Section 4 Science

I. OVERALL OBJECTIVES

To enable pupils to become familiar with nature and to carry out observations and experiments with their own prospectus, as well as to develop their problem-solving abilities and nurture hearts and minds that are filled with an affection for the natural world, and at the same time, to develop a realistic understanding of natural phenomena, and to foster scientific perspectives and ideas.

II. OBJECTIVES AND CONTENT FOR EACH GRADE

[Grade 3]

1. Objectives

(1) To develop perspectives and ideas about the properties and functions of weight, wind, force of rubber, light, and magnets and electricity through investigation comparing phenomena involving these matters, and through probing the identified problem and making learning material with interest.

(2) To foster an attitude of loving and protecting living things and to develop perspectives and ideas about the relationship between living things and the environment, the relationship between the sun and its effects on conditions on earth, through investigation comparing familiar animals and plants, and sunny and shady spots, as well as through probing the identified problems with interest.

2. Content

A. Matter/Energy

(1) Object and weight

To develop pupils' ideas about properties of objects by examining the weights and volumes, using objects such as clay.

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

b. Objects with the same volume may differ in weight.

(2) Function of wind and force of rubber

To develop pupils' ideas about wind and rubber by examining the phenomenon of wind and rubber moving objects.

a. The power of wind can move an object.

b. The force of rubber can move an object.

(3) Properties of light

To develop pupils' ideas about the nature of light by using mirrors and other devices and by exploring the way light travels and its brightness and warmth when it strikes an object.

a. Sunlight can be collected and reflected.
b. The brightness and warmth of sunlight changes when it strikes an object.

(4) Properties of magnet

To develop pupils' ideas about the properties of magnets, by exploring their functions and the objects that are attracted to them.

a. Some objects are attracted to a magnet and others aren't. Among those attracted to a magnet, some become magnetic when they are attached to a magnet.
b. Opposite poles of a magnet attract each other, whereas like poles repel each other.

(5) Pathway of electricity

To develop pupils' ideas about electric circuits by connecting a small bulb to a dry battery, and by exploring the connection path and the materials through which the electricity travels.

a. There are patterns of circuit connections that conduct electricity and others that don't.
b. There are materials that conduct electricity and others that don't.

B. Life/the Earth

(1) Insects and plants

To develop pupils' ideas about growth patterns and body structures by finding and raising familiar insects and plants, and by exploring the processes of their growth and body structure.

a. Insects grow in accordance with a fixed order of growth, and their body parts consist of the head, thorax and abdomen.
b. Plants grow in accordance with a fixed order of growth, and their body parts consist of roots, stems and leaves.

(2) Observation of familiar environment

To develop pupils' ideas about the relationship between living things and their surrounding environment through the

explorations of the conditions of familiar living things.

a. Living things are different in appearance, such as color, shape and size, etc.
b. Living things interact with their surrounding environment.

(3) The sun and the ground

To develop pupils' ideas about the sun and ground through the exploration of the changes in the position of shady spots and the difference between sunny and shady spot.

a. Shade is created by blocking sunlight, and the position of shady spots moves as the sun moves.
b. The sun warms the ground and there are differences in warmth and dampness between the sunny and shady spots.

3. Handling the Content

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

(2) With regard to item (1) in "B. Life/the Earth" in the Content, special consideration should be made as follows:

a. With regard to items a and b pupils must raise insects and grow plants.
b. With regard to item b, "Growth of Plants," only summer annual dicotyledonous plants should be used.

(3) With regard to item (3)-a, "movement of the sun" in "B. Life/the Earth," it should be regarded that the sun moves from east to west. In addition, the four directions: east, west, north, and south are dealt with when exploring the movement of the sun.

[Grade 4]

1. Objectives

(1) To develop perspectives and ideas about the properties and functions of objects, by investigating air, water, changes in the state of an object, and electrical phenomena, in relation to the functions of power, heat and electricity, and through probing the identified problem and making learning materials with interest.

(2) To foster an attitude to love and protect living things and to develop perspectives and ideas about the structure of the human body, the activities of animals/growth of plants, meteorology, and movement of

the moon and stars, by investigating them in relation to movement, seasons, temperature and time, through probing the identified problems with interest.

2. Content

A. Matter/Energy

(1) Properties of air and water

To develop pupils' ideas about the properties of air and water by exploring the changes in their volume and pressure in compressing air and water in a closed space.

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

b. Air in a closed space can be compressed, but water cannot be compressed.

(2) Metal, water, air and temperature

To develop pupils' ideas about the properties of metals, water and air, by exploring the changes in warming and cooling metals, water and air.

a. The volume of metals, water or air changes when heated or cooled.

b. The temperature of metals goes up gradually, spreading from the point being heated, but heated air and water move, raising the temperature of the whole.

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

(3) Function of electricity

To develop pupils' ideas about the functions of electricity, by exploring the functions of the dry battery and photocell in attaching them to small bulbs and motors.

a. The brightness and the rotation of a motor change as the number or circuit of dry batteries changes.

b. A photocell can rotate a motor.

B. Life/the Earth

(1) Structure and movement of the human body

To develop pupils' ideas about the relationship between the structure and movement of the human body, by exploring the movement of bones and muscles and by observing the movement of

humans and other animals or by using teaching materials.

a. The human body has bones and muscles.
b. The human body can move due to the functions of bones and muscles.

(2) Seasons and living things

To develop pupils' ideas about the relationship between seasons and animal activities and plant growth by finding and raising familiar animals and plants, and by exploring the activities of animals and the growth of plants in different seasons.

a. The activities of animals change depending on the season (warm/cold).
b. The growth of plants changes depending on the season (warm/cold).

(3) Weather conditions

To develop pupils' ideas about weather conditions and the change of water in natural world, by observing changes in temperature in a day and the process of the change from water to vapor, and by exploring changes in weather and temperature and the relationship between water and vapor.

a. The change in temperature in a day is different depending on 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 turn back into water drops (condensation).

(4) The moon and stars

To develop pupils' ideas about the characteristics and movement of the moon and stars, by observing the moon and stars, and by exploring the position of the moon and the color, brightness and position of stars.

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 cluster of stars does not change but the position of the cluster changes throughout the day.

3. Handling the Content

(1) In teaching “A. Matters/Energy” in the Content, pupils must make at least two kinds of learning materials.
(2) With regard to item (3)-a in “A. Matter/Energy” in the Content, both series circuit and parallel circuit should be dealt with.
(3) With regard to item (1)-b in “B. Life/the Earth” in Content, the function of joints should be dealt with.
(4) With regard to item (2) in “B. Life/the Earth” in 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) To develop perspectives and ideas about the regularity of change in objects and substances, by investigating the changes of dissolution of substances, the motion of pendulums, the change and function of electromagnets while focusing on the causes of their changes, and through probing the identified problems and making learning materials in a systematic fashion.

(2) To foster an attitude to respect life and to develop perspectives and ideas about the continuity of life, the function of running water, and the regularity of meteorological phenomena, by investigating the process of plant growth from germination to fruition, the birth and growth of animals, conditions of running water and weather changes while focusing on the factors such as condition, time, amount of water, natural disaster, through probing the identified problems in a systematic fashion.

2. Content

A. Matter/Energy

(1) Dissolution of substances

To develop pupils' ideas about the regularity of dissolution of substances, by dissolving substances in water, and by exploring the differences in dissolution according to water temperature or volume.

a. There is a limit to the amount of solute that can be dissolved in a solvent.
b. The solubility limits changes according to the temperature and amount of water or solutes. Moreover, using these properties, it

is possible to extract solutes.

c. The weight of water and a solute remains unchanged when the solute is dissolved in water.

(2) Movement of pendulums

To develop pupils' ideas about the regularity of the movement of pendulums, by using weights, and by exploring the movement of pendulums in changing the weight and the length of a thread.

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

(3) Function of electric currents

To develop pupils' ideas about the functions of electric currents, by passing an electric current through the conductive wire of an electromagnet and by exploring the change in strength of electromagnetic force.

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 strength of the electric current or the number of coils

B. Life/the Earth

(1) Germination, growth and fruition of plants

To develop pupils' ideas about the conditions of germination, growth and fruition by raising plants, and by exploring their germination, growth and fruition.

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.

(2) Birth of animals

To develop pupils' ideas about the formation and development of animals by raising fish and by using learning materials about the formation of humans, and by exploring the changes in the states of

eggs and small living things in water.

a. Fish have gender and the state of the inside of the discharged eggs changes as days go by.
b. Fish live off of small living things in water.
c. Humans grow inside the mother until they are born.

(3) Function of running water

To develop pupils' ideas about the relationship between the function of running water and the change in ground surface, by observing running water on the ground or rivers, and by exploring the difference in the function of speed and volume of running water

a. Running water has functions to cut into the ground, transport and pile up pebbles and soil.
b. The size and shape of pebbles on a riverside differ depending on if they are found upstream or downstream.
c. Depending on how it rains, the speed and the amount of running water change, and the state of the ground changes drastically due to swelling.

(4) Weather change

To enable pupils to develop ideas about weather change, by exploring the movement of clouds by observing the clouds of a day and by using visual information.

a. The volume and movement of clouds are related to changes in weather.
b. Changes in weather can be forecasted using meteorological information such as visual information.

3. Handling the Content

(1) With regard to "A. Matters/Energy" in Content, pupils must make at least two kinds of learning materials.

(2) With regard to item (1) in "B. Life/the Earth", special considerations should be made as follows:

a. With regard to item (1)-a, "nutrition within seeds," only starch should be dealt with.
b. With regard to item (1)-d, the coverage of lessons should be limited to stamen, pistil, calyx and petals. With regard to pollination, wind and insects should be dealt with.

(3) With regard to item (2)-c. in "B. Life/the Earth" in the Content, do not

deal with the process of fertilization.

(4) With regard to item (4)-b in "B. Life/the Earth" in the Content, weather change along with the pathway of typhoons and the relationship between typhoons and precipitation should be mentioned.

[Grade 6]

1. Objectives

(1) To develop perspectives and ideas about properties and regularity of materials by examining and reasoning the contributing factors and regularities of the phenomena caused by combustion, aqueous solution, levers, and electromagnets, and through probing the identified problems in a planned manner and making learning materials.

(2) To foster an attitude of respect for life and to develop perspectives and ideas about the physical functions of living things, interactions between living things and the environment, rules of changes formations of land, and position and characteristics of the moon, by exploring and reasoning the relationship between physical structures and functions of living things and environment, the formation and the change of land, and the moon and sun, and through probing the identified problems in a planned manner.

2. Content

A. Matter/Energy

(1) Mechanism of combustion

To develop pupils' ideas about the mechanism of combustion, by burning objects and by exploring the changes in them.

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

(2) Properties of aqueous solutions

To develop pupils' ideas about the properties and functions of aqueous solutions, by using various types of aqueous solutions, and by exploring their properties and how they change metals.

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

b. Gas is dissolved in some aqueous solutions.

c. Some aqueous solutions change the properties of metals.

(3) Regularity of a lever

To develop pupils' ideas about the regularity of a lever, by using

levers and changing the force points and strength, and by exploring the mechanism and functions of the lever.

a. The weight of two objects is the same when the objects are hooked at each end of a pole at an equal distance from a fulcrum and the pole is held level.
b. When the force point or strength changes, the power to tilt the lever changes. When the lever is balanced, a certain regularity exists among the force point, the strength and the power.
c. Tools using this regularity of a lever can be found in everyday life.

(4) Use of electricity

To develop pupils' ideas about the properties and the function of electricity, by using a generator, etc., and by exploring the ways to use electricity.

a. Electricity can be generated and stored.
b. Electricity can be transformed into light, sound, heat, etc.
c. The amount of heat generated by a heat wire depends on the thickness of the wire.
d. Tools using the properties and functions of electricity can be found in everyday life.

B. Life/the Earth

(1) Structure and functions of the human body

To develop pupils' ideas about the structure and function of the human body and other animals, by observing human beings and other animals and using learning materials, and by exploring the functions of respiration, digestion, excretion and circulation

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 intestine and the leftovers are excreted.
c. Blood travels through the body, is pumped through its course by the heart, and transports nutrition, oxygen and carbon dioxide.

(2) Nutrition of plants and pathway of water

To develop pupils' ideas about the structure and function of plants, by observing plants and by examining the pathway of water in plants and the function of creating nutrition in leaves.

a. When sunlight hits leaves, 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 mainly evaporates through the leaves.

(3) Living things and the environment

To develop pupils' ideas about the interaction between living things and the environment through exploration, such as observing the lives of animals and plants or using information materials.

a. The life of living things is closely related to the surrounding environment, through water and air.
b. Animals live in an eat-or-be-eaten world.

(4) Formation and change of land

To develop pupils' ideas about the formation and change of land, by observing the land and the matter included in soil, and by exploring the formation and creation of land.

a. Land is composed of gravels, sands, mud, volcanic ashes and rocks, and some land has layers.
b. Geological strata are formed by running water and volcanic eruptions; some contain fossil remains.
c. Volcanic eruptions change land formations.

(5) The moon and the sun

To develop pupils' ideas about the moon phases and the conditions of the surface, by observing the moon and the sun and by examining the location and the phases of the moon and the location of the sun.

a. The sun is located on the bright side of the moon. The moon phase changes depending on the positional relationship between the moon and the sun.
b. The condition of the moon's surface is different from that of the sun.

3. Handling the Content

(1) In teaching "A. Mattes/Energy" in the Content, pupils must make at least two kinds of objects.

(2) With regard to item (1) in "B. Life/the Earth," special considerations should be made as follows:

a. With regard to (1)-c, it should be mentioned that there is a

correlation between heart beats and pulsations.

b. With regard to (1)-d, lungs, the stomach, small intestines, large intestines, liver, kidneys, and heart should be dealt with as major organs.

(3) With regard to item (3)-a. in "B. Life/the Earth"-, it should be mentioned that water circulates.

(4) With regard to item (4) in "B. Life/the Earth," special considerations should be made as follows:

a. With regard to (4)-a, conglomerates, sandstone and mudstone should be dealt with as rocks.

b. Fossils in (4)-b should be dealt with as evidence that strata had been piled up by running water.

(5) Item (5)-a. in "B. Life/the Earth" should be dealt with as the positional relationship between the sun and the moon when viewed from the earth.

III. SYLLABUS DESIGN AND HANDLING THE CONTENT

1. In designing the syllabus, consideration should be given to the following:

(1) Some considerations should be given to consolidating scientific knowledge and concepts and to developing scientific perspectives and ideas by enriching observation, experiments, experience in nature and scientific experience in teaching the Content of each grade listed in Subsection II.

(2) Some considerations should be given to enrich activities that pupils can organize and in which they can examine the results of observations and experiments, and can think and explain natural events and phenomena by using scientific terms and concepts.

(3) Some considerations should be given to utilize museums and science centers actively by seeking partnership and cooperation with them.

(4) Based on the objectives of moral education listed in Subsection I-2 of Chapter 1 "General Provision" and Subsection I of Chapter 3 "Moral Education," instructions concerning the content listed in Subsection II of Chapter 3 "Moral Education" should be given appropriately. The instructions should be in accordance with the characteristics of science and should be related to the period for moral education.

2. In the handling of the content listed in Subsection II, consideration

should be given to the following:

(1) In giving instructions on observations, experiments, cultivation, raising animals and making learning materials; appropriate devices should be used, such as computers and audio-visual aids. In addition, special care must be taken to prevent accidents.

(2) In giving instructions on living things, weather, rivers and land; it is necessary to give pupils enough opportunities to go to the field and have experiential activities to familiarize them with nature, and at the same time, to help pupils develop an attitude of cherishing nature and contributing to the conservation of the natural environment.

(3) It is necessary to encourage every pupil to take initiatives in solving problems, to make connections between the outcomes of learning and everyday life, and to help them gain realistic understanding about natural events and phenomena.