live closer to the bottom.
      (4) Some fish live alone whereas others travel in large groups called schools.
      (5) There are three parts to the body of a fish; a head, trunk, and tail.
      (6) Fish breathe with gills. Most fish breathe by opening and closing their mouths.
      (7) Fish swim by moving its fins and tail.
      (8) Some fish eat only algae and other water plants.
      (9) Some fish eat animals, such as insects. worms, crayfish, snails and other fish.
      (10) Fish that other animals have many sharp teeth.
      (11) Most fish develop from eggs that the female lay outside her body.
   b. Amphibians
      (1) Their bodies are covered with a thin loose skin that is usually moist.
      (2) Their feet are often webbed and they have no claws.
      (3) Their eggs are fertilized outside the female's body. Young amphibians live in the water but adult amphibians live mostly on land.
   c. Reptiles
      (1) Reptiles have their own special characteristics.

(2) Those reptiles with feet have claws on their toes.
(3) Today there are only a few different kinds of reptiles that exist.
(4) Some turtles live in salt water, others live in fresh water, and still others live on land.
(5) The eggs have soft shells.

d. Birds
(1) Birds are all different sizes.
(2) Birds stand and perch on two legs.
(3) They have a horny beak and no teeth in their mouth.
(4) The smallest bird is the hummingbird.
(5) The largest bird is the ostrich.
(6) Most birds have a voice and some birds can sing beautifuly.
(7) Many birds migrate, or move from one home to another during the spring and fall of the year.
(8) The two main foods of birds are insects or seeds.
(9) Birds are hatched from eggs.
(10) Birds builds nests.
(11) Different kinds of birds build their nests in their own way.
(12) Birds use such material as earth, clay, twigs, grass, stems, leaves, bark, hair, feathers, and even string to build their nests.
(13) Birds have different beaks, wings, tails, and feet.
(14) These special forms, structure and functions are called adaptations.
(15) Birds have different kinds of feet, depending upon whether they are fitted or adapted for perching; climbing, swimming, wading, or grasping.
(16) Birds have beaks that are especially fitted for gathering their food and eating.
(17) The shape of the bird's wing is fitted or adapted for the kind of flying that a bird does.
(18) Birds can be helpful and harmful.

e. Mammals
(1) Mammals differ in size.
(2) The largest mammal is the blue whale.
(3) The mammals live in different places all over the world.
(4) Mammals eat plants and other animals.

(5) Bats are mammals that fly.
(6) The elephant is the only trunk-nosed animal alive today.
(7) Some mammals are helpful to man.
(8) Some mammals help man by eating pests.
(9) Some mammals help by doing work for us.
(10) Some mammals supply us with food.
(11) Some animals give us clothing.
(12) Some mammals are harmful to man

C. Life Activities of Animals

1. All animals grow, change, reproduce, breathe and take in food.
2. Animals need air, food and water.
3. Animals get oxygen from the air.
4. Each animal has its own way of getting its food.
5. All animals need energy.
6. Reproduction is the process by which animals bring forth their young.
7. Adaptation helps living thing to stay alive.
8. Living things grow and develop in different environments.

LEVEL 3

SCIENCE

Area II: Physical Science

I. Structure of Matter

A. Matter

1. Forms of
   a. Solid
   b. Liquid
   c. Gas
2. Substances
   a. Molecules
   b. Atoms
   c. Elements
   d. Compounds
   e. Mixture
   f. Solution
3. Changes of Matter
   a. Physical Change
   b. Chemical Change

B. Energy

1. Kinds of Energy
   a. Kinetic Energy
   b. Potential Energy
2. Forms of Energy
   a. Heat
   b. Light
   c. Electrical
   d. Sound

C. Machines

1. What machines do
2. Six Simple Machines
   a. Lever
   b. Wheel and Axle
   c. Pulley
   d. Inclined Plane
   e. Wedge
   f. Screw

D. Magnetism and Electricity

CONCEPTS TO BE DEVELOPED

I. Structure of Matter

A. Matter

1. Matter is anything that takes up, or occupies space and has weight.
   a. Matter consists of atoms and molecules.
   b. Air, water, wood, stones and metals are examples of matter.
   c. Man, plants, animals, stars and the planets are also examples of matter.
2. Forms of matter
   Matter is found in three forms, or states and these states are called solid, liquid, and gas.
   a. Solid
      (1) A solid has a definite size and shape.
      (2) Wood, iron, glass, ice, rubber, wool and butter are examples of solids.
      (3) Solids can be hard or soft.
   b. Liquid
      (1) A liquid has a definite size, but it does not have a definite shape.
      Water, milk, alcohol, oil and gasoline are examples of liquids.
      A liquid's shape depends upon the shape of the container into which it is poured.
   c. Gas
      (1) A gas does not have either a definite size or a definite shape.
      Air, oxygen, carbon dioxide and ammonia are examples of gases.
      When a gas is poured into a container, it spreads out until it has the same size as the container and also takes the shape of the container.
3. Matter can be changed from one state to another by heating or cooling.
   a. When liquid water is cooled until it freezes it becomes solid ice.
   b. When liquid water is heated until it boils it becomes a gas called steam.
4. The science that deals with the different kinds of matter around us, of what they are made, and the changes that happen to them is called chemistry.

B. Substances
   a. A material that is made of only one particular kind of matter is called a pure substance.
   b. Water, salt, sugar, silver and oxygen are examples of pure substances.
   c. Anything that is a liquid, solid, or gas is a substances.
   d. All substances are made up of tiny particles called molecules.
      (1) Molecules
         (a) A molecule is the smallest particle of a substance that still will be that substance, and still will have all the properties of that substance.
         (b) All the molecules of a substance are alike, but the molecules of one substance are different from the molecules of another substance.
         (c) Molecules are always moving rapidly, striking other molecules and then bouncing off in different directions.
      (2) Atoms
         (a) Molecules are made up of smaller particles called atoms.
         (b) In some cases a molecule is made up of just one atom.
         (c) In most cases a molecule is made up of more that one atom.
         (d) A molecule of oxygen is made up of two atoms of oxygen that are close together.
         (e) A molecule of water is made up of two atoms of hydrogen and one atom of oxygen. The formula for water is H_2O.
      (3) Element
         (a) There are 92 different kinds of atoms found on earth.
         (b) Each different kind of atom is called an element.
         (c) Some examples of elements are oxygen, hydrogen, and carbon.
      (4) Compounds
         (a) A compound is a substance that is made up of two or more elements that have combined chemically.
         (b) A chemical change takes place when a compound is formed.
         (c) Every compound has its own special properties, and in this way it is possible to tell one compound from another.

(5) Mixture
(a) A mixture is a substance made up of two or more elements or compounds that have combined in such a way that each element or compound has not lost its own special physical and chemical properties.
(b) The air we breathe is a good example of a mixture.
(c) The substances in a mixture usually can be separated very simply.
(d) Solids may be combined to form a mixture.
(e) A solid and a liquid may be combined to form a mixture.

(6) Solution
(a) A solution is the mixture formed when the molecules of one substance dissolve among the molecules of another.
(b) Sugar dissolved in water forms a solution.
By testing the water, we can tell there is sugar in the water.
The molecules of sugar have spread out and moved between the molecules of water.

3. Changes of Matter
a. Chemical Change
(1) A chemical change occurs when the molecules of a substance are broken down into their components.
(2) In a chemical change the molecules of the substance change.
(3) Burning is a chemical change.
b. Physical Change
(1) Physical change is a change that takes place in a substance without changing the molecules.
(2) A change is physical when the molecules are not broken up.
(3) When substances freeze, melt, form crystals, and evaporate, they are called physical changes.

B. Energy

1. Energy is the ability of matter to move other matter or to produce a chemical change in other matter.
2. Energy is also the name given to the ability to do work.
3. There are two kinds of energy: kinetic energy and potential energy.

a. Kinetic Energy
   (1) Kinetic energy is the energy that a body has because it is moving.
   (2) Kinetic energy, therefore, is the energy of motion and is an action energy.

b. Potential Energy
   (1) Potential energy is the energy that a body has because of its position and condition.
   (2) Potential energy is stored up energy. It will not do any work until it is released or set free.
   (3) A rock held over a cliff has potential energy because it is in a position to do work when it is released.
   (4) Water at the top of a dam, or waterfall also has potential energy because of its position.
   (5) When potential energy is set free, it is changed to kinetic energy. Energy can change from one form to another.

3. Forms of Energy
   a. There are many forms of energy
   b. Scientists divide these forms into six main groups.
      (1) Mechanical Energy
         (a) Mechanical energy is the energy produced from all kinds of machines.
         (b) All moving bodies produce mechanical energy.
         (c) Mechanical energy is the kind we see most often around us.
      (2) Heat Energy
         (a) Heat energy is the energy produced by the moving molecules in a substance
         (b) The faster the molecules move, the more heat energy the substance has and the hotter the substance gets.
         (c) The sun is the Earth's chief source of radiant energy.
         (d) Light energy from the sun can be changed to heat energy.
         (e) Heat energy may be used to do work.
         (f) Heat energy heats our homes, dries our clothes, cooks our food, and runs power plants.
      (3) Electrical Energy
         (a) Electrical energy is the energy produced by electrons moving through a substance.
         (b) A stream of these electrons moving through a substance is called an electron current.

(c) Electric energy lights our homes, runs motors, and makes our telephones, radios and television sets operate.

(4) Sound Energy
(a) Sound energy travels in waves.
(b) It is produced when matter moves back and forth, or vibrates rapidly.
(c) Another kind of wave energy is radiant energy.
(d) These forms include light rays, X-rays, radio waves, cosmic rays and radiant heat.

(5) Chemical Energy
(a) Chemical energy is a form of potential energy because the energy is stored in substances.
(b) This chemical energy is released when a chemical reaction takes place and new substances are formed.

C. Machines

1. What Machines Are
a. Machines are devices that help make work easier.
b. A force must be used to make a machine work.
c. A force is a push or pull.
d. A force may be produced by electricity steam, gasoline, wind, earth's gravity, falling water, sun's rays, springs and weights and muscles.

2. Six simple machine
a. Lever
(1) A lever is a rigid bar, straight or curved, that rest on a fixed point called a fulcrum.
(2) Some examples of levers are wrench, knife, scissors, hammer, rake, shovel, bicycle pedal, pliers and handle bars of tricycles.

b. Wheel and Axle
(1) A simple wheel and axle machine is one where a large wheel is connected to a smaller wheel or shaft called an axle.
(2) Wheels need axles before they will work.
(3) Wheels with axles go around when they are pushed or pulled.
(4) When either the wheel or the axle turns, the other part also turns.
(5) One complete turn of the wheel produces one complete turn of the axle.
(6) If the wheel turns but the axle does not, it is not a wheel and axle machine.
(7) The wheel does not have to be a complete wheel. Instead there may be a crank that turns. When the crank is turned it

(8) The wheel is one of man's greatest inventions. Almost all important machines have several wheels in them to make them work, from typewriter to steam shovels and elevators.

(9) Examples of wheel and axle machines containing complete wheels include the automobile steering wheel, gear wheels of the bicycle, doorknob, and screwdriver.

(10) Examples of wheel and axle machines containing a crank instead of a complete wheel can be found in the pencil sharpener, meat grinder, and egg beater.

c. The Pulley

(1) A pulley is a wheel that turns around a stationary axle.

(a) Usually there is a groove in the rim of the pulley so that the rope around the pulley will not slip off.

(b) Sometimes two or more wheels are placed side by side on the same axle.

(c) Pulleys are just wheels on axles, but they have grooves in the rims.

(2) There are two types of pulleys: The fixed pulley and the movable pulley.

(3) The fixed pulley does not move, and is fastened to one spot.

(a) It helps us only by changing the direction of the force.

(b) It gives no gain in force, speed or distance.

(c) Fixed pulleys are used with clothes lines, flag poles, and Venetian blinds

(d) The fixed pulley acts like a turning first class lever, with the fulcrum at the center of the axle, the effort at one rim of the pulley wheel, and the resistance at the other rim.

(4) The movable pulley moves along the ropes.

(a) It helps us gain force but we lose in distance.

(b) In a single movable pulley, two sections of the rope support the pulley so that one half as much effort is needed to raise a resistance.

(c) A movable pulley does not change the direction of the force.

d. The Inclined Plane

(1) An inclined plane is slanting surface that connects one level to a higher level.

(2) An inclined plane is a simple machine that gives us a gain in force.

(a) By moving an object up an inclined plane we use less force in getting the object up to a higher level than if we had to lift the object directly from the lower level to the higher level.

(3) The longer the inclined plane, the more gradual the slope becomes, and the less force will be found by dividing the resistance by the effort

(4) Some examples of inclined planes are sliding boards, steps, roads built over mountain sides, some bridges, roller coasters.

e. The Wedge

(1) A wedge is a simple machine that is used either to spread an object apart or to raise an object.

(2) A wedge has a sloping or slanting side just like an inclined plane.

(3) With the wedge the incline moves into or under the object.

f. The Screw

(1) The screw is an inclined plane that winds around and around in a spiral.

(2) The spiral ridge of a screw is called the thread.

(3) Examples of the screw are found in the wood screw, bolt, caps of jars and bottles, monkey wrench.

D. Magnetism and Electricity

1. Magnetism

a. Magnets

(1) Magnets are materials that will pick up or attract materials made of iron, steel, cobalt, and nickel.

(2) Such materials are called magnetic materials.

b. The Law of Magnetic Attraction

(1) The force of a magnet is strongest at its ends, which are called poles.

(2) A man-made magnet always has two poles: a north-seeking pole and a south-seeking pole.

c. The Magnetic Field

(1) The lines of force that surround a magnet is called a magnetic field.
The space around a magnet also can act like a magnet.
Lines of force surround a magnet.

2. The Force of a Magnet
   a. The force of a magnet can pass through many materials.
   b. A magnet can attract magnetic materials without thouching them.
   c. Like magnetic fields repel.
   d. Unlike magnetic fields attract.
   e. The earth behaves as a magnet.
   f. Magnets can be used to pick up pins and needles.
   g. Magnets are used in electric motors and generators.
   h. Magnets are used to keep cabinet and refrigerator doors closed.
   i. Magnets are used in compasses and in many toys and games.
3. Electricity
   a. Electricity can be carried by a wire.
   b. Switches are useful in turning lights "on" and "off".
   c. Insulation is necessary to keep electrical wires from short circuiting.
   d. Doorbells are rung by switches.
   e. Electromagnets can be made.
   f. Scientist do not know exactly what electricity is.
   g. The word electricity is used to describe a flow of electrons.
   h. Lightening is a hugh electric spark produced by static electricity.

LEVEL 3

SCIENCE

Area III: Earth and Space Science

I. The Sun

A. Characteristics of the Sun

1. A star
2. Distance
3. Movement
4. Color
5. Importance to mer.

B. Effects of the Sun on the Earth

1. Sun and the year
2. Day and night
   a. Sunrise and sunset
3. Seasons
4. Source of energy
5. Weather

II. The Solar System

A. The Nine Planets

1. Mercury
2. Venus
3. Earth
4. Mars
5. Jupiter
6. Saturn
7. Uranus
8. Neptune
9. Pluto

B. Comets

C. Meteors and Meteorites

D. Asteroids and Planetoids

III. The Moon

A. Characterists of the Moon

1. Size
2. Shape
3. Atmosphere
4. Temperature
5. Movement
6. Phases
7. Tides
8. Eclipses

IV. Stars

A. Kinds

1. Dwarfs
2. Giants
3. Supergaints

B. Color

C. Shape

D. Brightness

E. Constellations

F. Galaxies

Area: Astronomical and Space Science

I. The Sun

A. Characteristics of the sun

1. The sun is a hot bright star.
2. The sun is much larger than the earth.
3. The sun is 93,000,000 miles from the earth.
4. The sun rotates counterclockwise.
5. The sun rotates about once every 27 days.
6. The sun is not a solid body, but it is a huge ball of very hot gases.
7. Our sun is classified as a yellow star.
8. The sun gives us heat, light, and energy.
9. Without the sun's light nothing could live.

B. Effects of the sun on the earth

1. The sun causes the year on earth.
   a. The time needed for the earth to make one complete turn or revolution around the sun is called the earth's year.
   b. The earth's year is 365 1/4 days.
2. The sun causes day and night on earth.
   a. The earth gets its light from the sun.
   b. Only one-half of the earth can be lighted at one time by the sun.
   c. When one-half is lighted by the sun, the other half is in darkness.
   d. The half that is lighted by the sun has daytime.
   e. The half that is turned away from the sun is in darkness or has nighttime.
3. The sun causes the seasons on Earth.
   a. Because of the tilt of the earth and because of the earth's revolution around the sun, the earth has different seasons of the year.
4. The sun is a source of energy for the earth.
   a. The sun sends out radiant energy in all directions.
   b. Only a very small part of the sun's energy travels to the earth.
   c. This small part heats the earth and gives it light.
   d. The sun's energy also makes it possible for green plants to make food.

e. Without the energy of sunlight the earth would be frozen and lifeless.

5. The sun causes the weather.
   a. The sun does not heat every part of the earth equally.
   b. This unequal heating causes movements of great masses of air.
   c. The sun causes water to evaporate and become water vapor.
   d. The combination of moving air masses, difference in air pressure, and changing amounts of water vapor in the air make the weather.

II. The Solar System

A. Planets

1. Any very large body that moves around the sun is called a planet.
2. The path that a planet follows around the sun is called its orbit.
3. The sun and the nine planets moving around it are part of the solar system.
4. Planets give off no light of their own but shine by reflected light.
5. Each of the planets is different.
6. The heavenly bodies that move around the sun are called satellites.
7. A satellite is any heavenly body that travels around another heavenly body.
8. The word planet means wanderer.
9. Planets are much smaller than the sun and most of the other stars.
10. Planets are not stars, because they shine by reflected light.
11. The planets spin like a top or rotate as they travel around the sun.
12. They rotate around an imaginary line called an axis.
13. The time needed for a planet to make one complete rotation on its axis is called the planet's day.
14. Many of the planets have their own smaller satellites that revolve around them.
    a. The satellites of the planets are called moons.
    b. Astronomers have discovered 31 moons.
       (1) Earth has one moon.
       (2) Mars has two moons.
       (3) Jupiter has twelve moons.
       (4) Saturn has ten moons.

(5) Uranus has five moons.
(6) Neptune has two moons.

15. The planets are all alike in some ways.
    a. They are all satellites of the sun.
    b. They all revolve in a counterclockwise direction from west to east.
    c. They all rotate on their axis.
    d. They all get energy from the sun.

16. The names of the planets in order of their increasing distance from the Sun, are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto.
    a. Mercury
        (1) Mercury is the smallest of the nine planets.
        (2) Mercury is the planet nearest the sun, and it is about 36 million miles away from the sun.
        (3) Mercury moves around the sun once every 88 days.
        (4) The same side of Mercury always faces the sun.
        (5) The other side is always in darkness.
        (6) Sometimes Mercury can be seen.
            (a) It can be seen near the horizon shortly after sunset or just before sunrise.
        (7) The side of Mercury facing the sun is very hot (700°F).
        (8) The side away from the sun is very cold (460°below zero).
        (9) Mercury has no moons.
        (10) Mercury has no oxygen or water, and very little atmosphere of any kind.
        (11) Mercury is sometimes called an evening or morning star even though it is really a planet.
    b. Venus
        (1) Venus is the next closest planet to the sun, and it is about 67 million miles from the sun.
        (2) Venus is the brightest of all planets.
        (3) Venus moves around the sun once every 225 days.
        (4) Venus is about as big as earth, with a diameter of about 7,600 miles.
        (5) Venus has an atmosphere.
        (6) The surface temperature is about 585°F.
        (7) Venus is surrounded by thick clouds.
    c. Earth
        (1) Earth is the next planet after Venus, and it is about 93 million miles from the sun.

(2) It revolves around the sun once every 365 1/4 days.
(3) It rotates on its axis once every 24 hours.
(4) At its equator earth rotates at a speed of about 100 miles an hour.
(5) Earth has one moon.
(6) Earth is the only planet where the temperature of its surface is usually between the boiling and freezing point of water.
(7) It is probably the only planet where life as we know it exists.
(8) Our planet seems to be just the right distance from the sun.
(9) The earth gets enough of the sun's energy to warm the soil and the air.

d. Mars
(1) Mars is the next planet after earth and it is about 140 million miles away from the sun.
(2) It is the next closest planet to earth.
(3) Mars is a small planet.
(a) It is only half as big as earth.
(4) Its day is about the same length as ours
(5) It revolves around the sun once every 687 days.
(6) It rotates on its axis once every 24 1/2 hours as its day is just about the same as earth's day.
(7) Mars is more like earth than any other planet.
(8) We can sometimes see Mars.
(9) It is bright red.
(10) It has seasons, land, and water.
(11) Two little moons orbit around Mars.
(12) Scientists tell us that Mars has a thin layer of atmosphere.
(13) Scientists have long dreamed of exploring Mars.

e. Jupiter
(1) The biggest planet of all is Jupiter.
(2) It has an atmosphere of poisonous gases.
(3) The days as well as the nights are freez
(4) It revolves around the sun once every 1 years.
(5) Jupiter has 12 moons.
(6) Jupiter has a red spot on it that change in brightness from time to time.

f. Saturn
(1) Saturn is about 890 million miles away from the sun.

(2) It revolves once around the sun in about 29 1/2 years.
(3) It rotates on its axis once every 10 hours.
(4) Saturn has ten moons.
(5) Saturn is lovely to look at through a telescope.
(6) Saturn is surrounded by three broad but thin rings that revolve at different speeds around its equator.
(7) Saturn has no water or oxygen.
(8) It is very cold on Saturn.

g. Uranus
(1) Uranus revolves once around the sun in about 84 years.
(2) It rotates on its axis once in about 10 hours.
(3) It has five moons.
(4) Uranus is far, far from the sun.
(5) It is very cold on Uranus.
(6) The planet has atmosphere that is probab made of poisonous gas.

h. Neptune
(1) Neptune is even farther from the sun and even colder than Uranus.
(2) It takes Neptune about 165 of our years to travel once around the sun.
(3) Neptune rotates on its axis once in abo 8 hours.
(4) Neptune, like Mars, has two moons.
(5) Scientists call Neptune and Uranus the twin planets.
(6) They both are about the same size.
(7) They both are made up of a solid core.
(8) Neptune can be seen only through a tele scope.
(9) Scientists or Astronomers do not yet kn how long it takes Neptune to rotate onc on its axis or how many moons it has.

i. Pluto
(1) Pluto is the last and most recently dis covered planet in the solar system.
(2) It is about 3,700 million miles from th sun.
(3) It revolves once around the sun in abou 248 years.
(4) It is the coldest planet.
(5) Very little is known about the atmosphe on Pluto.

B. Comets

1. Comets are bodies that revolve around the sun in long oval-shaped orbits.
2. The sun is at one far end of the comet's orbit.
3. The comet has a head and a tail.
4. The comets head is made up of small rocks and dust mixed with frozen gases.
5. The comet does not have a tail as it nears the sun.
6. Some comets return to the earth.
   a. Enicke's comet returns every 3 1/2 years.
   b. Halley's comet returns every 76 years.
7. Scientists do not know exactly how comets were formed.

C. Meteors and Meteorites

1. Meteors are rocks in space through which the earth passes as it travels around the sun.
2. Billions of meteors enter the earth's atmosphere each year.
3. Meteors make a bright streak of light as they travel through the air.
4. Those meteors that strike the earth's surface before they burn up are called meteorites.
5. If meteorites are large enough, they can form a large crater when they strike the earth.
6. Meteor Crater in Arizona and Chubb Crater in Canada were probably made by meteorites.
7. One meteor, weighing about 35 tons, is in the American Museum of Natural History in New York City and was founded by Admiral Peary in Greenland in 1894.
8. The meteors that reach Earth seem to come from two different sources.
   a. Most of them are probably small bits of rocks that are traveling through space.
   b. Some also seem to come from comets; because swarms of meteors, called meteor showers, are seen every time the earth crosses the path of a comet.

III. The Moon

A. Characteristics of the moon.

1. The moon is a very large ball of rocky material that revolves around the earth.
2. The moon is our closest Neighbor in space.
3. The moon is about 240,000 miles away.
4. The moon looks larger than the sun or other stars, because it is much closer to us here on the earth.

5. The moon is much smaller than the earth.
6. The moon shines because it reflects light from the sun.
7. The way the moon looks to us at any time as it changes is what we call the phase of the moon.
8. The moon is about 2,160 miles in diameter.
9. The moon is about 1/4 the size of the earth.
10. The surface of the moon is very mountainous and rough.
11. The moon has no atmosphere.
12. The moon has no water or water vapor.
13. The temperature on the surface of the moon varies greatly, depending upon whether it is day or night.
    a. During the day the temperature is very hot (250°F).
    b. At night the temperature is very cold (200° below zero F).
14. The surface of the moon is made up of smooth plains, jagged mountains, and craters.
15. The moon travels around the earth in a path or orbit that is shaped like an ellipse.
16. The moon revolves around the earth in a counter-clockwise direction from the west to the east.

B. Phases of the Moon

1. The change in the amount of lighted surface that we see on the moon are called phases of the moon.
2. When we cannot see the moon at all, this phase is called the new moon.
3. When a little of the lighted side of the moon can be seen on the earths, it is in its crescent phase.
4. About one week after the new moon one-half of the lighted side of the moon can be seen on earth.
    a. This phase is called the first quarter or half moon.
5. A few days later, almost all of the moon's lighted side can be seen; and this phase is called the gibbous moon.
6. About two weeks after the new moon, all of the lighted side of the moon can be seen; and this phase is called the full moon.
7. About one week after the full moon, only one half of the moon's lighted side can be seen on the earth; and this phase is called the last quarter or half moon.
8. Men have explored the moon.

C. Tides

1. The moon causes tides.
2. Tides are the rise and fall of the oceans caused by the moon's pull of gravity on earth.

D. Eclipses

1. At certain times the moon passes between the earth and the sun in such a way that people on earth cannot see the sun.
   a. This is called an eclipse of the sun.
   b. An eclipse of the sun happens only when there is a new moon--where the moon is between the earth and the sun.

IV. Stars

A. Kinds of stars

1. Stars are suns in space and they produce their own light.
2. Stars are not in a fixed position, but they are moving rapidly through space in all directions.
3. Stars differ in size.
   a. Small stars, like the sun, are called dwarfs
   b. Large stars are called giants.
   c. Tremendously large stars are called super-giants.
4. Stars differ in color depending upon their age and temperature.
   a. The youngest stars are blue-white or white.
   b. Yellow stars have surface temperatures of about 10,000°F.
   c. Orange stars have surface temperatures of about 6,000 to 8,000 degrees F.
   d. Red stars are the oldest stars, and they have surface temperatures of about 3,000 to 6,000
5. The brightness of stars depends upon its temperat size and distance from the earth.
6. Stars are not pointed but have a round shape.
7. Although stars seem to twinkle, they really do n
   a. The stars are so far away that they are only small dots of light when we look up at them.
   b. Movements of the earth's air make the thin rays of light from these distant stars move back and forth or twinkle.

V. Constellations

A. Long ago astronomers divided the stars into groups. These grouping of stars are called constellations.

B. The constellations were named after gods, legendary heroes and heroines, and animals or objects.

1. The North Star, called Polaris, is so close to the celestial north pole that it does no seem to move at all.
2. Polaris is the last star in the handle of the Little Dipper, which is part of the constellation called the Little Bear.

C. Stars, like the sun, are huge, hot balls of gas that are glowing brightly.

D. Stars are so far away that they look like tiny points of light.

F. Star pictures are groups of stars called constellation

1. The most important group in the northern sky is called the Big Dipper.
2. The Big Dipper is important because it helps us to find the North Star.
3. Another star picture you can see in the night sky is that of the Big and Little Bears.
4. Some other constellations are Orion, the Mighty Hunter, the Scorpion, and Leo, the Lion.

VI. Galaxies

A. A galaxy is a large collection of stars, dust, and gas all held together in a group by the pull of gravity.

B. The sun and the solar system are part of a galaxy call the Galaxy.

C. Part of the galaxy call the Milky Way can be seen at night.

LEVEL 3

SCIENCE

Area IV: Earth Science

I. The Earth

A. Composition

1. Land
2. Air
3. Water

B. Layers of the Earth

1. Crust
2. Mantle
3. Core

C. Kinds of Land

1. Mountains
2. Plains
3. Rivers
4. Valleys
5. Canyons
6. Deserts
7. Swamps
8. Jungle
9. Cold Lands
10. Oceans
11. Lakes

D. Rocks

1. Kinds of Rocks
   a. Igneous
   b. Sedimentary
   c. Metamorphic

E. Minerals

1. Identification of Minerals
2. Conservation of Minerals

II. Forces That Shape and Change the Earth's Surface

A. Weathering

B. Erosion by Water

C. Erosion by Ice

D. Erosion by Wind

III. Soil

A. How Soil is Formed

B. Kinds of Soil

C. Soil Erosion

D. Enriching the Soil

IV. Weather

Area IV: Earth Science

I. The Earth

A. The earth is made up of land, air, and water.

B. The water makes up 7/10 of the earth's surface.

C. The land makes up 3/10 of the earth's surface.

D. There is more water than land on our earth.

E. Composition

1. Air
   a. Air is all around us.
   b. The blanket of air that surrounds the earth is called the atmosphere.
   c. Air usually cannot be seen.
   d. Sometimes we can feel the air.
   e. We can cause air to move.
   f. Air can move from one place to another place.
   g. Air takes up space.
   h. Air has weight.
   i. All the air together is called the atmosphere.
   j. The atmosphere has weight.
   k. The weight of the atmosphere is called air pressure.
   l. Air pressure can be measured.
   m. The air pressure changes when the weather starts to change.
   n. Air pressure of the air can be used to change things.
   o. The pressure of the air can be used to hold things up.
   p. There are many air spaces in soil.
   q. Things that have enough air in them will float.
   r. There are smoke, dust, and water in the soil.
   s. Air expands when heated.
   t. Warm air rises.
   u. Cold air sinks.
2. Water
   a. The water in oceans, seas, lakes, and rivers make up a part of the earth.

b. The water area is called the hydrosphere.
c. The hydrosphere has weight.
d. The water area provides us with water to drink.
e. It provided rain for growing crops.
f. Waterways are provided for trade.
g. Waterfalls give us power.

3. Land
a. The land area is called the lithosphere.
b. The land area make up the continents and islands as well as the bottom of the oceans.
c. Men have made permanent homes on the lithosphere.

F. Layers of the earth.

1. The earth is made up of three seperate layers; the crust, the mantle, and the core.
2. The crust is a very thin layer or rock which is mostly granite and basalt.
3. The crust is the outer shell.
4. The mantle is beneath the earth's crust and is the middle layer.
5. The core is beneath the earth's mantle.
6. The core is the third layer.

G. Kinds of Land

1. Mountains
a. Mountains are high elevations of land.
b. Mountains may have snow or trees and plants growing on them.
c. The highest mountain in Mount Everest near India.

2. Plains
a. The flat lowlands are the plains.
b. On these fertile lands, wheat, cotton, corn, rice, and other crops are grown.
c. Some plains land can be found in Kansas, South America, and the Netherlands.

3. Rivers, Valleys, and Canyons
a. Deep valleys with steep slopes are called canyons.
b. Valleys are low land lying between hills or mountains.
c. River is a large natural stream of water flowing into oceans and lakes.
d. The mightiest canyon of them all is the Grand Canyon in Arizona.

e. This Canyon is a mile deep.

4. Deserts, Swamps, and Jungles
   a. Hot, dry, and sandy parts of the world are called deserts.
   b. The Sahara Desert is in North Africa.
   c. Hot, wet land that is thickly covered with trees and vines are jungles.
   d. Wet, spongy lands are swamps.
5. Cold Lands
   a. Some land far to the north and south are cold the year round.
   b. The Arctic and Anartic regions are always covered with ice and snow.
   c. Summers come for only a short time in these regions.

H. Rocks

1. The solid part of the earth is made up of hard material called rock.
2. The three kinds of rocks are igneous, sedimentary, and metamorphic.
   a. Igneous
      (1) Igneous means formed from fire.
      (2) Igneous rocks are rocks formed from molten material in or below the earth's crust.
      (3) Some examples of igneous rocks are granite, basalt, and pumice.
   b. Sedimentary
      (1) Sedimentary rocks were formed from different sediments that gathered for several thousand years.
      (2) These sediments were cemented tightly together.
      (3) Kinds of sediment that forms sedimentary rock includes sand, clay, silt, pebbles, and gravel.
         (a) Streams and rivers carry these sediments to lakes or oceans, where they settle to the bottom.
         (b) Layers are formed at the bottom of oceans, which slowly change into rock.
   c. Metamorphic rocks are igneous and sedimentary rocks that were buried deeply under other rocks.
      (1) These rocks are then changed by heat and pressure.
      (2) Metamorphic means changed in form.

(3) Some of the more common metamorphic rocks are gneiss, quartzite, slate, marble, and hard coal.

II. Forces That Wear Away the Earth's Surface

A. Weathering

1. The earth s' face is always changing.
2. The rocks that make up the earth's surface are always being broken up and carried away.
3. This process of breaking down rocks is called weathering.
4. Weathering is caused by the action of the sun, air and water.

B. Erosion by Water

1. Erosion is carried on water, ice, and wind.
2. Erosion is the wearing away of the soil by water and wind and ice.
3. Water is the greatest of all forces that produce erosion.
4. Ground water causes erosion below the earth's surface.
5. Running water causes erosion on the earth's surface.
   a. As rainwater runs off to join streams and rivers, it carries particles of soil and rock with it.
6. The oceans both erodes and build up the earth's surface.
   a. The waves, pounding against the rock and land along the shore, wear them away and then carry off the rock particles.

C. Erosion by Ice

1. Glaciers are huge masses of ice formed where the climate and weather are very cold.
2. The moving mass of ice is called a glacier.
3. Valley glaciers are glaciers formed in mountain valleys where snow remains the whole year.

D. Erosion by Wind

1. The chief work of wind is to carry away loose bits of soil and rock.
   a. Over a long period of time, wind can blow away all the loose material from a desert floor leaving only a bare rock behind.

2. The wind can also deposit materials, especially when it slows down.

III. Soil

A. Soil is formed from rocks.

B. Different kinds of rocks make different kinds of soild.

C. Soil is important because plants and and animals depend on matter in the soil.

D. There are many kinds of soil.

1. Sandy soil has mostly sand in it, together with a little clay, and it contains almost no humus.
2. Clay soil has mostly clay in it together with a little sand and humus.
3. Loam is soil that has proper amounts of gravel, sand, and clay in it, together with lots of humus.
   a. It is usually dark brown or black in color.
   b. Loam is the best soil for most crops.

E. When living things die and decay, minerals may return to enrich the soil.

F. Man's future depends on how well he cares for good soil.

IV. Weather

1. Changes in the air make the weather.
2. Sun, water, and air help to make the weather.
3. The sun plays the most important part in making our weather.
   a. The sun heats the earth and the earth heats the air above it.
   b. Warm air rises.
   c. Cool air moves in when warm air rises.

A. Wind

1. Air that moves is called wind.
2. Warm air and cool air moves from place to place.

B. Kinds of Winds

1. Winds are named according to how hard the wind is blowing.
2. When the air does not move at all we say it is calm.
3. When the wind moves the leaves or trees just a little, we call it a gentle breeze.
4. When the wind blows the leaves from the trees and form little waves in the water, we call it a fresh breeze.
5. When the wind bends small trees and walking is difficult, we call it a strong wind.
6. When the wind moves large trees, we call it a high wind.
7. When the wind blows down trees and does damage we call it a gale.
8. Warm wet air rising from the sea may cause a very strong wind called a hurricane.
9. The strongest of all wind is a tornado.
10. A very strong wind called the jet stream moves high above the earth.

C. Water

1. Water helps to make changes in the weather.
2. Water is always in the air around us even when we can't see it.
3. The form of water that we can't see is called water vapor.
4. When water changes from a liquid into an invisible gas called water vapor, this change is called evaporation.
5. Humidity refers to the water vapor in the air.
6. When water vapor changes into a liquid, the change is called condensation.

D. Water Cycle

1. All the water on earth is constantly evaporating to form water vapor.
2. This evaporation takes place from the surfaces of the oceans, lakes, ponds, reservoirs, and rivers.
3. This water vapor is constantly condensing back into water again.
4. This process of evaporation and condensation goes on in a continuous cycle, called the water cycle.

E. Clouds

1. Clouds are made of little drops of water.
2. Clouds, are formed when a mass of air is cooled.
3. We name clouds by this shape.
4. Sometimes clouds help us tell what kind of weather we will have.
5. Cumulus clouds are heaped up masses of clouds.
6. Some cumulus clouds called "thunderheads" may brin storms.
7. Cirrus clouds are high, fair weather clouds.
8. Low stratus clouds mean that rain may be coming.
9. Numbus clouds are dark storm clouds.

F. Water in the air.

1. There are many forms of water in the air.
2. Precipitation refers to all forms of moisture that fall from the atmosphere.
3. Rain, drizzle, sleet, and hail are forms of precipi tation because they fall from the atmosphere.
4. Dew, frost, fog, and clouds are not forms of precipitation.
5. According to scientists that study the weather these are forms of condensation.
6. Rain is formed when little drops of water come together and form large drops.
7. Rain is the water that falls from a cloud.
8. Dew is formed when moist air condenses on cool surfaces.
9. Snow is water vapor that freezes before it falls.
10. Frost is water vapor that has condensed and frozed on cold objects.
11. Sleet is part rain and part snow.
12. Hail is frozen raindrops.
13. Fog is a cloud that comes down so low that it touch the ground.
14. Thunder is the sound produced by the rapid heating and expansion of the air through which lightening passes.

G. Weather Forecasts

1. Meteorology is the science that deals with the study of the weather.
2. A meteorologist is a person who studies and fore- casts the weather.
3. A thermometer is used to measure the temperature of the air.
4. The barometer is used to measure air pressure.
5. A wind vane is used to measure wind direction.
6. A hygrometer is used to measure relative humidity.

7. An anemometer is used to measure wind speed or velocity.
8. The rain gauge measures the amount of a rainfall.
9. Keeping a weather chart can help tell what the weather may be like.
10. Main is constantly trying to control the weather.
11. By dropping small particles of dry ice, silver iodide, or other crystals into three clouds, man has caused some of the cloud droplets to become ice crystals.
12. When the ice crystals are large enough, they fall as snow.
13. This snow turns to rain when it falls into low, warmer air.

LEVEL 4

EARTH SCIENCE

I. Astronomy--The motion and path of celestial bodies are predictable. Everything in the universe is in motion.

A. The Sun and other Stars

1. Everything in the solar system is moving with the sun as it moves in space.
   a. Planets, moons, and other bodies in the solar system revolve around the sun.
2. The sun is a medium sized star.
3. The sun is the largest body in our solar system.
4. The heat and light from the sun warm and light the bodies of the solar system.
   a. Some of the sun's heat and light reaches beyond our solar system to other bodies in our universe.
5. The sun only seems to move across the sky.
6. There are many stars.
7. We believe the stars are at a great distance from the earth.
8. The movement of stars denotes the passing of time.
9. The Big Dipper seems to change its position because of the earth's revolution.

B. Planets

1. We believe planets move around the sun.
2. There are nine known planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto.
   a. There may be more not yet discovered.
3. Planets are alike in some ways.
4. Planets differ in some ways.
5. Planets have days and years, as Earth does, but they are of different lengths.
   a. The reasons that the planets have days and years are the same for all planets.
6. There are moons of planets, planetoids, comets, and meteors in our solar system.
7. If there is life upon other planets, it might differ from life upon Earth since conditions on each planet differ.

C. The Earth

1. The earth is a planet which travels around the sun.
2. The earth is composed of three spheres: a solid sphere, a liquid sphere, and a gaseous sphere.
   a. Earth's solid sphere is the heaviest of the three.
   b. The lithosphere is all one huge piece, even though about 3/4 of its surface is covered with water.
   c. The three spheres of Earth intermingle: gases, liquids, and solid mix together a great deal.
3. The three spheres of Earth are held together by gravity.
   a. Gravity pulls everything toward the center of the earth's solid sphere.
   b. Things fall because the earth pulls them down.
   c. Things roll or slide down a slope because the earth pulls them.
   d. The earth's pull can harm us, however, we can use the earth's pull in a great many ways.
   e. It is more difficult to carry things up than down because of gravity.
   f. The earth may pull with a different force on different things.
      (1) We measure the earth's pull with scales.
      (2) Weight is the measure of force with which gravity pulls on an object.
      (3) When equal volumes of different substances weigh different amounts, we say they have different densities.
      (4) The earth rotates on its axis.
         (a) The earth rotates on its axis from west to east.
         (b) We measure time by the earth's rotation.
         (c) We explain the motion of the stars, sun, and moon across the sky each day as being due to the rotation of the earth.
      (5) One side of the earth faces the sun as it rotates; the other side is always from the sun and in the earth's shadow.
         (a) The rotation of the earth brings day and night.
         (b) The earth makes one complete turn in one day. (Rotates once in a day)
         (c) Twenty-four hours make one day.
      (6) The earth revolves around the sun.
         (a) The earth makes one revolution around the sun in about 365 days, or one year.

(7) Clocks and calendars are used to tell time.
(8) The earth is divided into time lines (longitude).
  (a) There are twenty-four principal meridians, or lines of longitude.
  (b) One hour elapses as a principal meridian moves to the position of the next principal meridian.
(9) Life upon Earth has evolved to its present state because of the conditions which exist on this planet.
(10) Neither moon nor earth has its own light.

D. Moon

1. The moon is round like the earth.
2. The moon is smaller that the earth.
   a. The moon is 1/4 the size of earth.
3. The moon travels around the earth.
   a. The pull of the earth keeps the moon on its path around the earth.
   b. The moon moves around the earth once every 28 days.
4. The moon shines because it reflects light from the sun.
   a. The changes we see in the lighted part of the moon are caused by its changing position relative to earth and sun as it revolves.
   b. Craters, mountains, and valleys on the moon make the shadows we see.
5. There is no living thing on the moon.

E. Comets

1. A comet, like the moon, may travel in a predictable orbit.
2. Some comets do not return.
3. The orbit of Halley's comet is an ellipse.
4. Newton thought the pull of gravitation extended beyond the Earth to the moon.
5. An object in motion tends to move in a straight line.
6. The pull of gravitation between Earth and moon shapes the moon's orbit around the earth.
7. Meteors may be fragments of disintegrated comets.
8. The head of a comet is a mixture of ice and rock.
9. Meteors don't appear at regular times.
10. Friction of a meteor against the atomsphere results in the light.
11. The shape of orbits and the position of bodies in space are predictable.

12. Prediction should be based on understanding.
13. The gravitational pull of Jupiter may affect Halleys comet.

II. The Earth is made up of air, water, and land.

A. Land

1. The earth has an outer crust.
   a. The land is the crust of the earth.
   b. The outer crust of the earth consists of bedrock and mantle rock.
      (1) The crust is soil and rock.
2. Non-living things of earth are minerals.
   a. Rock is made up of minerals.
   b. There are different kinds of minerals.
   c. Minerals take the form of crystals.
      (1) A crystal is a regularly shaped mineral having angles and flat surfaces.
   d. Many substances solidify into crystals.
3. There are three kinds of rocks: igneous, sedimentary, metamorphic.
   a. Different kinds of rocks are formed in different ways.
   b. Rocks are being made in bodies of water.
      (1) Sandstone and shale are two kinds of rock that are made under water.
   c. Some rocks are made deep in the earth.
      (1) Granite is one of them.
      (2) Granite was once so hot it was liquid.
      (3) Granite has crystals of quartz in it.
         (a) It may also have mica in it.
   d. Coal is a useful rock.
      (1) Coal is formed from decayed plant life through a process of heat and pressure spanning millions of years.
      (2) There are 2 main kinds of coal; anthracite and bituminous coal.
4. The inside of the earth is hot.
   a. Hot molten magma collects in pools deep within the earth.
   b. Magma sometimes breaks through the ground forming a volcano.
5. Rocks break down into soil.
   a. Soil is very important to us.
   b. Wind and water help break up rock.
   c. Rocks are changed and worn as time goes on.
   d. Such forces as wind, weather, and water wear rocks away.
      (1) Some surfaces become hotter in sunlight than do other surfaces.

e. Rocks tell us something about the history of the earth.
f. The expansion of freezing water breaks down rocks.
(1) Expansion of water as it turns to ice has great force.

7. Air extends out into space for a 1,000 miles and more, becoming thinner with height.
a. No one knows where the atmosphere ends.
b. There is much to be learned about the atmosphere.
(1) Scientists continue their search for additional information.

8. Beyond the earth's atmosphere, there doesn't seem to be any fluid friction.

C. Water

1. Scientists who explore the oceans are oceonographers.
2. The oceans contain many things which man can use.
3. Ocean currents influence weather and climate.
4. The ocean floor is much like the surface of the land.
5. The seashore is a place of change and unrest.
6. The rise and fall of the ocean are known as tides.
a. The pull of the moon and sun causes the tides.
b. The tide rises or falls about every six hours.
c. There are spring tides and neap tides.
7. An iceberg is a large block of ice floating in the ocean.
a. Icebergs are formed when huge pieces of ice break off glaciers that extend into the sea.
b. Most of an iceberg is submerged beneath the surface of the water.
8. Warm water rises because it expands.
a. Cold water sinks in warm water.
b. Warm water rises in cold water.
9. Water containing dissolved substances is heavier than pure water.
10. Water is a component of all organisms.
11. The water supply is the result of the cycle of evaporation and condensation.
12. Different processes are used to purify water.
a. Sand can be used to filter some materials out of water.
13. The water table marks the water level in soil.

III. Weather is a condition of the atmosphere.

A. Wind

1. Wind brings changes in the weather.

2. Unequal heating of the earth's surface causes rising and falling air currents.
3. Many local winds are the result of unequal heating of the earth's surface.
4. Wind is air in motion.
5. Rising air currents cause certain types of clouds and local storms.
6. Warm air is forced upward by cooler air surrounding it.

B. Precipitation is an important condition of weather.

1. Precipitation is water that falls to earth in the form of rain, snow, sleet, hail, or dew.
   a. Rain sometimes falls on the desert.
2. Water vapor in air can be changed to water.
   a. Water vapor condenses when cooled.
   b. Condensation gives up heat energy.
   c. Rising air cools and its water vapor condenses to form a cloud.
   d. Rain forms as cloud droplets come together into larger drops of water.
   e. Condensation can produce rain.
      (1) Cloud droplets are formed by the cooling of water vapor.
      (2) Cloud droplets collide to make rain drops.
   f. Ice specks melt to make raindrops.
   g. When water molecules in the air are cooled, they become closer together and are visible.
      (1) They condense.
3. Desert rainwater dries up or drains away swiftly.
   a. Water evaporates to become a gas, water vapor.
   b. Water becomes an invisible gas and returns to a liquid.
      (1) Steam is invisible.
   c. Evaporation is explained by the molecular theory.
   d. Evaporation takes heat energy.
4. Meteorologists keep accurate measurements of precipitation.
   a. The water supply is the result of the cycle of evaporation and condensation.
   b. Ocean currents influence weather and climate.
   c. Weather occurs as a result of changes in the troposphere.
   d. Heating of land and water surfaces causes air to be unevenly heated.
      (1) Scientists use the thermometer to measure the temperature of the air.
         (a) The thermometer is an instrument of science.
      (2) The temperature of the air influences weather.

e. New knowledge of the atmosphere will greatly assist men in exploring weather changes, making long range weather predicitons, and enlarging the possibilities for further safe exploration of regions beyond earth.
(1) Men can use what they learn about the weather to help them plan their daily lives.

IV. Travel and Exploration

A. Aviation

1. There are many types of airplanes developed for different uses.
2. Airplanes need energy to fly.
a. Gravity tends to pull an airplane down.
b. Lift causes an airplane to rise.
c. Thrust moves an airplane forward.
d. Drag tends to hold an airplane back.
e. When the speed of air increases, the pressure of air becomes less.
f. The forces of gravity, lift, thrust, and drag are balanced when the airplane levels off in steady flight.
3. Airplanes are controlled by three sets of surfaces.
a. Airplanes are controlled by rudders, elevators, and airlerons.
b. The airlerons control the banking of an airplane.
c. The elevators cause an airplane either to climb or to descend.
d. The rudder causes an airplane to turn to the right or to the left.
e. The rotor of a helicopter controls its movements.
1. A helicopter can hover in the air.
4. Jet propulsion gives a jet airplane its thrust.
a. Escaping exhaust gases create jet propulsion.
5. Airplanes and gliders have wings.
6. Weather is important to airplane pilots.

B. Space is beyond the atmosphere.

1. Space goes on for billions of miles.
a. Men are now exploring space.
b. Man uses instruments to advance his knowledge of our solar system and regions beyond it.
(1) Data gathered from advanced and precise instruments are carefully recorded and studied.

c. A hypothesis is based on observation and analysis of objects and events; it determines the design of the investigation.
   (1) A hypothesis must be tested with evidence.
d. As new modes of travel and new technical instruments are employed, there is reason to put confidence in the findings reported.
e. Much remains to be found out about our solar system.

LEVEL 4

Life Science

I. Living Things

A. Living things are made of cells.

1. The structure and growth of cells varies according to the functions of cells in the living thing.

B. A living thing needs food for growth.

1. A living thing grows by cell division.

C. Living things are part of the environment.

1. The environment of a living thing includes all surrounding conditions that affect its growth.
2. Ecology is the study of the relationship of living things to each other and to their non-living environment.

D. A living thing is adapted to a special environment.

1. A difference in environment affects the kinds of living things that are adapted to a region of the Earth's surface.
2. A living thing is dependent on all the conditons and all other living things in its environment.
3. The inherited characteristics of a living thing can develop only in the kind of environment in which the growing plant or animal can interchange matter and energy with the environment.
   a. Through the action of bacteria and other organisms, that matter of once living things is returned to the environment.
4. Living things are interdependent with one another and with their environments.
5. Many living things too small to be seen without a microscope are called microorganisms.

E. The struggle to survive is a sharp one among living things.

1. Changes in living things are continual.

2. Left undisturbed, a community of living things tends to stabilize itself.
   a. Sudden events such as floods or fires, causes communities to change.
   b. Living things adapt themselves to the changing conditions at the seashore.

II. Plants

A. Structure--Plants survive because of structural characteristics.

1. Moss is a tiny plant.
2. Bacteria are tiny plants.
3. Yeast is a microorganisms.
4. Plant roots hold soil.
5. Cover crops (ie-grass) hold soil.
6. Trees hold the soil with there roots and they provide cover.

B. Classification--Plants are living things.

1. Dependent plants (Non-green plants)
   a. All living things in a community depend upon green plants for food.
   b. Non-green plants are dependent on green plants or their products for food.
   c. Green plants are dependent upon animals in its environment.
   d. Yeast is a dependent plant.
   e. There are 3 main kinds of bacteria: bacilli, cocci, sprilla.
2. Independent Plants (Green Plants)
   a. Green plants get the matter for growth from soil and water.
   b. Green plants use energy from their own foods and from inorganic substances in the environment.
   c. Green plants give off oxygen in light and take in carbon dioxide.

C. Life Activities

1. Nutrition
   a. Water enters plant stems.
   b. Water rises up special regions in plant stems.
   c. Some of the water that enters the leaves of plants evaporates into the air.
   d. Soil chemicals dissolve in water and enter plant roots.
   e. Cactuses have special ways of obtaining water.
   f. Yeast uses sugar for food.
   g. Matter from the environment is used for growth by cells of green plants and all other living things.

h. Minerals important for plant growth are found in soil water.
i. Different parts of a tree grow at different rates.
j. Plants obtain food materials from soil and make and store food.
k. Plants obtain their needs from their environment.

2. Reproduction
a. Plants reproduce themselves.
b. Moss has spores instead of seeds.
c. Yeast reproduces by budding and fission.
d. Seeds transmit the characteristics of parent plants.

D. Conditions for life-green plants need the right conditions for growth.

1. Plants need water.
a. Water in plants often has sugar dissolved in it.
2. Plants have life cycles adapted to growth in their environments.
3. Desert plants need little water.
a. Desert plants store water.
4. There is a great variety of plants living on Earth.
a. Many plants and animals live together in communities.
b. Life in a plant and animal community is interrelated.
5. The amount and kind of light energy received affects the ability of green plants to make food and to grow.
6. Tiny plants known as plankton grow by the thousands in large bodies of water.
7. The action of decay returns to the soil compounds essential to growing plants.
8. Plants and animals are dependent on each other.
9. Many kinds of plants are found in the polar regions.

E. Change--Adaptation

1. Different plants are adapted to different environments.
2. Plants of the Artic and Antarctic have adapted to the cold and snow.
3. Plant life upon Earth is abundant.
4. Plants are adapted to where they live.
5. Plants have developed certain adaptations which serve as protections.
6. Plants of the desert adapt themselves to the environmental conditions.

F. Conservation

1. The abundance of plant life is a kind of protection for plants.
2. Tough stems and bark are protections.
3. Spines and thorns are protections.
4. Producing many seeds or spores is a protection.
5. Dispersal of seeds is a protection to plants.
6. Roots are a protection to plants.
7. Leaves may be a protection to some plants.
8. Man protects some plants.
9. Some plants are helpful to man for food and for shelter.
   a. Plants contain vitamins and minerals needed for growth and health.
   b. Plants contain sugar and starch needed for energy.
10. Plants reduce erosion.
11. Irish moss provides a shelter for animals of the sea.

III. Animals

A. Structure

1. A turtle's shell is part of its body.
2. Snakes have bones.
3. Mollusks have soft bodies; most of them have hard shells.
4. Feathers help keep birds dry and warm.
5. Rodents have chisel-like incisor teeth.
6. Skunks have sharp, pointed teeth.
7. Woodpeckers have chisel-like beaks and spearlike tongues.
8. Sapsuckers have brush-like tongues.
9. Bones, muscles, and tendons support the body.
10. The digestive system changes foods so they can be used by the body.
11. The circulatory system carries blood and food materials to all parts of the body.
12. Many animals have muscles.
13. Muscles make the parts of our body move.
    a. Muscles pull but don't push.
14. The body is built around a framework of bones called a skeleton.
    a. Some bones move, others don't.

B. Classification

1. There are many kinds of animals.
   a. Insects
   b. Amphibians
   c. Birds

d. Fish
e. Mollusks
f. Microscopic
g. Plant-eating mammals
h. Flesh-eating mammals

2 Mammals are animals which have hair or fur, feed milk to their young, and breathe with lungs.
   a. Skunks are fur bearing animals that feed their young on milk.
3. Gnawing animals are rodents.
   a. Beavers are rodents that cut down trees to make dams and lodges.
   b. Rats, mice, prairiedogs, rabbits, porcupines, squirrels, and chipmunks are rodents.
4. Turtles, snakes, alligators, and lizards are reptiles.
5. Mollusks have soft bodies; most of them have hard skeletons.
   a. Some mollusks have one-part shells; others have two-part shells.
6. Animals whose blood changes its temperature with the temperature of the air are called cold-blooded.
7. Animals whose temperature stays the same are warm-blooded.

C. Life Activities

1. Nutrition--Animals need food to grow.
   a. Woodpeckers eat insects from trees.
   b. Sapsuckers get their name from eating sap from trees.
   c. Turtles feed upon small living animals and sometimes upon vegetation.
   d. Snakes feed on animals which they swallow whole.
   e. Houseflies feed on animal wastes and human food, and often carry bacteria filled bits of the former food.
   f. Some mosquitoes feed on plant juices; only female mosquitoes live on blood.
   g. Foods for birds are often scarcer in winter than in summer.
      (1) Some birds find insects in winter.
      (2) Some birds find seeds and fruits for food in winter.
   h. Desert animals get water from food they eat.
   i. A number of animals make use of the sugar in sap.
   j. Animals need food to keep alive and continue the species.
   k. Some animals prey upon other animals and use them for food.
      (1) Snails eat tiny water plants.

m. Man uses plants and animals for food.
(1) A proper balance of food is necessary to get daily needs.
(2) Food provides the energy that produces muscular motion.

2. Reproduction--Animals reproduce
a. Every species of animal has a life cycle in which the same pattern of development (successive changes in structure from egg to adult) is repeated over and over again.
b. The life cycle of a salmon is completed after the eggs hatch and the young salmon return to salt water to develop into adult salmon.
(1) The salmon's life cycle is repeated.
c. Houseflies and mosquitoes go through four stages in their life cycles.
(1) The larva, or maggot stage, of houseflies is often spent in the waste of animals, including those of man.
d. Caterpillars are young butterflies and moths.
(1) They don't look like the parents.
(2) They change as they grow.
(3) Some caterpillars spin cocoons.
(4) Moths come from cocoons.
(5) Butterfly caterpillars don't spin cocoons.
e. Young frogs and toads do not look like their parents when they hatch.
(1) They also change as they grow.
f. Fish, turtles, and birds look like their parents when they hatch.
g. Turtles lay their eggs in soil and give no further care to the eggs or the young.
h. Some snakes lay eggs; some keep the eggs inside their bodies until they develop.
i. Snakes shed their skins in one piece.

D. Conditions for life

1. Young woodpeckers are helpless and need to be cared for by their parents.
2. Some animals survive better by living in groups.
3. Some animals survive by living alone.
4. Animals compete with each other.
5. Animals have certain habits which help them to survive.
6. Animals depend on other living things in various ways.
7. Some bacteria live in humans and give off poisons that harm humans.
8. Immature mosquitoes live in water.
9. A body must be taken care of to keep it working properly. Good health needs: fresh air, exercise, and rest.

10. Animals need air, water, and food.
11. Life in a plant and animal community is interrelated.
12. Tiny animals known as plankton grow by the 1000's in large bodies of water.
13. Animals are abundant.
    a. There is infinite variety in the animal kingdom.
14. Some animals protect their young by giving them care.
15. Wild animals must be able to obtain food and find protection or they die.
16. An aquarium is a home for water animals.
    a. In an aquarium, animals and plants help each other.
17. Many animals live together in a social organization.
    a. These are social animals.
18. Some animals live together part of the time.
    a. These animals are partly social in their habits.
19. A few animals live alone all, or most, of the time.
    a. These are solitary animals.
20. The social orgaization of some groups of animals is highly complex.
21. Man is a social being.
22. Man's social life differsmarkedly from the social life of bees, ants, and other animals.
23. There are advantages and disadvantages in social living.
24. High tide brings food to animals of the seashore.
25. Some seashore animals can live in the water or out of the water.
26. Mollusks can be found in both salt water and fresh water.
27. Many kinds of plants and animals are found in the polar regions.

E. Changes--Adaptations

1. Living things adapt themselves to the changing conditions at the seashore.
2. Animals of the Artic and Antarctic have adapted to the cold and snow.
3. Each animal has certain adaptions which aid in its survival.
4. The adaptations of each animal are suited to that animal and are not necessarily good for any other animal.
5. These adaptions help an animal to be suited to its particular niche in the environment.
6. Animals survive because of structural characteristics and habits.
7. Turtles try to escape danger by diving into the water or by withdrawing into their shells.
8. Porcupines depend on their quills for protection.

9. Most animals are adapted to chiefly a land, water, or air environment.
10. Animals of the desert adapt themselves to the environmental conditions.
11. Protective coloration helps to guard an animal against its enemies.
12. Migration is one way animals are able to survive.
    a. Some birds fly to warmer regions in winter.
    b. Some birds are adapted for winter conditions.
    c. Wild mallard ducks are adapted to an annual cycle of migration.
    d. Scientists have ideas about the reasons for migration but they aren't proved.
    e. In winter, many birds from the northern states migrate to southern states.
    f. Some mammals and butterflies migrate.
13. Hibernation is a way animals are able to survive.
    a. Some animals hibernate all winter.
14. By using his brain to modify the environment, man is able to live in environments to which he is not structurally adapted.
    a. Knowledge of concepts, whether obtained by trial and error or by investigation has been essential to keeping man alive.
    b. In order to progress, man makes changes in the natural community of living things.
    c. Our behavior tells much concerning the way we think and feel about our environment.
15. Animals are adapted in different ways.
    a. The embryonic structures are social adaptations.
    b. In both structure and behavior (migration) the duck is adapted to its environment.
    c. All organisms have inborn behavior that adapts them to their environment.
        1. Behavior may be inborn or learned.

F. Conservation

1. Some animals are useful or harmless.
    a. Skunks are relatively harmless.
    b. Porcupines are relatively harmless.
    c. Some animals are used for their food.
    d. Some animals are used for their fur.
    e. Some animals are used for work.
    f. Some useful animals kill harmful animals.
    g. Most woodpeckers are helpful.
    h. Most birds are useful because they eat insects or weed seeds.
2. Some animals are harmful.
    a. Sapsuckers are the only woodpeckers that can harm trees.
    b. The insects that bore into trees are harmful.

c. Mosquitoes transmit certain diseases when they feed first on sick people and then on healthy people.

3. Many of the acts of man are the result of rational thought.
   a. Man should study the interrelationships within a living community before making changes in the environment.
   b. We can prevent the spread of disease by houseflies by destroying the places in which they breed, by keeping them from our food and by properly disposing of our body wastes.
   c. We can help prevent the spread of diseases by mosquitoes by keeping them from biting sick people.
4. We should learn to study and enjoy living things in their natural surroundings.

LEVEL 4

PHYSICAL SCIENCE

I. Structure of Matter

A. Definition of Matter

1. Materials are matter.
2. Matter is anything that occupies space and has weight.
3. Matter is of many kinds.
4. Matter is molecular in nature.
5. Matter is made up of tiny particles having different arrangements.

B. Elements

1. Substances have properties that distinguish them from one another.
2. A substance may be recognized by its properties.
3. Matter is composed of tiny particles called molecules.
4. The molecules in an element are alike.
5. An element is made up of one kind of atom.

C. Compounds

1. A compound is made up of more than one element.
   a. The molecules in a compound are different.

D. Mixture

1. Matter is not all molecular.
2. Air is a mixture of gases.

E. Atoms

1. Molecules are often composed of smaller particles called atoms.
2. Molecules are composed of one or more atoms.
3. Molecules and their atoms are in constant motion.

F. States of Matter

1. The three states of matter are solid, liquid, and gas.
2. Solids tend to keep their shape.
3. Liquids take the shape of the container they are in.
4. Gases spread out and fill whatever space is available.
5. Water vapor is the gaseous form of water.
6. Air and water cannot occupy the same space at the same time.
7. Ice is not as dense as liquid water; ice therefore floats in water (an iceberg).
8. Matter can be changed from one form to another.
   a. Matter changes its state and form.

II. Changes of Matter

A. Physical and chemical change

1. When matter changes from one form to another, the total amount of matter remains unchanged.
2. Non-living things change chemically and physically.
3. Physical and chemical changes are taking place all the time.
   a. Acids turn blue lithmus paper pink.
   b. Alkalis turn pink lithmus paper blue.
4. Physical changes include dissolving, evaporating, condensing, and freezing.
   a. A change from one form to another without becoming a different substance is a physical change.
   b. Water undergoes a physical change when it freezes from a liquid into ice.
5. Changes that make new substances are chemical changes.
   a. In a chemical change, atoms react to produce a change in molecules.
6. Heating and cooling of substances causes them to change in form.
   a. Most substances expand when heated and contrast when cooled.

B. Solutions and Suspensions

1. Many substances dissolve in water.
2. When the water in a solution evaporates, the substances dissolved in the water do not evaporate.
3. Substances in solution pass through s filter, fine particles mixed in water don't go through a filter.

4. Substances sometimes come out of solutions as crystals.
5. Air can be collected and cleaned by the displacement method.

C. Molecules

1. Non-living things are made up of molecules.
2. Molecules are constantly moving.
   a. Heat makes molecules move faster.
   b. Molecules of substances move more rapidly when heated and less rapidly when cooled.
3. Molecules of substances interact.
4. Molecules can be moved around to form compounds or to obtain elements.
5. Energy is released during a molecular change.

D. Oxidation

1. Iron and oxygen combine to form iron oxide, rust.
2. Oxygen rusts iron more quickly than air does.
3. As iron rusts, the air in a closed container diminishes.
   a. Some molecules of air seem to disappear when iron rusts.
4. Carbon dioxide and water are products of burning.

III. Energy

A. Relationship of Matter

1. When energy changes from one form to another, the total amount of energy remains unchanged.
2. A loss or gain of energy affects molecular motion.

B. Light--Light is a form of energy.

1. Light comes to us from the sun and other incandescent substances.
2. Light can be reflected and absorbed.
   a. Objects become visible as light is reflected from them to the eye.
   b. We see most objects by reflected light.
   c. Reflected light must reach the eye to be seen.
   d. There could be no color without light.
      (1) White is a combination of all colors.
      (2) Black is the absence of color.
3. Light travels in straight lines.
4. Light can travel through space.

5. Light may be bent as it passes through certain material.
   a. Light rays can be bent by lenses.
   b. A convex lens bends light to a focus.
      (1) A hand lens can magnify, produce an image on a screen, and make distant things look smaller and upside down.
      (2) Magnifying lenses are thicker in the center than around the edges.
      (3) Magnifying lenses are used in many devices that produce images.
   c. Light may be bent as it enters or leaves water.
6. Light energy may be released by a chemical change.
   a. The light energy of a candle comes from paraffin.
   b. The light energy of a candle is produced by chemical change.
7. Chemical energy can become light energy.
8. Light energy behaves sometimes and waves, sometimes as particles.
9. Light can be polarized by certain materials.
   a. The behavior of polarized light is explained by a wave model.

C. Sound--Sound is a form of energy.

1. Where there is sound there is movement.
2. Sound is caused by something vibrating.
   a. A vibration is a to and fro movement.
3. Sound waves are set in motion when something vibrates.
   a. Sound travels in waves, by molecular motion.
   b. Sound waves transmit energy.
   c. Sound waves travel in all directions from their source.
   d. Sound travels by the motion of molecules in air.
4. Sound has to have conductors to travel on.
   a. Sound waves travel through many kinds of materials.
   b. The molecular theory explains why sound travels better in a solid than in a gas.
   c. Sound travels approximately 1,100 feet per second in air.
5. Sound waves can be produced in different ways.
   a. The vocal cords in human beings produce sound waves.
      (1) Vocal cords stretched across the larynx vibrate to produce speech sounds.

b. The ear is the organ through which sound waves come to us.

6. Sound can be absorbed.
7. Echoes are caused by the bounce of sound.
   a. Echoes are reflected sounds.
   b. Sound that hits a wall can bounce back as an echo.
8. Sound may differ in pitch.
   a. The pitch of a sound depends on the rate of the vibrations.
   b. Changing the rate of vibrations changes the pitch.
   c. The rate of vibration can be changed in different ways.
9. Sound may differ in intensity.
10. Sounds may differ in quality.
11. Sounds play a very large part in making communication around the world possible.

D. Heat comes from the sun, fire, electricity, and friction.

IV. Forces and Motion

A. Machines

1. Machines help to make available sources of energy that assist man in his work.
   a. Men can use energy to a greater advantage.
2. Rapid advances in forms of transportation have been made possible by the use of machines.
3. Machines work against the force of gravity.
4. Machines overcome friction.
5. Some machines help to lift things.
6. There are many kinds of machines.
7. There are six simple machines which are the lever, wheel and axle, wedge, incline plane, screw, and pulley.
   a. A lever is a simple machine.
      (1) There are three kinds of levers: first class, second class, and third class.
      (2) Each class of lever differs in the positions of its force, fulcrum, and load.
   b. The wheel and axle is a simple machine.
      (1) Wheels are machines.
      (2) Wheels are useful.
      (3) We gain force by using a wheel and axle.
   c. The wedge is a simple machine.
      (1) There are many kinds of wedges.
      (2) A wedge increases forces.

d. An inclined plane is a simple machine.
   (1) There are many kinds of inclined planes.
   (2) It is easier to move a load up an inclined plane to lift it.
e. The screw is a simple machine.
   (1) The screw is a special kind of inclined plane.
f. A pulley is a simple machine.
   (1) There are two kinds of pulleys: fixed pulley and movable pulley.
   (2) A fixed pulley changes the direction of force; it provides no gain in force.
   (3) We gain force by using a movable pulley.

8. Simple machines are put together to make complex machines.
   a. Complex machines may be analyzed into two or more simple machines.
   b. Complex machines have many uses.

B. Work

1. Machines work against gravity.
2. A machine is a device that helps us to do work.
3. A machine is something that makes work easier.

C. Machines are tools.

1. Men have made progress in using energy partly because they have been able to use tools and invent machines.

D. Moving Objects--Everything in the universe is in motion.

1. Moving things have energy.
   a. The energy of moving things depends on their speed.
2. Moving things need space in which to stop.
   a. The greater the energy of a moving object, the greater the distance needed to stop.
   b. A knowledge of stopping distances helps us to be safe.
      (1) Accidents are usually the result of carelessness.
3. Friction is resistance to movement encountered when two objects rub against each other.
   a. Friction is useful.
   b. Friction causes wear.
   c. There is more friction between rough surfaces than between smooth surfaces.

d. Men have found ways to reduce friction.
   (1) Friction can be decreased by using smooth surfaces, by substituting rolling friction, or by using lubricants.
e. Men have found ways to increase friction.
   (1) Friction is increased when objects are pressed more tightly together.
f. There is friction when objects are moved through water and air.
g. Fluid friction is sometimes much less than sliding friction.
   (1) Fluid friction becomes greater when speed is increased.

V. Gravity

A. Inertia

1. The tendency of objects to resist starting and stopping is called inertia.
2. Objects at rest tend to resist starting to move.
3. Objects in motion tend to resist stopping.
4. See IV, D, 3. (Friction)

VI. Forces of Fluids

A. Characteristics of Air

1. Air takes up space and has weight.
2. Warm air expands.
3. Cold air contracts.
4. Warm air rises.
   a. Cold air tends to push up warm air and take its place.
5. The draft in stoves and fireplaces and circulation of air in a room are usually due to the upward movement of warm air as it is pushed up by cool air.
   a. A given volume of cold air weighs more than the same volume of warm air.
6. Convection currents in a room provide ventillation.
   a. Convection currents are cold air replacing warm air.

B. Make up of air

1. Nitrogen is the most plentiful gas in air.
2. About one-fifth of air is oxygen.
3. Exhaled air contains carbon dioxide.
4. Air contains oxygen and carbon dioxide which are important for life.

C. Measuring air pressure

1. Gravity causes the air to have pressure.
2. Pressure can be measured by a barometer.

VII. Electrical and Magnetic Forces

A. Electricity

1. Electricity is a form of energy.
2. Electricity has many uses:
   a. We use electricity to do work.
   b. The use of electricity has greatly changed man's way of life.
   c. Electricity can be used to generate heat energy.
      (1) Electric current heats a wire.
3. Electricity produces light and heat.
4. An electric current is a flow of electrons.
   a. Electrons flow from a negative terminal to a positive terminal.
5. An electric current flows only through a complete circuit.
   a. A switch closes a circuit.
      (1) Switches are used to make circuits and break them conveniently.
   b. There are two kinds of wired circuits: a series circuit and a parallel circuit.
      (1) The parts of a series circuit share electrons, if one light goes out, for example, all the lights goes out.
      (2) Each part of the parallel circuit has its own supply of electrons; one light may go out but the rest of the lights keep burning.
   c. A grounded circuit is a type of circuit where by a pipe or metal container is used for part of a circuit and takes the place of a wire.
   d. Electricity from dry cells needs a complete circuit if it is to be used.
      (1) Dry cells may be connected so that the energy of the electricity is increased.
6. A short circuit can be dangerous because it heats the wires through which a current is flowing.
7. Electric energy is transformed form other kinds of energy.
   a. A dry cell or flashlight battery is an example of chemical energy being changed into electrical energy.
8. Safety devices such as circuit breakers and fuses are used in buildings using electricity. Much remains to be learned about electrical forces.

B. Conductors

1. Conductors and materials through which electrons can flow.
   a. Substances that carry electricity are called conductors.
   b. Metal carries electricity well.
2. Nonconductors are materials through which electrons cannot flow.

C. Insulation

1. Many things do not carry electricity well.
   a. Substances that don't carry electricity well are used as insulators.
2. A lamp cord contains two wires, each wire covered with insulation and then the cord itself covered with insulation.
   a. If insulated wire is used, covering must be removed from the ends of the wires.

D. Magnetism

1. Magnets are pieces of iron that attract other pieces of iron.
2. Magnets are used in many ways.
3. Man has been aware of magnetism for centuries.
   a. Much remains to be learned aboutmagnetism.
4. Materials that are attracted by magnets are known as magnetic materials.
   a. The repulsion test may be used to determine whether a piece of iron is a magnet.
5. Magnetism is the energy produced around a magnet.
6. A magnet can be made with another magnet.
7. Lodestones are natural magnets.
8. A compass needle is a magnet free to rotate.
9. Earth acts as a huge magnet.

E. Like and Unlike Poles

1. Each magnet has a north and south pole.
2. Like poles repel each other.
3. Unlike poles attract each other.

F. Electromagnets

1. An electromagnet is a temporary magnet, that is its magnetism can be turned on and off.
2. Men have learned to make electromagnets by passing an electric current through a wire which is coiled around an iron core.