Section 4 Science

I. OVERALL OBJECTIVES

Aim to develop pupils' competencies necessary to scientifically solve problems about natural objects and phenomena, through familiarizing with nature, using Approaches of science, and conducting observations and experiments with a comprehensive vison. Specifically, ensure that pupils:

(1) Develop knowledge and understanding of natural objects and phenomena, and acquire fundamental skills for observations, experiments, and other scientific activities.

(2) Develop abilities of scientific problem-solving through conducting observations, experiments, and other scientific activities.

(3) Nurture deep appreciation and love for nature, and develop attitudes toward active scientific problem-solving.

II. OBJECTIVES AND CONTENT FOR EACH GRADE

[Grade 3]

1. Objectives

(1) Matter/Energy

(i) Develop knowledge and understanding of "Properties of objects", "Effects of forces generated by wind and rubber", "Properties of light and sound", "Properties of magnets", and "Electric circuits", and acquire fundamental skills for observations, experiments, and other scientific activities.

(ii) Develop abilities to generate questions based on differences and similarities of objects and phenomena, through investigating "Properties of objects", "Effects of forces generated by wind and rubber", "Properties of light and sound", "Properties of magnets", and "Electric circuits".

(iii) Develop attitudes toward active scientific problem-solving, through investigating "Properties of objects", "Effects of forces generated by wind and rubber", "Properties of light and sound", "Properties of magnets", and "Electric circuits".

(2) Life/the Earth

(i) Develop knowledge and understanding of "Familiar living things" and "The sun and the ground", and acquire fundamental skills for observations, experiments, and other

scientific activities.

(ii) Develop abilities to generate questions based on differences and similarities of objects and phenomena, through investigating “Familiar living things” and “The sun and the ground”.

(iii) Develop attitudes to love and care for living things, and attitudes toward active scientific problem-solving, through investigating “Familiar living things” and “The sun and the ground”.

2. Content

A. Matter/Energy

(1) Object and weight

Regarding the properties of objects, provide instructions to help pupils acquire the following items, through exploring activities in which pupils compare the weight, while paying attention to the shape and volume of the objects.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.

(a) The weight of an object remains unchanged even when the shape changes.

(b) Objects may differ in weight even when their volume is the same.

b. Develop abilities to generate questions and express them regarding the properties of objects, through investigating the relationship between the object’s shape and their weight, and the relationship between the object’s volume and their weight, based on their differences and similarities.

(2) Effects of forces generated by wind and rubber

Regarding the effects of forces generated by wind and rubber materials, provide instructions to help pupils acquire the following items, through exploring activities in which pupils compare how objects are moved by wind or rubber materials, while paying attention to the forces and how the objects move.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.

(a) The force generated by wind can move an object. Furthermore, if the magnitude of the force by wind over an object is changed, the movements of

the object also change.

(b) The force generated by rubber materials can move an object. Furthermore, if the magnitude of the force by rubber on an object is changed, the movements of the object also change.

b. Develop abilities to generate questions and express them regarding the effects of forces generated by wind and rubber, through investigating the movements of the objects due to the forces generated by wind and rubber, based on their differences and similarities.

(3) Properties of light and sound

Regarding the properties of light and sound, provide instructions to help pupils acquire the following items, while paying attention to the brightness and warmth of an object or the vibration of an object when producing sound, through exploring activities in which pupils compare the difference of them when strength of the light or the volume of the sound is changed.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and scientific activities.

(a) Sunlight travels in a straight line and can be collected and reflected.

(b)The brightness and warmth of an object changes when struck by sunlight.

(c) An object vibrates when sound is emitted from or is transmitted through the object. When the volume of the sound changes, the vibration of the object changes.

b. Develop abilities to generate questions and express them regarding the properties of light and sound, through investigating the brightness and warmth of an object when struck by sunlight, and the vibrations of an object when producing sound, based on their differences and similarities.

(4) Properties of magnets

Regarding the properties of magnets, provide instructions to help pupils acquire the following items, while paying attention to the behavior of familiar objects when magnets are placed closer to the objects, through exploring activities in which pupils compare them.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.

(a) Some objects are attracted to a magnet, and others are not. Furthermore, some objects become magnetic when they are moved close to a magnet.

(b) Opposite poles of a magnet attract each other, whereas like poles repel each other.

b. Develop abilities to generate questions and express them regarding the properties of magnets, through investigating the behavior of familiar objects when magnets are placed closer to the objects, based on their differences and similarities.

(5) Pathway of electricity (Electric circuits)

Regarding electric circuits, provide instructions to help pupils acquire the following items, through exploring activities in which pupils compare the patterns of circuit connections that conduct electricity and those that do not conduct electricity, while paying attention to how dry cells, small bulbs and objects are connected, and what kinds of the objects they are.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.

(a) There are patterns of circuit connections that conduct electricity and others that do not.

(b) Some materials conduct electricity, and others do not.

b. Develop abilities to generate questions and express them regarding electric circuits, based on their differences and similarities, through investigating how dry cells, small bulbs and objects are connected, and what kinds of the objects they are.

B. Life/the Earth

(1) Familiar living things

In the process of searching for and raising familiar living things, provide instructions to help pupils acquire the following items, while paying attention to their behaviors, surrounding environment, growth patterns and body structures, through exploring activities in which pupils compare them.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.

(a) Living things are different in appearances such as color, shape, and size. Living things interact with their surrounding environment.

(b) Insects grow in accordance with a fixed order of growth. The body parts of imagoes consist of the head, thorax, and abdomen.

(c) Plants grow in accordance with a fixed order of growth. Their body parts consist of roots, stems, and leaves.

b. Develop abilities to generate questions and express them regarding the interaction of familiar living things with the environment, fixed patterns of the growth of insects and plants, and their body structures, through investigating familiar living things, based on their differences and similarities.

(2) The sun and the ground

Regarding the relationship between the sun and ground conditions, provide instructions to help pupils acquire the following items, while paying attention to sunny and shady area, through exploring activities in which pupils compare the differences.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.

(a) The shade is created by blocking sunlight, and the position of shady area moves as the position of the sun changes.

(b) The sun warms the ground, and there are differences in warmth and dampness between sunny and shady area.

b. Develop abilities to generate questions and express them regarding the relationship between the sun and the ground, through investigating the conditions of sunny and shady area, based on their differences and similarities.

3. Additional comments on handling the contents

(1) In teaching “A. Matter/Energy” in the Content, learning opportunities in which pupils make at least three kinds of learning materials must be provided.

(2) Regarding item (4) a. (a) in “A. Matter/Energy” in the Content, it should be mentioned that the power of magnets to attract objects changes depending on the distance between the magnets and the objects.

(3) Item (1) in “B. Life/the Earth” in the Content should be dealt with as follows.

a. Items a. (b) and (c) should be taught through the raising of insects and the growth of plants.

b. In item a. (c), only summer annual dicotyledonous plants should be used.

(4) Regarding item (2) a. (a) in “B. Life/the Earth” in the Content, the changes of the position of sun from east to south and west should be dealt with. In addition, the four directions, east, west, south, and north, are dealt with when exploring the position of the sun.

[Grade 4]

1. Objectives

(1) Matter/Energy

(i) Develop knowledge and understanding of “Properties of air, water and metal” and “Function of electric currents”, and acquire fundamental skills for observations, experiments, and other scientific activities.

(ii) Develop abilities to generate evidence-based predictions and hypotheses based on previously learned content and life experience, through investigating “Properties of air, water and metal” and “Function of electric currents”.

(iii) Develop attitudes toward active scientific problem-solving, through investigating “Properties of air, water and metal” and “Function of electric currents”.

(2) Life/the Earth

(i) Develop knowledge and understanding of “Structure and movement of human body”, “Relationship between the environment and the activities of animals or the growth of plants”, “Journey of rainwater and the ground conditions”, “Weather conditions”, and “The moon and stars”, and acquire fundamental skills for observations, experiments, and other scientific activities.

(ii) Develop abilities to generate evidence-based predictions and hypotheses based on previously learned content and life experience, through investigating “Structure and movement of human body”, “Relationship between the environment and the activities of animals or the growth of plants”, “Journey of rainwater and the ground conditions”, “Weather conditions, and the moon and stars”.

(iii) Develop attitudes to love and care for living things and attitudes toward active scientific problem-solving, through investigating “Structure and movement of human body”, “Relationship between the environment and the activities of animals

or the growth of plants", "Journey of rainwater and the ground conditions", "Weather conditions", and "The moon and stars".

2. Content

A. Matter/Energy

(1) Properties of air and water

Regarding the properties of air and water, provide instructions to help pupils acquire the following items, while paying attention to the changes in their volume and pressure, through exploring activities in which pupils relate them to the compression force.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.

(a) When air is compressed in a closed space, the volume decreases and the pressure increases.

(b) The air in a closed space can be compressed, but water cannot be compressed.

b. Develop abilities to generate and express evidence-based predications and hypotheses about the relationship between changes in compression force and the volume and pressure of air and water, based on previously learned content and life experience, through investigating the properties of air and water.

(2) Metal, water, and air and their temperatures

Regarding the properties of metal, water, and air, provide instructions to help pupils acquire the following items, while paying attention to changes in their volume and states and how heat conducts, through exploring activities in which pupils relate them to changes in temperature.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.

(a) The volume of metals, water, and air change when heated or cooled, but there are differences in the extent of those changes.

(b) Metals heat up gradually from the point being heated, while water and air heat up as a whole through the movement of heated portion of water and air.

(c) The form of water changes into vapor or ice depending on temperature. When water becomes ice, its volume increases.

b. Develop abilities to generate and express evidence-based predictions and hypotheses about how heat conducts and about changes in the volume and states of metal, water and air when the temperature of them is changed, based on previously learned content and life experience, through investigating the properties of metal, water, and air.

(3) Function of electric currents

Regarding the function of electric currents, provide instructions to help pupils acquire the following items, while paying attention to the magnitude and direction of electric currents and the behavior of the objects connected to dry cells, through exploring activities in which pupils relate them.

a. Develop knowledge and understanding of the following contents, and acquire skills related to observations, experiments, and other scientific activities.

(a) When the number of dry cells and circuit change, then the magnitude and direction of electric currents change. As a result, the brightness of small bulbs and the rotation of a motor change.

b. Develop abilities to generate and express evidence-based predictions and hypotheses about the relationship between the magnitude and direction of electric currents and the behavior of objects connected to dry cells, based on previously learned content and life experience, through investigating the function of electric currents.

B. Life/the Earth

(1) Structure and movement of human body

Regarding human and other animals, provide instructions to help pupils acquire the following items, while paying attention to the structures and functions of their bones and muscles, through exploring activities in which pupils relate them to the bones and muscles in their body.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.

(a) Human body has bones and muscles.

(b) Humans can move their body because of the functions of bones and muscles.

b. Develop abilities to generate and express evidence-based predictions and hypotheses about the structures and functions of the bones and muscles of humans and other animals, based on previously learned content and life experience, through investigating humans and other animals.

(2) Seasons and living things

In the process of searching for and raising familiar animals and plants, provide instructions to help pupils acquire the following items, while paying attention to the activities of animals and the growth of plants along with the changes of seasons, through exploring activities in which pupils relate them to the changes of seasons.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.

(a) Activities of animals change along with warm season or cold season.

(b) Growth of plants changes along with warm season or cold season.

b. Develop abilities to generate and express evidence-based predictions and hypotheses about changes in the activities of animals and the growth of plants along with the changes of seasons, based on previously learned content and life experience, through investigating familiar animals and plants.

(3) Journey of rainwater and the ground conditions

Regarding the journey of rainwater and the ground conditions, provide instructions to help pupils acquire the following items, while paying attention to how rainwater flows and permeates the ground, through exploring activities in which pupils relate them to the slope of the ground and the size of the particles of soil.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.

(a) Water flows from high places to low places and eventually forms pools.

(b) How water permeates the ground depends on the size of the particles of soil.

b. Develop abilities to generate and express evidence-based predictions and hypotheses about the relation of how rainwater flows and how it permeates the ground to the slope of the ground and the size of the particles of soil, based on previously learned

content and life experience, through investigating the journey of rainwater and the ground conditions.

(4) Weather conditions

Regarding the weather and the conditions of water in the natural world, provide instructions to help pupils acquire the following items, while paying attention to temperature and where water goes, through exploring activities in which pupils relate them to weather conditions and the state change of water.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.
    (a) Temperature change in a day varies depending on the weather.
    (b) Water evaporates from the surface of water or the ground and turns into vapor in the air. In addition, vapor in the air may condense; it turns back into water drops.

b. Develop abilities to generate and express evidence-based predictions and hypotheses about the relationship among weather conditions, the state change of water, temperature, and where water goes, based on previously learned content and life experience, through investigating the weather and the conditions of water in the natural world.

(5) The moon and stars

Regarding the features of the moon and stars, provide instructions to help pupils acquire the following items, while paying attention to changes in their position and the passage of time, through exploring activities in which pupils relate them to their position in the sky and time.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.
    (a) The shape of the moon appears to change day to day, and its position changes throughout the day.
    (b) There are stars in the sky with different levels of brightness and colors.
    (c) The alignment of a group of stars does not change, but the position of the group changes throughout the day.

b. Develop abilities to generate and express evidence-based predictions and hypotheses about the relationship between changes in the positions of the moon and stars and the passage of time, based on previously learned content and life experience, through investigating the features of the moon and stars.

3. Additional comments on handling the contents

(1) Regarding item (3) a. (a) in "A. Matter/Energy" in the Content, both series circuit and parallel circuit should be dealt with.

(2) In teaching "A. Matter/Energy" in the Content, learning opportunities in which pupils make at least two kinds of learning materials must be provided.

(3) Regarding item (1) a. (b) in "B. Life/the Earth" in the Content, the function of joints should be dealt with.

(4) Regarding item (2) in "B. Life/the Earth" in the Content, the activities of at least two animals and the growth of at least two plants should be observed over the course of one year.

[Grade 5]

1. Objectives

(1) Matter/Energy

(i) Develop knowledge and understanding of "Dissolution of substances", "Motion of pendulums", and "Magnetic force created by electric currents", and acquire fundamental skills for observations, experiments, and other scientific activities.

(ii) Develop abilities to generate solution methods based on predictions and hypotheses, through investigating "Dissolution of substances", "Motion of pendulums", and "Magnetic force created by electric currents".

(iii) Develop attitudes toward active scientific problem-solving, through investigating "Dissolution of substances", "Motion of pendulums", and "Magnetic force created by electric currents".

(2) Life/the Earth

(i) Develop knowledge and understanding of "Continuity of life", "Function of water flow", and "Regularity of weather phenomena", and acquire fundamental skills for observations, experiments, and other scientific activities.

(ii) Develop abilities to generate solution methods based on predictions and

hypotheses, through investigating “Continuity of life”, “Function of water flow”, and “Regularity of weather phenomena”.

(iii) Develop attitudes to respect life and attitudes toward active scientific problem-solving, through investigating “Continuity of life”, “Function of water flow”, and “Regularity of weather phenomena”.

2. Content

A. Matter/Energy

(1) Dissolution of substances

Regarding the dissolution of substances, provide instructions to help pupils acquire the following items, while paying attention to the amount and conditions of the solute, through exploring activities in which pupils control conditions such as the temperature and amount of water.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.

(a) The total weight of water and a solute remains unchanged when the solute is dissolved in water.

(b) There is a limit to the amount of solute that can be dissolved in water.

(c) The solubility changes depending on the water temperature, the amount of water, and the kind of solutes. Moreover, using these properties, it is possible to extract solutes.

b. Develop abilities to generate and express solution methods, based on predictions and hypotheses about the regularity of how substances dissolve, through investigating the dissolution of substances.

(2) Motion of pendulums

Regarding the regularity of pendulum’s motion, provide instructions to help pupils acquire the following items, while paying attention to the time taken for a pendulum to swing back and forth, through exploring activities in which pupils control conditions such as the weight and the length of the pendulum.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.

(a) The time taken for a pendulum to swing back and forth does not change if the weight changes, but it does change when the length of the pendulum changes.

b. Develop abilities to generate and express solution methods, based on predictions and hypotheses about the conditions related to the time taken for a pendulum to swing back and forth, through investigating the regularity of pendulum's motion.

(3) Magnetic force created by electric currents

Regarding the magnetic force created by electric currents, provide instructions to help pupils acquire the following items, while paying attention to the magnitude and direction of electric currents and the number of turns in a coil, through exploring activities in which pupils control those conditions.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.

(a) A coil with an electric current magnetizes an iron core. When the direction of the electric current changes, the polarity of the electromagnet changes.

(b) The strength of an electromagnet changes depending on the magnitude of the electric current or the number of turns in the conducting wire.

b. Develop abilities to generate and express solution methods, based on predictions and hypotheses about conditions related to the magnitude of the magnetic force created by electric currents, through investigating the magnetic force.

B. Life/the Earth

(1) Germination, growth and fruition of plants

Regarding the growth of plants, provide instructions to help pupils acquire the following items, while paying attention to the conditions of germination, growth and fruition, through exploring activities in which pupils control those conditions.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.

(a) Plants germinate by using the nutrition in seeds.

(b) It is water, air and temperature that influence plant germination.

(c) Sunlight and fertilizer affect plant growth.

(d) Some flowers have stamen and pistil; when pollen sticks to the stigma of the pistil, its base develops into the fruit, and the seeds are produced in the fruit.

b. Develop abilities to generate and express solution methods, based on predictions and hypotheses about the germination, growth and fruition of plants and conditions pertaining to these, through investigating the growth of plants.

(2) Birth of animals

Regarding the development and growth of animals, provide instructions to help pupils acquire the following items, while paying attention to the conditions of eggs and fetuses in the context of raising fish and making use of data about the development of human, through exploring activities in which pupils relate them to the passage of time.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.

(a) There are male and female fish, and the inside of the laid eggs changes as days progress.

(b) Humans grow inside the mother until they are born.

b. Develop abilities to generate and express solution methods, based on predictions and hypotheses about the conditions and progress of animals' development and growth, through investigating their develolpment and growth.

(3) Function of water flow and change in ground surface

Regarding the function of water flow and the change in ground surface, provide instructions to help pupils acquire the following items, while paying attention to the speed and amount of water flow, through exploring activities in which pupils control those conditions.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.

(a) Flowing water can cause the ground to erode and it transports and deposits pebbles and soil.

(b) The size and shape of pebbles on the riverside differ depending on upstream or downstream.

(c) Depending on how it rains, the speed and the amount of water flow change, and the state of the land may change drastically due to increased water.

b. Develop abilities to generate and express solution methods, based on predictions and hypotheses about the relationship between the function of water flow and the change in ground surface, through investigating the function of water flow.

(4) Weather changes

Regarding how weather changes, in the process of observing the conditions of clouds and making use of meteorological information such as visual information, provide instructions to help pupils acquire the following items, while paying attention to the volume and movement of clouds, through exploring activities in which pupils relate them to weather changes.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.

(a) Changes in weather are related to the volume and movement of clouds.

(b) Changes in weather can be predicted using meteorological information such as visual information.

b. Develop abilities to generate and express solution methods, based on predictions and hypotheses about the relationship between weather change and the volume and movement of clouds, through investigating weather change.

3. Additional comments on handling the contents

(1) In teaching “A. Matter/Energy” in the Content, learning opportunities in which pupils make at least two kinds of learning materials must be provided.

(2) Regarding item (1) in “A. Matter/Energy” in the Content, it should be mentioned that solutes spread evenly in aqueous solutions.

(3) Item (1) in “B. Life/the Earth” in the Content should be dealt with as follows.

a. Regarding item a. (a), only starch should be dealt with as the nutrition in seeds.

b. Regarding item a. (d), stamen, pistil, calyx, and petals should be dealt with. With regard to pollination, it should be mentioned that wind and insects are related to pollination.

(4) Regarding item (2) a. (b) in “B. Life/the Earth” in the Content, the process of fertilization of human beings should not be dealt with.

(5) Regarding item (3) a. (c) in “B. Life/the Earth” in the Content, natural disasters should be mentioned.

(6) Regarding item (4) a. (b) in “B. Life/the Earth” in the Content, weather changes along with the pathway of typhoons, the relationship between typhoons and precipitation, and the natural disasters resulting from typhoons should be mentioned.

[Grade 6]

1. Objectives

(1) Matter/Energy

(i) Develop knowledge and understanding of “Mechanism of combustion”, “Properties of aqueous solutions”, “Regularity of a lever”, and “Properties and functions of electricity”, and acquire basic skills for observations, experiments, and other scientific activities.

(ii) Develop abilities to produce more valid ideas about those mechanisms and properties, regularities and functions, through investigating “Mechanism of combustion”, “Properties of aqueous solutions”, “Regularity of a lever”, and “Properties and functions of electricity”.

(iii) Develop attitudes toward active scientific problem-solving, through investigating “Mechanism of combustion”, “Properties of aqueous solutions”, “Regularity of a lever”, and “Properties and functions of electricity”.

(2) Life/the Earth

(i) Develop knowledge and understanding of “Body structures and functions of living things”, “Interaction of living things with the environment”, “Formation and change of land”, and “The moon phase and the positional relationship between the moon and the sun”, and acquire basic skills for observations, experiments, and other scientific activities.

(ii) Develop abilities to produce more valid ideas about their functions, interaction, variations and relationship, through investigating “Body structures and functions of living things”, “Interaction of living things with the environment”, “Formation and change of land”, and “The moon phase and the positional relationship between the moon and the sun”.

(iii) Develop attitudes to respect life and the attitudes toward active scientific problem-solving, through investigating “Body structures and functions of living things”,

"Interaction of living things with the environment", "Formation and change of land", and "The moon phase and the positional relationship between the moon and the sun".

2. Content

A. Matter/Energy

(1) Mechanism of combustion

Regarding the mechanism of combustion, provide instructions to help pupils acquire the following items, while paying attention to changes in the air, through activities in which pupils explore how materials burn using multiple approaches.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.

(a) When plants burn, oxygen in the air is used and carbon dioxide is produced.

b. Develop abilities to produce and express more valid ideas about changes in the air when materials burn, through investigating the mechanism of combustion.

(2) Properties of aqueous solutions

Regarding aqueous solutions, provide instructions to help pupils acquire the following items, while paying attention to solutes, through activities in which pupils explore the differences in the properties and functions of aqueous solutions caused by the solutes using multiple approaches.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.

(a) There are acid, alkaline and neutral aqueous solutions.

(b) Gas is dissolved in some aqueous solutions.

(c) Some aqueous solutions change the properties of metals.

b. Develop abilities to produce and express more valid ideas about the differences in the properties and functions caused by the solutes, through investigating the properties and functions of aqueous solutions.

(3) Regularity of a lever

Regarding the regularity of a lever, provide instructions to help pupils acquire the following items, while paying attention to the place or magunitude of an applied force,

through activities in which pupils explore the function of a lever using multiple approaches.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.

(a) When the place or magnitude of an applied force changes, the force to tilt the lever changes. When the lever is balanced, a certain regularity exists among them.

(b) Tools using this regularity of a lever can be found in everyday life.

b. Develop abilities to produce and express more valid ideas about the relationship among the place and magnitude of an applied force, and the function of a lever, through investigating the regularity of a lever.

(4) Use of electricity

Regarding electricity generation, electricity storage, and conversion of electricity, provide instructions to help pupils acquire the following items, while paying attention to the amount and functions of electricity, through activities in which pupils explore them using multiple approaches.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.

(a) Electricity can be generated and stored.

(b) Electricity can be converted into light, sound, heat, and movement.

(c) Tools using the properties and functions of electricity can be found in everyday life.

b. Develop abilities to produce and express more valid ideas about the relationship between the amount and functions of electricity, and about generation, storage, and conversion of electricity, through investigating the properties and functions of electricity.

B. Life/the Earth

(1) Structure and functions of human body

Regarding human and other animals, provide instructions to help pupils acquire the following items, while paying attention to body structures and the functions of

respiration, digestion, excretion and circulation, through activities in which pupils explore the functions to sustain life using multiple approaches.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.
    (a) Oxygen is taken into the body, and carbon dioxide and other gases are excreted from the body.
    (b) Food is digested and absorbed while it passes through the mouth, stomach and intestines, and unabsorbed food is excreted.
    (c) Blood travels through the body by the function of the heart, and transports nutrition, oxygen, and carbon dioxide.
    (d) There are a variety of organs in the body for sustaining vital activities.

b. Develop abilities to produce and express more valid ideas about body structures and the functions of respiration, digestion, excretion and circulation, through investigating the body structures and functions of human and other animals.

(2) Nutrition of plants and pathway of water

Regarding plants, provide instructions to help pupils acquire the following items, while paying attention to their body structures, the pathway of water and the function of creating nutrition in leaves, through activities in which pupils explore the functions to sustain life using multiple approaches.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.
    (a) When sunlight hits the leaves of plants, starch is produced in the leaves.
    (b) There are pathways of water in roots, stems and leaves, and the water taken up by the roots is mainly excreted by evaporation through the leaves.

b. Develop abilities to produce and express more valid ideas about body structures, the pathway of water, and the function of creating nutrition in leaves, through investigating the body structures and functions of plants.

(3) Living things and the environment

Regarding living things and the environment, in the process of observing the life of animals and plants and making use of data, provide instructions to help pupils acquire

the following items, while paying attention to the interaction of living things with the environment, through activities in which pupils explore them using multiple approaches.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.
    (a) The life of living things is closely related to the surrounding environment, through water and air.
    (b) There is eat-or-be-eaten relationship among living things.
    (c) Human interacts with the environment and devises better ways to live.
b. Develop abilities to produce and express more valid ideas about the interaction of living things with the environment, through investigating living things and the environment.

(4) Formation and change of land

Regarding the formation and change of land, provide instructions to help pupils acquire the following items, while paying attention to the land and the materials included in soil, through activities in which pupils explore formation and creation of land using multiple approaches.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.
    (a) Land is composed of materials such as gravels, sands, mud, and volcanic ashes, and some land has layers. Some layers contain fossil remains.
    (b) Geological strata are formed by the function of water flow and volcanic eruptions.
    (c) Volcanic eruptions and earthquakes change land formations.
b. Develop abilities to produce and express more valid ideas about the formation and creation of land, through investigating the formation and change of land.

(5) The moon and the sun

Regarding how the shapes of the moon are seen, provide instructions to help pupils acquire the following items, while paying attention to the positions of the moon and the sun, through activities in which pupils explore their positional relationship using

multiple approaches.

a. Develop knowledge and understanding of the following contents, and acquire skills for observations, experiments, and other scientific activities.

(a) The sun is located to the bright side of the moon. How the shapes of the moon are seen change depending on the positional relationship between the sun and the moon.

b. Develop abilities to produce and express more valid ideas about the relationship between the position and shapes of the moon and the position of the sun, through investigating how the shapes of the moon are seen.

3. Additional comments on handling the contents

(1) In teaching “A. Matter/Energy” in the Content, pupils must make at least two kinds of learning materials.

(2) With regard to item (4) a. (a) in “A. Matter/Energy” in the Content, hand-cranked generators, photocells, etc. should be dealt with as tools that generate electricity.

(3) Item (1) in “B. Life/the Earth” in the Content should be dealt with as follows.

a. With regard to item a. (c), it should be mentioned that there is a correlation between heart beats and pulsations.

b. With regard to item a. (d), the lungs, the stomach, small intestines, large intestines, liver, kidneys, and heart should be dealt with as major organs.

(4) Item (3) in “B. Life/the Earth” in the Content should be dealt with as follows.

a. With regard to item a. (a), it should be mentioned that water circulates.

b. With regard to item a. (b), small living things in water should be observed and it should be mentioned that they become food for fish, etc.

(5) Item (4) in “B. Life/the Earth” in the Content should be dealt with as follows.

a. With regard to item a. (b), conglomerates, sandstone and mudstone should be dealt with as rocks created by the function of running water.

b. With regard to item a. (c), natural disasters should be mentioned.

(6) With regard to item (5) a. (a) in “B. Life/the Earth” in the Content, the positional relationship between the sun and the moon should be dealt with using the view from the earth.

III. SYLLABUS DESIGN AND ADDITIONAL COMMENTS ON HANDLING THE

CONTENTS

1. In designing the syllabus, the following should be considered:
   (1) By overseeing the whole picture of contents and times in the units, provide instructions for realization of proactive, interactive, and authentic learning of the pupils in order to develop competencies that are focused on those units. When doing this, based on the characteristics of learning process in school science, enhance learning activities to scientifically solve problems such as observations and experiments with a comprehensive vision, using Approaches of science.
   (2) Regarding the development of the abilities to think, make judgments, and express themselves in each grade, the main abilities are described in the relevant grade. In teaching, the development of the abilities listed in the other grades should be considered sufficiently.
   (3) For pupils with disabilities or special needs, devise instructional contents and methods in a planned and organized manner which are tailed to difficulties that can occur while doing learning activities.
   (4) Based on the objectives of moral education listed in Subsection I. 2 (2) of Chapter 1 “General Provisions”, treat appropriately the content listed in Subsection II. of Chapter 3 “Special Subject Morality” in accordance with the characteristics of school science, considering the relationship to the subject of Morality.

2. In the handling of the content listed in Subsection II., the following should be considered:
   (1) Ensure that language activities are enhanced by placing importance on the following learning activities: a) generating questions and thinking about and explaining predictions and hypotheses, and methods of observations and experiments, and other scientific activities, b) organizing and discussing the results of observations and experiments, and c) thinking and explaining using scientific terms and concepts.
   (2) In giving instructions on observations, experiments, and other scientific activities, ensure that the pupils are able to appropriately make use of computers and telecommunications networks, etc. in association with the teaching content. Furthermore, when carrying out learning activities intended to help pupils acquire logical thinking ability while their experiencing the programming listed in Subsection III. 1 (3) b. of Chapter 1 “General Provisions”, while also taking into consideration the burden of the pupils, ensure that they think how the movement of an object is

controlled by given conditions and how the movement changes when the conditions are changed. For example, the activities mentioned above are incorporated with the contents of "A. Matter/Energy" (4) for [Grade 6] in Subsection II where pupils should learn the tools using the properties and functions of electricity.

(3) In giving instructions on living things, weather, rivers, and land, incorporate enough outdoor activities familiarizing pupils with nature and enough experiential activities. At the same time, help pupils develop attitudes to respect life and contribute to the conservation of the natural environment.

(4) In giving instructions on weather, rivers, and land, ensure that pupils acquire a basic understanding concerning disasters.

(5) Encourage every pupil to take initiatives in solving problems and enhance learning activities that are intended to make connections between their daily lives and other subjects and learning activities that are based on the ideas of setting up a purpose, measuring and controlling.

(6) Utilize museums and science learning centers actively by seeking partnership and cooperation with them.

3. In giving instructions on observations, experiments, and other scientific activities, sufficient care must be taken to prevent accidents. In addition, give due consideration to the development of the learning environment and ensure the appropriate treatment of the chemicals used in science classes.