PELANGI

Teacher's Guide

SCIENCE

Primary Education Smart+

Prathomsuksa

5

Based on the Basic Education Curriculum B.E. 2551
(Revised Edition B.E. 2560)

Contents

Preface

The learning standards of science based on the Basic Education Curriculum B.E. 2551 (revised Edition B.E. 2560) are divided into four main strands. They are:

Strand 1: Biology Science

Strand 2: Physical Science

Strand 3: Earth and Space Science

Strand 4: Technology

All the elements in this course including the contents, the teaching and learning activities, and the measurement and evaluation of the learning outcomes are very important to be coherent in order to lay a good strong foundation in the students in every level from Grade 1 to Grade 12.

Students not only need to know and understand the basic knowledge of science, but also to apply it in their daily life and hopefully when they further their studies in the disciplines of science. The contents of each strand are relevant and suitable for each level, neither too easy nor too difficult. There are also links between the knowledge, the learning process and learning activities that encourage students to develop thinking skills which include analytical, creative and critical thinking skills. Besides that, students are encouraged to develop science process skills and also the 21st century skills. These skills allow students to be long-life learners and succeed in this information age. For example, by knowing how to carry out researches and construct their own knowledge with the use of inquiry strategies, students can solve their problems systematically. They can make great decisions based on the various kinds of information and empirical evidences gathered.

Goals

The new teaching and learning of science focuses on students themselves, allowing them to discover the knowledge mostly by themselves. With their fundamental knowledge and the results from their scientific investigations, students can construct their own principles, conceptual ideas and understandings systematically.

The teaching and learning of science has the following important goals:

1. To understand principles, theories and rules that are fundamental in science.
2. To understand the nature of science and the limitations of science.
3. To have important skills for study, research and technological development.
4. To realize the relationship between science, technology, humanity and the environment in which they affect and influence each other.
5. To apply knowledge and understanding in science and technology in order to benefit the society and life.
6. To develop the process of thinking and imagination, and the ability to manage and solve problems with excellent communication and decision-making skills.
7. To be a scientist who upholds values, moral and ethics issues when applying scientific knowledge and technology wisely.

General Learning Outcomes in each Strand

This revised curriculum aims to provide the knowledge of science to students and focuses on the relation between the knowledge and the learning process. Students will develop important skills to carry out researches, construct the knowledge using the inquiry approach and solve a variety of problems. By having students participate in every stage of learning and doing various practical activities that suit each level, they will acquire the following general learning outcomes in each strand:

✧ Biology Science

Learning about life and living things, elements of living things, life processes, structures and functions of living things (how they live?), heredity, diversity of living things in the environment, the environment and the evolution of organisms.

✧ Physical Science

Learning about the nature of substances, changes in substances, motion, energy and waves.

✧ Earth and Space Science

Learning about the components of the universe, interactions within the Solar System, space technology, Earth system, geological changes and the processes of changes of the climate and their effects on organisms and the environment.

✧ Technology

- **Design and Technology**

Learning about the technology for living in the fast-changing society. Using knowledge and skills in science and mathematics creatively to solve problems and improve our life by applying the engineering processes. Choosing an appropriate technology with consideration for the impact on life, society and the environment.

- **Computer Science**

Learning about computational thinking, analytical thinking, systematic problem solving and the application of computer science, information technology and communication to solve the real life problems effectively.

Strands and Learning Standard

Strand 1: Biology Science

Standard 1.1: Understand the diversity of the ecosystem, the relationships between non-living things and living things, the relationships between organisms in the ecosystem, the energy transfer, the changes in the ecology, the meaning of population, the problems and impacts on the natural resources and environment, the guidelines for natural resource conservation and the environmental solutions including the applications of knowledge to benefit.

Standard 1.2: Understand the properties of organisms, the basic unit of life, the movement through cells, the relationships between structures and functions of different organ systems in animals and humans that work together, and the relationship between structures and functions of organ systems in plants that work together including the applications of knowledge to benefit.

Standard 1.3: Understand the processes and the importance of inheritance, the genetic materials, the genetic changes affecting organisms, biodiversity and the evolution of organisms including the applications of knowledge to benefit.

Strand 2: Physical Science

Standard 2.1: Understand the properties of matter, the component of matter, the relationships between the properties, structures and the energy bonds between particles, the principles and the nature of changes in the states of matter, the solution forming and the chemical reactions.

Standard 2.2: Understand the nature of forces in everyday life, the effects of forces on objects and the various kinds of movements of objects including the applications of the knowledge to benefit.

Standard 2.3: Understand the meaning of energy, the transition and transfer of energy, the interaction between matter and energy, energy in everyday life, the nature of waves, and the phenomena related to sound, light and electromagnetic waves including the applications of knowledge to benefit.

Strand 3: Earth and Space Science

Standard 3.1: Understand the components, the characteristics, the processes of forming and the evolution of the universe, the galaxy, the stars and the Solar System including the interactions within the objects in the Solar system that affects the organisms and the applications of knowledge to benefit.

Standard 3.2: Understand the components and relationships of the Earth's systems, the changes on the Earth's surface and inside the Earth, geohazards and the changes on the climate including the impacts on the organisms and environment.

Strand 4: Technology

Standard 4.1: Understand the key concepts of technology for living in a rapidly changing society, the applications of knowledge and skills in science and mathematics creatively to solve problems and improve our life with the engineering design processes and the selection of appropriate technology with consideration for the impact on life, society and the environment.

Standard 4.2: Understand and apply computational thinking in solving real life problems systematically, and use information technology and communication to learn, work, and solve problems effectively, knowingly and ethically.

Learners' Quality of Grade 6 students

- Understand the general characteristics of living things and life of living things around us.
- Understand structure, particular characteristics and adaptation of organisms including the relationship of organisms in the habitat. The functions of various parts of the plant and the function of the human digestive system.
- Understand the properties and classifications of materials, state and the changing state of matter, dissolution, chemical change, reversible and irreversible changes and a simple separation.
- Understand the characteristics of gravity, resultant force, friction force, electric force and the effects of various kinds of forces, the results of forces acting on an object, pressure, principle (of force acting) on the object, simple circuit and the basis knowledge of sound and light phenomena.
- Understand the phenomenon of rise and fall including the changing of the appearances of the moon's phases, the components of the Solar System, orbital period of the planets, the differences of planets and stars, the rise and fall of the star cluster, using star map, eclipse and the development and benefits of space technology.
- Understand the characteristics of the water source, the water cycle, the formation of cloud, mist, dew, frost, precipitation, rock formation, rock cycle, the use of rocks and minerals, fossils formation, the formation of wind, sea breezes, monsoons, features and impacts of natural disasters, geohazard and the causes and effects of greenhouse gases.
- Find information effectively and evaluate credibility, decide to select information based on logical reasoning to solve problems, use

information and communication technology to work together, understand your rights and duties, and respect other people's rights.

- Ask questions or impose problems about subject to learn as given or from their own interest, predict multiple answers, create a hypothesis corresponding to the question or problem that is investigated. Plan, survey and investigate by using appropriate tools and information technology in order to collect both quantitative and qualitative data.
- Analyze, conclude and summarize the relation of information derived from survey and investigation by using the proper model in order to communicate the results of the survey with references reasonably.
- Show the interest and determination to learn the subject, be creative in studying the subject of their own interests, show their own opinions, accept the reliable information with available references and listen to other people's opinions.
- Take responsibility with committed work determinedly, carefully, economically, honestly until the work is accomplished and work with others creatively.
- Realize the value of the knowledge of science and technology, apply knowledge and scientific process in living, admire, praise and respect the rights of the inventor and learn more, carry out a project or piece of work as assigned or from their own interest.
- Appreciate, gratitude, and concern, show the behavior of usage and care natural resources and environment worthily.

Yearly Teaching Plan

Science Prathomsuksa 5 (Grade 5)

7 chapters 80 hours

Learning areas	Time (hours)
1. Living Things and the Environment • Animal and plant adaptations • Interdependence among living things • Interactions between living and non-living components • Environmental protection	16
2. Heredity • Heredity	6
3. Changes in Matter • Physical changes • Chemical changes	16
4. Forces • Resultant force • Friction	12
5. Sound • How does sound travel? • Pitch and loudness of sound • Noise	10
6. Stars • Stars and planets • Constellations	8
7. Water • Water sources • Conservation of water • Natural phenomena involving water	12

Note: The hours needed for each subtopic can be changed when necessary. The above allocated hours are just a suggestion. The total number of hours for this subject is as prescribed in the basic learning time structure, while the learners must attain the standard as prescribed in the learning standards and indicators.

Chapter 1 Living Things and the Environment

Time: 16 hours

Strand 1: Biology Science

Standard Sc.1.1

Indicator

Sc.1.1 Gr.5/1. Describe the structure and characteristics of organisms that are suitable for living as a result of the adaptation of organisms in each habitat.

Sc.1.1 Gr.5/2. Describe the relationship between living things and living things and the relationships between living things and non-living things for the benefit of their livings.

Sc.1.1 Gr.5/3. Write a food chain and identify the role of living organisms which are producers and consumers in the food chain.

Sc.1.1 Gr.5/4. Realize the value of the environmental by taking part in environmental protection.

Introduction:

Plants and animals respond to stimuli. Both of them have structures and characteristics which can help them to adapt to the environment in order to live and survive in their environment.

The relationship between the producers and the consumers is called a food chain. A food chain always starts with green plants. A food web consists of two or more food chains linked together. Decomposers such as bacteria and fungi break down dead animals and plants into simpler substances.

Everything surrounding a living thing that affects how it lives is called its environment. The environment of a living thing includes the living and non-living components it comes into contact with.

Learning objectives:

Students will be able to:

- Explain the terms related to adaptations of organisms in their habitats.
- List examples of living things with adaptations and their advantages.
- Explain the structures and characteristics of plants and animals for adaptation.
- Describe the relationships among living things and the relationships between living things and non-living things for their benefits.
- Describe food webs and food chains.
- Describe how a change affects a food chain.
- Explain the importance of humans taking part in environmental protection.
- Give examples of how to take part in environmental protection.

Competency:

Communication skill, thinking skill, problem solving skills, applying life skills, technological application skill

Concept:

Organisms, both plants and animals have special structures and characteristics to help them to survive in their environment.

In any habitat, every organism has relationships with each other and with the non-living things for their survival. As some living things can make their own food and some relay on others for food, they can be identified as producers and consumers in food chains and food webs.

Start up:

1. Talk about plants or animals which are extinct. Teacher may use the following questions;
   - What does extinct mean?
   - What animals are extinct?
   - Why do animals become extinct or endangered?
2. Assess students' prior knowledge by asking what they knew (Part K) and what they want to know (Part W) on page 1.

Teaching/Learning activities:

1st – 4th hours (Animal and plant adaptations)

1. Have students carry out Let's Try activity on pages 2 and 3 in order to find out whether organisms have different structures and characteristics to survive in their habitats.
2. Explain that every organism has specialized structures and characteristics to help it to survive in its habitat which called "adaptation". Refer to page 3.
3. Teacher shows more examples of plant adaptations. Refer to pages 3 and 4.
4. Ask students to answer the question in Let's Think on page 4. Also ask students to compare the characteristics of plants living in our forest and those living in cold places such as Greenland.
5. Teacher shows more examples of animal adaptations. Ask students to think about tropical animals and their adaptations. Refer to pages 5 and 6.
6. Assign students to search for more information on animal adaptations. Refer to Let's Find Out on page 6. Then, discuss in class.
7. Explain more about camouflage. Give examples of how camouflage helps living things to survive. Refer to page 7.

5th – 8th hours (Interdependence among living things)

1. Ask students to read the text on pages 8 and 9. Ask them to underline the terms in dark blue with red pen such as producers, consumers, herbivores, carnivores, omnivores and food chain. Ask them to describe those terms and give an example each.
2. Give a few examples of food chains. Ask students to list and explain the food chains found in their local areas or found in rivers and grasslands. Lead them to discuss the factors which can affect the food chains.
3. Carry out Let's Try activity on page 10 to understand that food chains can be interconnected. Discuss and conclude that some food chains are related and can be combined to make a food web. Ask them for the reasons why food chains are interconnected.
4. Ask students to compare between a food chain and a food web. Refer to Let's Think on page 11.
5. Then, ask them to analyze and discuss the food web shown on page 12. Assign some students to construct a food chain consisting six types of organisms based on that food web. Refer to Let's Think on page 12.
6. Referring to page 12, explain how a food chain is disturbed when there are some changes to one of its components. Write an example of food chain and ask students to predict what happens when one of its components is reduced or increased.
7. Explain *decomposer*. Refer to page 13. Explain the importance of decomposers.
8. Ask students to predict the scenario if there are no decomposers on the Earth. What will happen? Refer to Let's Know More on page 13.
9. Explain the relationships between plants and animals. Refer to pages 14 and 15.
10. Discuss if plants depend on animals to disperse their seeds. Give examples. Refer to Let's Think on page 15.

9th – 12th hours (Interactions between living and non-living components)

1. Explain what environment is. Refer to page 16.
2. Let's students carry out Let's Try activity on page 16 in order to find out if organisms interact with non-living components of the environment.
3. Water and sunlight are important to all living things. Discuss with students how living things ensure they get the suitable amount of water and sunlight. Refer to pages 17 and 18.
4. Guide student to think and discuss that some animals do not like sunlight and they hide themselves from sunlight. Ask them to answer the question in Let's Think activity on page 18.
5. Air (oxygen), temperature and soil are important to living things, both plants and animals. Discuss how some living things ensure they get the suitable amount of oxygen, temperature and soil in some harsh environments. Refer to pages 19 to 21.

13th – 15th hours (Environmental protection)

1. Explain that all living things depend on the environment to survive. Any changes in the environment will affect the lives of living things, including us. Refer to pages 22 and 23. Deforestation, poaching and pollutions have great negative impacts on living things. Ask them for more such examples.
2. Explain the principles of 3R's. Guide them what they can do in order to conserve and reserve the environment. Refer to pages 23 and 24.
3. Ask students to share their experiences in applying 3R's in their daily life.
4. Give a few examples of how the growing population affects the environment. Humans also can change the environment. Explain briefly. Then, ask students to find out other factors that pollute our environment and threaten the survival of living things. Assign them to do a poster and share their finding. Refer to Let's Find Out on page 24.

5. Have students to do the questions on pages 6 to 14 of the Workbook as their homework.

16th hour (Conclusion)

1. Wrap up the class by using the following sample questions:
   (a) What are the adaptations of plants and animals that help them to live and survive in their environments?
   (b) What are the relationships among living things and between living things and non-living things for their survival?
   (c) What is a food chain?
   (d) What is a food web?
   (e) What is an environment? Why is it so important to living things especially human beings?
   (f) What are the effects of increasing populations on the environment?
   (g) What are the natural and man-made factors that change the environment?
   (h) Can we protect our environment? How?
2. To test their understanding of this chapter, have students fill in the blanks in Part L column on page 25.
3. Encourage them to watch a video by scanning the QR code on page 25.
4. Guide the whole class to discuss what they want to know more about living things and the environment in Part W column on page 26.
5. Use the Mind Map on page 26 to help students to understand the relationships between all the subtopics learnt in this chapter.
6. Ensure students understand the terms used in this chapter by referring to the Glossary.
7. Have students to do the questions in Mastery Practice on pages 15 to 20 of the Workbook as their homework.

Learning materials:

- Primary Education Smart Plus Science Textbook Prathomsuksa 5
- Primary Education Smart Plus Science Workbook Prathomsuksa 5

Assessment:

1. Assessing cognitive behavior; test on page 25 (Part L)
2. Assessing affective behavior; (refer to Scoring Rubric for Affective Domain)
3. Assessing thinking process; (refer to Scoring Rubric for Scientific Thinking)

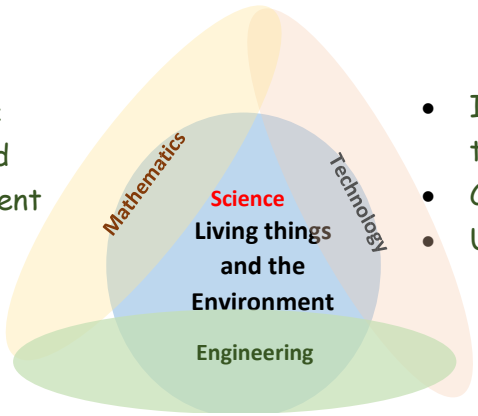
STEM Activity

Overview

In this lesson, students will learn more about ecology which is the study of the interactions between living things and their environment. Nowadays, it is a popular idea of building a biodome to study the behaviors and interactions of the living things. Students will find more information about a dome and its characteristics. They will use the engineering design process to create the dome with a height of 30 cm.

Subjects Integration

- Geometric shapes and measurement



- Information and communication technology
- Construct simple structures
- Using tools

Engineering design process

Time: 4 hours

Start up:

1. Divide students into team of 3 or 4.
2. Review their understanding about engineering design process by using the suggested questions:
   (a) What is *engineering design process*?
   (b) What are the purposes of the engineering design process?
   (c) Who use the engineering design process?

Lesson development:

1. Students read the situation on page 27. Then, the whole class discusses and identifies the problem by answering the following questions:
   (a) What is the problem of this situation?
   (b) What are our missions?
   (c) What do you need to know to get started?
2. Enhance students to explore and make connections between science, technology, engineering and mathematics by posing the following sample questions:
   (a) What is a dome? Why do engineers build a dome?
   (b) What does a dome look like?
   (c) What are the advantages of a dome?
   (d) How do you get further information about the dome?
   (e) What is the geometric shape of a dome?
   (f) Does the shape of a dome look like a hemisphere?
   (g) Can you use tiny triangles to make a hemisphere?
   (h) What materials should you consider?
   (i) How can we report our experiment results? What type of chart is used?
3. Ask students to think about how to assess their project. Discuss in class and set their criteria by using the following questions:
   (a) What are the success criteria? (height = 30 cm)
   (b) How can you conclude if your product is successful or a failure?
4. Students brainstorm and draw their designs. Then, let them follow their plans and create. (Teacher may ask each group to present some brief ideas before they start so that teacher can give some suggestions for their possible solution or prevent trial and error.)
5. After they finish their mission, ask them test their product by using the criteria in #3. Teacher may use these following questions:
   (a) What works or what does not work?
   (b) How will you modify your solution to make it better?

6. Let them improve their design. (Teacher can skip this step if you do not have enough time.)
7. Each group prepares and presents their creative work and explains their journey of creating.

Conclusion:

1. Each group presents their ideas and results. Teacher should encourage peers to ask or give some comments.
2. End the lesson by asking the students:
   (a) What are pros and cons of your products?
   (b) Did you learn anything from this activity? Explain more.
   (c) Do all of you have the same or different ideas? Why or why not?

Assessment:

Refer to Scoring Rubric for STEM Activities.

Chapter 2 Heredity

Time: 6 hours

Strand 1: Biology Science

Standard Sc.1.3

Indicator

Sc.1.3 Gr.5/1. Describe the genetic characteristics that are passed from parents to the offspring of plants, animals and humans.

Sc.1.3 Gr.5/2. Show curiosity by asking questions about their similarities to their parents.

Introduction:

Heredity is the passing on of characteristics from one generation to the next. This is why offspring look like their parents.

Learning objectives:

Students will be able to:

- Explain that heredity is the passing on of characteristics from parents to young.
- Identify the characteristics or traits that are passed on.
- Observe and ask questions about their similarities to their parents.

Competency:

Thinking skill, applying life skills, technological skills

Concept:

All living organisms reproduce in order to increase their numbers. They pass on their genetic traits to the offspring, differentiating them from other organisms. Due to heredity, different types of plants have different characteristics of leaves and colors of the flowers. Different animals have different characteristics such

as the colors of feathers, shapes of feathers and shapes of ears. Humans have traits such as presence of widow's peak, presence of dimples, presence of eyelids, ability of rolling tongue and presence of ear lobes.

Start up:

1. Talk about the similarities among family members of students. Teacher may show them some pictures of family of dogs or cats and use this following questions:
   (a) Can you observe some similarities among these animals? What are they?
   (b) Why do the offspring look similar to their parents?
2. To assess the students' prior knowledge, ask them what they knew (Part K) and what they want to know (Part W) on page 29.

Teaching/Learning activities:

1st – 5th hours (Heredity)

1. Have students carry out Let's Try activity on page 30 in order to find out whom they look like.
2. Explain that heredity is the passing on of traits from one generation to the next generation. Refer to pages 31 and 32.
3. Ask students to predict what would happen to the organisms if they do not reproduce. Refer to page 33. Explain more about *extinct*.
4. Talk about Gregor Mendel by referring to Let's Know More on page 33. Teacher may assign students to search for more information and share in class.
5. Explain the physical traits that are inheritable in humans. Refer to pages 34 and 35. Teacher may assign students to observe these physical traits among their family members.

6. Ask students to think if other characteristics such as dyed hair, scars and handwriting can be passed on from parents to offspring. Why? Refer to the Let's Think activity on page 35.
7. Have students carry out Let's Try activity on page 36 in order to find out whether animals pass on their traits to their offspring.
8. Explain more about heredity in animals. Refer to pages 37 to 39.
9. Have students carry out Let's Try activity on pages 40 and 41 in order to find out whether plants pass on their traits to their offspring.
10. Explain more about heredity in plants. Refer to pages 42 and 43.
11. Have students do the questions on pages 25 to 28 of the Workbook as their homework.

6th hour (Conclusion)

1. Wrap up the class by using the following sample questions:
   (a) What is heredity? Do all living things pass on their genetic traits?
   (b) Why is heredity important in living things?
   (c) What are the advantages and disadvantage of heredity in living things?
   (d) Do animals and plants have genetic transmission when they undergo artificial reproduction techniques?
2. To test their understanding of this chapter, have students fill in the blanks in Part L column on page 44.
3. Encourage them to watch a video by scanning the QR code on page 44.
4. Guide whole class to discuss what they want to know more about heredity in Part W column on page 45.
5. Use the Mind Map on page 45 to help students to understand the relationships between all the subtopics learnt in this chapter.
6. Ensure students understand the terms used in this chapter by referring to the Glossary.

7. Have students to do the questions in Mastery Practice on pages 29 to 33 of the Workbook as their homework.

Learning materials:

- Primary Education Smart Plus Science Textbook Prathomsuksa 5
- Primary Education Smart Plus Science Workbook Prathomsuksa 5

Assessment:

1. Assessing cognitive behavior; test on page 44 (Part L).
2. Assessing affective behavior (refer to Scoring Rubric for Affective Domain).
3. Assessing thinking process (refer to Scoring Rubric for Scientific Thinking).

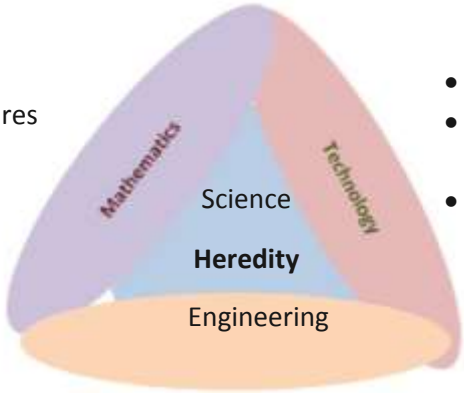
STEM Activity

Overview

This activity allows students to search for more information via the Internet in order to choose a type of dinosaur and create models of a family of dinosaurs and the environment they lived in using recycled materials. Teacher can challenge and give each group different conditions such as their reproduction methods (lay eggs or give birth to live young) and their food.

Subject Integration

- 3 dimensions figures
- Data collection



- Using simple tools
- Construction simple device
- Searching information

Engineering design process

Time: 5 hours

Start up:

1. Divide students into groups of 3 or 4.
2. Review their understanding of the engineering design process by using these suggested questions:
   (a) What is STEM education?
   (b) What was the engineering design process that you use in the previous STEM activity?
   (c) Why did each group come up with different designs?

Lesson development:

1. Review their understanding of heredity by using these suggested questions:
   (a) What is *heredity*?
   (b) Why is heredity important to living things?
2. Students read the situation on page 46. Then, teacher asks and leads the whole class to discuss in order to identify the problem. Teacher may use these sample questions:
   (a) What is the problem of this situation?
   (b) What are our missions?
   (c) What do you need to know to get started?
3. Enhance students to explore and make connections between science, technology, engineering and mathematics by posing the following sample questions:
   (a) What are the basic needs of the animals?
   (b) What are the characteristics of dinosaurs that help them to adapt in the environment?
   (c) Do animals choose their habitats base on their needs? How?
   (d) Within each dinosaur groups, are there any similarities and differences in their habitats? Explain.
   (e) How do we search for more information of dinosaurs?
4. Ask students to think about how to assess their project. Discuss in class and set their criteria with the following questions:
   (a) What are the success criteria? (a family of dinosaurs, the young and adults, the environment built from recycled materials, etc.)
   (b) How do we assess our work? (finish on time, clear and correct explanation)
5. Students brainstorm and draw their designs. Then, let them follow their plans and create. (Teacher may ask each group to present some brief ideas

before they start so that teacher can give some suggestions for their possible solution or prevent trial and error.)

6. After they finish their mission, ask them to test their product by using the criteria in #4. Teacher may use the following questions:
   (a) What works or what does not work?
   (b) How will you modify your solution to make it better?
7. Let them improve their design. (Teacher can skip this step if you do not have enough time.)
8. Each group prepares and presents their creative work and explains their journey of creating.

Conclusion:

1. Each group presents their ideas and results. Teacher should encourage peers to ask or give some comments.
2. End the lesson by asking the students:
   (a) How does your prototype look like?
   (b) What are the criteria that your group meet or do not meet? How did you know? What are the steps of your design?
   (c) Do all of you have the same ideas? Why or why not?

Assessment:

Refer to Scoring Rubric for STEM Activities.

Chapter 3 Changes in Matter

Time: 16 hours

Strand 2: Physical Science

Standard Sc.2.1

Indicator

Sc.2.1 Gr.5/1. Describe the changing in the states of matter when the substance is heated and cooled using empirical evidence.

Sc.2.1 Gr.5/2. Explain the solubility of the substance in water using empirical evidence.

Sc.2.1 Gr.5/3. Analyze the change of a substance when chemical changes using empirical evidence.

Sc.2.1 Gr.5/4. Analyze and identify reversible and irreversible changes.

Introduction:

Everything around us is made of matter. Heat causes changes in the states of matter. Matter can change its states through freezing, melting, evaporation and condensation. Some processes such as burning and rusting produce new substances. Solutions usually can be separated.

In this chapter, you will guide students to learn about matter and its properties. Students will also learn about two types of changes, namely physical change such as changes of states of matter and chemical change such as burning. They also study how solution can be separated using some methods. In addition, they will know that a chemical change is an irreversible change.

Learning objectives:

Students will be able to:

- Explain that there are two types of changes in matter.
- State that heat causes changes in states of matter.
- Experiment and conclude that changing states of matter is a physical change.
- Experiment and conclude that when a substance is mixed with water, it is known as a solution.
- Experiment and conclude that a chemical reaction occurs when the substance undergoes changes and produces a new substance.
- Explain and give examples of reversible and irreversible changes.

Competency:

Communication skill, thinking skill, applying life skills, problem solving skills, technological application skill

Concept:

Changes in the states of matter are a physical change. By increasing heat to a solid substance, it changes its state into a liquid. This process is known as melting or fusion. When it is heated to the next level, the liquid turns to a gas and this process is known as boiling or vaporization. However, when heat is lost from the gas to a certain level, it will change to its liquid state. This process is known as condensation. If the heat is lost to a certain level, the liquid will change to its solid state and this process is known as freezing or solidification.

Some substances can change from its solid state to its gaseous state without passing through its liquid state. This process is known as sublimation. Some

gases can change into their solid states without passing the liquid state. This process is called deposition.

When mixing a substance with water and the substance blends homogeneously with the water, the product is known as a solution.

Changes in states of mater and dissolving a substance in water are examples of physical changes. There are no new substances produced.

When a mixture of two or more substances produces a new substance, this change is known as a chemical change. It can be observed from the changing color or odor, or the appearance of gas bubbles or sludge, or an increase or decrease in temperature.

Some changes that occurred in a substance can be reversed. Such changes are known as a reversible change. Irreversible changes are changes that cannot be reversed.

Start up:

1. To assess the students' prior knowledge, ask them what they knew (Part K) and what they want to know (Part W) on page 48.
2. Let students observe a glass of water with ice cubes and ask them the following questions: (answers may vary)
   (a) What is formed on the outer part of the glass?
   (b) What will happen to the ice cubes in the water after a while?
   (c) How do we change the water back into ice?

Teaching/Learning activities:

1st – 10th hours (Physical changes)

1. Substances can be changed. They are taking place around us all the time. Refer to page 49. Ask students to give some examples of changes in their daily life.
2. Have students carry out Let's Try activity on pages 49 and 50 to understand what happens in some physical changes.
3. Explain more about physical change. Ask students to give examples of physical changes around them.
4. Heat causes the changes in states of matter which are physical changes. Explain the key words in changing state of matter such as
   - melting or fusion
   - freezing or solidification
   - boiling or vaporization
   - condensation
   - water vapor
   - evaporation
   - frost
   - deposition
   - sublimation

   Refer to pages 51 and 52. Randomly, select some students and ask them to state the meanings of those terms.
5. Besides being physical changes, changes in states of matter are also reversible changes. Refer to pages 52 and 53. Ask students how to change water from one state to another. Ask students to give more examples of reversible change.

6. Have students carry out Let's Try activity on pages 53 and 54 to understand what happens when a substance is mixed with water. Some can dissolve but some cannot dissolve.
7. Explain that a solution is a homogeneous mixture that has a uniform appearance and composition throughout. In the process of dissolving salt in water, no new substance is formed. Therefore, dissolving salt in water is a physical change. Refer to page 54.
8. Have students carry out Let's Try activity on page 55 to understand how we get the salt from a salt solution. Discuss and ask students to name the changing states of matter and conclude this process.
9. Recall about reversible change. Explain that not all physical changes are reversible. Some are irreversible changes. Refer to pages 56 and 57.
10. Engage students to think about reversible and irreversible changes. Assign students to do Let's Think activity on page 57. Share their ideas and discuss in class.

11th – 15th hours (Chemical changes)

1. Have students carry out Let's Try activity on pages 58 and 59 to understand chemical change.
2. Explain that chemical changes produce new substances and are irreversible changes. Refer to page 59.
3. Ask students to give some examples of irreversible changes. Refer to page 60.
4. Have students to do the questions on pages 37 to 39 of the Workbook as their homework.

16th hour (Conclusion)

1. Wrap up the class by using the following sample questions:
   (a) What is a physical change? What is a chemical change? Give some examples.
   (b) How does a physical change differ from a chemical change?
   (c) What causes the changing in states of matter?
   (d) What is a reversible change? What is an irreversible change? Give some examples.
   (e) How does a reversible change differ from an irreversible change?
2. To test their understanding of this chapter, have students fill in the blanks in Part L column on page 61.
3. Encourage them to watch a video by scanning the QR code on page 61.
4. Guide the whole class to discuss what they want to know more about changes in matter in Part W column on page 62.
5. Use the Mind Map on page 62 to help students to understand the relationships between all the subtopics learnt in this chapter.
6. Ensure students understand the terms used in this chapter by referring to the Glossary.
7. Have students to do the questions in Mastery Practice on pages 40 to 45 of the Workbook as their homework.

Learning materials:

- Primary Education Smart Plus Science Textbook Prathomsuksa 5
- Primary Education Smart Plus Science Workbook Prathomsuksa 5

Assessment:

1. Assessing cognitive behavior; test on page 61 (Part L).
2. Assessing affective behavior (refer to Scoring Rubric for Affective Domain).
3. Assessing thinking process (refer to Scoring Rubric for Scientific Thinking).

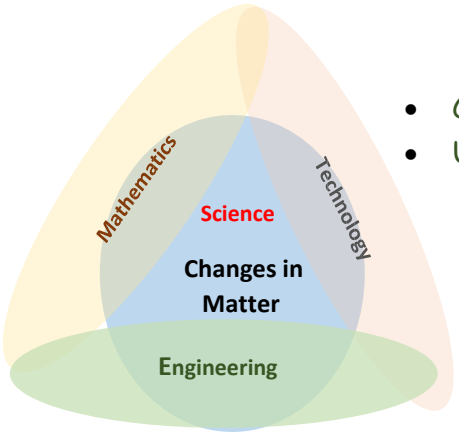
STEM Activity

Overview

This lesson will extend students' concept of how materials change when heat is applied. Melting is a physical change whereby a substance changes from its solid state into its liquid state. The activity will challenge students to their real life situation of how to prevent ice from melting. They will find out what materials can prevent ice from melting.

Subject integration

- Time
- Size



- Construct simple structures
- Using tools

Engineering design process

Time: 4 hours

Start up:

1. Divide students into groups of 3 or 4.
2. Review about engineering design process and technology by asking some of these sample questions:
   (a) How does technology impact our daily life?
   (b) What are the advantages of using engineering design process to create something?

Lesson development:

1. Students read the situation on page 63. Then, whole class discusses and identifies the problem by answering the following questions:
   (a) What is the problem of this situation?
   (b) What are our missions?
   (c) What do you need to know to get started?
2. Enhance students to explore and make connections between science, technology, engineering and mathematics by posing these following questions:
   (a) What is the average temperature in our country?
   (b) What are the purposes of the ice?
   (c) Why do we want to keep the ice cool as long as possible?
   (d) What unit of time is suitable for measuring the time in this activity, seconds or minutes?
   (e) What materials can be used to prevent the ice from melting?
3. Ask students to think about how to assess their project. Discuss in class and set their criteria by these following questions:
   (a) What are the success criteria? (time, etc.)
4. Students brainstorm and draw their designs including label materials. Then, let them follow their plans and create. (Teacher may ask each group to present some brief ideas before they start so that teacher can give some suggestions for their possible solution or prevent trail and errors.)
5. After they finish their mission, ask them test their product by using the criteria in #3. Teacher may use these following questions:
   (a) What works or what does not work?
   (b) How will you modify your solution to make it better?
6. Let them improve their design. (Teacher can skip this step if you do not have enough time.)

7. Each group prepares their creative work and explains their journey of creating.

Conclusion:

1. Each group presents their ideas and results of testing. Teacher should encourage peers to ask or give some comments.
2. End the lesson by asking students:
   (a) What did you do when you faced a problem?
   (b) What process that you use for creating or designing in this activity? How?
   (c) Did every group come up with the same design? Why not?

Assessment:

Refer to Scoring Rubric for STEM Activities.

Chapter 4 Forces

Time: 12 hours

Strand 2: Physical Science

Standard Sc.2.2

Indicator

Sc.2.2 Gr.5/1. Describe how to find the resultant force of many forces acting on static objects on the same plane from empirical evidence.

Sc.2.2 Gr.5/2. Write a diagram showing the forces acting on the object on the same plane and the resultant force acting upon the object.

Sc.2.2 Gr.5/3. Use spring scales to measure the forces acting on the object.

Sc.2.2 Gr.5/4. Identify the effect of friction on the changes of an object's motion from empirical evidence.

Sc.2.2 Gr.5/5. Write a diagram showing the friction and force acting on the object on the same plane.

Introduction:

A force is a push or a pull. We can use a spring balance to measure the strength of a force. An object subjected to a few forces will move based on the resultant force or the combined force.

Friction is the force that opposes the motion of an object. Friction depends on the roughness of the contacting surfaces and the weight of the object.

Learning objectives:

Students will be able to:

- Find and collect data regarding the resultant force of many forces acting on static objects on the same plane.
- Write a diagram showing the forces acting on the object on the same plane and the resultant force acting upon the object.
- Identify the effects of a resultant force on an object and measure the strength of a force.
- Use spring scales to measure the forces acting on the object.
- State the factors affecting friction.
- Write a diagram showing the friction and forces acting on the object on the same plane.

Competency:

Thinking skill, applying life skills, technological application skill

Concept:

The resultant force is the sum of the forces acting on an object. The resultant force of the two forces acting on an object is equal to the sum of the two forces when the two forces are on the same plane and in the same direction. In contrast, it will be equal to the difference of the two forces if both forces are on the same plane, but in the opposite directions. For a static object, the resultant force acting on the object is zero.

A diagram of the forces acting on an object can be drawn using arrows. The direction of an arrow indicates the direction of the force and the length of the arrow indicates the magnitude of the force acting on the object.

Friction is a force that occurs when two surfaces rub against each other. It resists the object's movement. When a force is acting on an object and the object remains static, a friction acts in the opposite direction, preventing it from moving. If the object is moving, friction will cause that object to move slowly and eventually stop it.

Start up:

1. To assess prior knowledge of students, ask what they knew (Part K) and what they want to know (Part W) on page 65.
2. Talk about forces by referring to the picture as shown in page 65. (Answers may vary)
   (a) When the children are playing tug of war, both teams are pulling equally hard but they are not moving. What are the directions of the forces applied by the two teams? How do the forces act?
3. Show them a picture of a man pushing a car and a picture of many men pushing a car, and then ask: (Answers may vary)
   (a) When we are pushing our car, we are actually applying a force to make the car move forward. What happens if two persons push it? Will the car move forward easily?

Teaching/Learning activities:

1st – 5th hours (Resultant force)

1. Explain what force is. Force is either a push or a pull. How do we measure it? Refer to page 66.
2. Explain how we use an arrow to show the direction and magnitude of the force acting on an object. Refer to page 66.
3. Have students work on Let's Try activity on pages 67 to 69. What are the effects of two forces on an object?

4. Show them the pictures of two forces acting on a box by referring to pages 69 and 70. Ask them that:
   (a) What happens to a stationary object when a force is applied?
   (b) What happens if two forces are applied from the same direction?
   (c) What happens if two forces are applied from opposite directions?
   (d) What happens to an object if both forces are acting in the opposite directions with force A greater than force B?
5. Explain resultant forces by referring to pages 69 and 70.
6. Ask students to answer the question in Let's Think on page 70. Students should answer that if the two forces are equal and in opposite directions, the object will not move.
7. Ask students to think. What happens to an object
   (a) if two forces are acting equally on the object in the opposite directions?
   (b) if two different strength of forces are acting on the object in the opposite directions?
8. Explain about the balanced force. Refer to page 71.

6th – 11th hours (Friction)

1. Have students carry out Let's Try activity on page 72. Will the pencil and ping-pong ball roll forever?
2. Explain that when we roll a ball, it will roll and then it will slow down and stop eventually. Why will it stop? Friction stops it. What is friction or frictional force? Refer to page 72.
3. Give some examples of friction in our daily life. Refer to page 73. Ask students to give other examples and explain them.
4. Have students carry out Let's Try activity on page 74. Which surface has a larger friction, a smooth surface or a rough surface?
5. Have students carry out Let's Try activity on page 75. Which object experiences a greater friction, a heavy object or a light object?

6. Explain more about the factors that affect friction. Refer to pages 76.
7. Friction helps us in our daily activities. How is it so? Refer to pages 77 and 78. What happens if there is no friction?
8. Friction also has its disadvantages. Refer to page 78.
9. Have students to do the questions on pages 49 to 53 of the Workbook as their homework.

12th hour (Conclusion)

1. Wrap up the class by using the following sample questions:
   (a) What are the effects of a force on an object?
   (b) What are the factors affecting friction?
   (c) What are the advantages and disadvantages of friction?
2. To test their understanding of this chapter, have students fill in the blanks in Part L column on page 79.
3. Encourage them to watch a video by scanning the QR code on page 79.
4. Guide the whole class to discuss what they want to know more about forces in Part W column on page 80.
5. Use the Mind Map on page 80 to help students to understand the relationships between all the subtopics learnt in this chapter.
6. Ensure students understand the terms used in this chapter by referring to the Glossary.
7. Have students to do the questions in Mastery Practice on pages 54 to 58 of the Workbook as their homework.

Learning materials:

- Primary Education Smart Plus Science Textbook Prathomsuksa 5
- Primary Education Smart Plus Science Workbook Prathomsuksa 5

Assessment:

1. Assessing cognitive behavior; test on page 79 (Part L).
2. Assessing affective behavior (refer to Scoring Rubric for Affective Domain).
3. Assessing thinking process (refer to Scoring Rubric for Scientific Thinking).

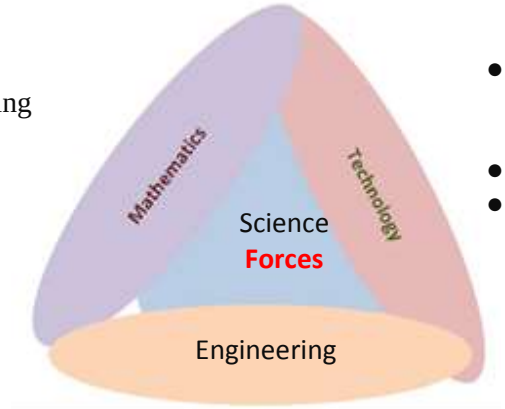
STEM Activity

Overview

This activity will engage students to use the engineering design process for designing and creating a structure that allows a small toy car to move slowly down the structure. This activity must be fun for kids to apply their knowledge of force and friction.

Subject integration

- Reading and drawing line graphs
- Angle



- Information and Communication Technology
- Construct simple structures
- Using tool

Engineering Design Process

Time: 5 hours

Start up:

1. Divide students into groups of 3 or 4.
2. Review their understanding about the engineering design process by using their previous STEM activity.
   (a) What was your previous STEM activity?
   (b) What did you create? How?
   (c) Did each group come up with the same design? Why or why not?

Lesson development:

1. Students read the situation on page 81. Then, whole class discusses and identifies the problem by answering these questions:
   (a) What is the problem of this situation?
   (b) What are our missions?
   (c) What do you need to know to get started?
2. Enhance students to explore and make connections between science, technology, engineering and mathematics by posing these suggested questions:
   (a) What is a ramp? What are purposes of using a ramp?
   (b) Does a ramp make the car move easily or hard?
   (c) Will a steep ramp make the car move faster?
   (d) How many ramps we should use?
   (e) Which cars move faster, heavier or lighter cars and shorter or longer cars? How does friction affect a moving car?
   (f) Does adding texture on the ramp slow down or speed up the car? What textures might slow down the car and speed it up as it goes down the ramp?
   (g) Can we change the surface of the ramp by attaching some materials to the ramps?
   (h) Will the different cars experience different amounts of friction when going down these ramps causing the cars to speed up or slow down?
   (i) How do we measure the time take for the cars to finish the structure? A stopwatch?
3. Ask students to think about how to assess their project. Discuss in class and set their criteria with the following question:
   (a) What are the success criteria? (The structure must be at least 25 cm tall and have three ramps the structure should be able to slow down the

movement of the toy car but the toy car should not stop or move backward in the structure, etc.)

4. Students brainstorm and draw their designs. Then, let them follow their plans and create. (Teacher may ask each group to present some brief ideas before they start so that teacher can give some suggestions for their possible solution or prevent trial and error.)
5. After they have finished their mission, ask them to test their product by using the criteria in #3. Teacher may use the following questions:
   (a) What works or what does not work?
   (b) How will you modify your solution to make it better?
6. Let them improve their design. (Teacher can skip this step if you do not have enough time.)
7. Each group prepares and presents their creative work and explains their journey of creating.

Conclusion:

1. Each group presents their ideas and results of testing. Teacher should encourage peers to ask or give some comments.
2. End the lesson by asking the students:
   - When you compare your work with your friend's work, what are advantages and disadvantages of your ideas?
   - What are the steps of your design?
   - What are the benefits of this activity?
   - Do all of you have the same ideas? Why or why not?

Assessment:

Refer to Scoring Rubric for STEM Activities.

Chapter 5 Sound

Time: 10 hours

Strand 2: Physical Science

Standard Sc.2.3

Indicator

Sc.2.3 Gr.5/1. Explain hearing through medium from empirical evidence.

Sc.2.3 Gr.5/2. Identify variables, experiments and describe the causes and the characteristics of high- and low-pitched.

Sc.2.3 Gr.5/3. Design an experiment and explain the characteristics and the causes of loud and quiet sounds.

Sc.2.3 Gr.5/4. Measure the volume of sounds using the sound level meter.

Sc.2.3 Gr.5/5. Recognize the value of sound level knowledge by suggesting the guidelines to avoid and reduce noise pollution.

Introduction:

Sound is produced by the vibrations of objects. Sound needs a medium (such as solid, liquid or gas) to travel. Pitch is how low or high a sound is. It depends on the frequency of the sound. The loudness of the sound depends on the size of the vibration.

Noises are loud and unpleasant sounds. Traffic jams and construction sites produce a lot of noises. Listening to noises over a long period of time can damage the ears and cause deafness.

Learning objectives:

Students will be able to:

- Describe how sound is produced.
- Describe how sound travels.

- Differentiate between pitch and loudness of sound.
- Describe how music is made.
- State the meaning of noise.
- State ways to protect our ears from noise.

Competency:

Communication skill, applying life skills

Concept:

Sound is caused by vibrations of a sound source. Sound travels from its source in all directions through a medium.

A sound source that vibrates at low frequency produces low-pitched sound while a source that vibrates at high frequency produces high-pitched sound. A sound source that vibrates with high energy produces loud sound while a source that vibrates with low energy produces soft sound.

The sound that is too loud damages hearing. The sound that causes a disturbance is referred to as noise pollution.

Start up:

1. Assess students' prior knowledge by asking what they knew (Part K) and what they want to know (Part W) on page 83.
2. Guide students to talk about their prior knowledge of sound by using these following sample questions:
    - How do musical instruments produce sound?
    - How does sound travel to our ears?
    - What is noise pollution?
    - How do we prevent it?

Teaching/Learning activities:

1st – 3rd hours (How does sound travel?)

1. Have students carry out Let's Try activity on page 84 to find out that sound can travel through solids, liquids and gases.
2. Explain how sound is produced. Refer to pages 85 and 86.
3. Explain that sound needs a medium to travel. These media can be solids, liquids and gases which let sound travel through differently. Refer to page 86.
4. Explain that there are many ways to make vibrations in order to make sound. Have students think what happens if there is no medium. Can sound travel in outer space where there is no medium such as air? Why? Refer to Let's Think activity on page 86.
5. Have students carry out Let's Try activity on page 87 to find out how we can make telephone cups work better.

4th – 7th hours (Pitch and loudness of sound)

1. What is *pitch*? What is frequency of sound? Refer to page 88.
2. Have students carry out Let's Try activity on pages 88 and 89 to find out the relation between the frequency and the pitch of the sound. Refer to pages 89 and 90 for explanation.
3. Explain more on how we differentiate the voice of a man and a woman, and how dogs and cats detect some sounds that we cannot hear. Refer to Let's Know More on page 90.
4. Have students carry out Let's Try activity on page 91 to find out the relation between the energy and the loudness of a sound. Refer to page 92 for explanation.
5. Have students carry out Let's Try activity on page 92 to find out the relation between the distance and the loudness of a sound.

6. Explain why we hear a sound softer when we are further away from a sound source and louder when we are nearer to it. Refer to page 93.
7. Using the text on page 93, help students to understand that by opening or closing the holes on a recorder, we can make different sounds.
8. Have students carry out Let's Try activity on page 94 to make music by plucking rubber bands.
9. Get students to find out how other musical instrument produce music. Refer to Let's Know More on page 94.

8th – 9th hours (Noise)

1. What is *noise*? How do we measure the loudness of a sound? Refer to Let's Try activity on page 95.
2. Explain the level of loudness of sound. Refer to page 96.
3. Explain the the unit of measuring the loudness of sound. Refer to Let's Know More on page 96.
4. Why must we protect our ears from loud noise? What happens to our ears if we are exposed to loud noise for a long time? Refer to page 97.
5. Have students to do the questions on pages 72 to 74 of the Workbook as their homework.

10th hour (Conclusion)

1. Wrap up the class by using the following sample questions:
   (a) How is sound produced and how does it travel?
   (b) What is the difference between the pitch and the loudness of a sound?
   (c) How do we protect our ears from noise?
2. To test their understanding of this chapter, have students fill in the blanks in Part L column on page 98.
3. Encourage them to watch a video by scanning the QR code on page 98.

4. Guide the whole class to discuss what they want to know more about sound in Part W column on page 99.
5. Use the Mind Map on page 99 to help students to understand the relationships between all the subtopics learnt in this chapter.
6. Ensure students understand the terms used in this chapter by referring to the Glossary.
7. Have students to do the questions in Mastery Practice on pages 75 to 77 of the Workbook as their homework.

Learning materials:

- Primary Education Smart Plus Science Textbook Prathomsuksa 5
- Primary Education Smart Plus Science Workbook Prathomsuksa 5

Assessment:

1. Assessing cognitive behavior; test on page 98 (Part L).
2. Assessing affective behavior (refer to Scoring Rubric for Affective Domain).
3. Assessing thinking process (refer to Scoring Rubric for Scientific Thinking).

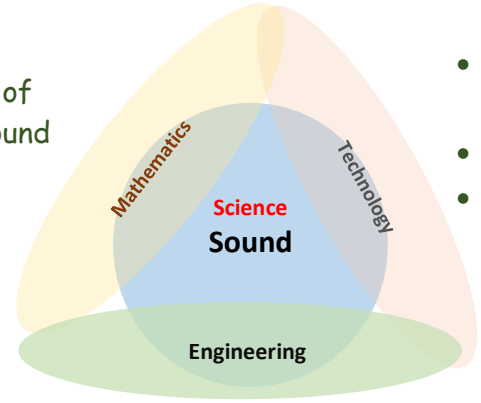
STEM Activity

Overview

In this activity, students will work in pairs to investigate the sound level chart and soundproof materials. Then, they will create a model house that is soundproof.

Subject integration

- Measurement of loudness of sound



- Information and Communication Technology
- Construct simple structure
- Using tools

Engineering Design Process

Time: 4 hours

Start up:

1. Divide students into teams of 3 or 4.
2. Review their knowledge content on sound.
   (a) How is sound produced?
   (b) What is the frequency of a sound?
   (c) Are loud noises good for us? Why?
   (d) Where do loud noises come from?
   (e) How do we reduce loud noises?

Lesson development:

1. Students read the situation on page 100. Then, whole class discusses and identifies the problem by answering these questions:
    (a) What is the problem of this situation?
    (b) What are our missions?
    (c) What do you need to know to get started?
2. Engage students to explore and make connections between science, technology, engineering and mathematics by posing these suggested questions:
    (a) What causes sound?
    (b) How loud is too loud? What is the range of decibel of sound that can cause damages to our ears?
    (c) What are the types of materials that can absorb sound?
    (d) What are the used materials that we should use?
    (e) What tools should we have to build the model house?
    (f) Have you been to a sound lab room? Did you notice its walls? How are the walls different? What materials are used?
3. Ask students to think about how to assess their project. Discuss in class and set their criteria with the following question:
    (a) What are the success criteria? (materials that can absorb sound, loudness of sound under 70 dB, etc.)
4. Students brainstorm and draw their designs. Then, let them follow their plans and create. (Teacher may ask each group to present some brief ideas before they start so that teacher can give some suggestions for their possible solution or prevent trial and error.)
5. After they finish their mission, ask them to test their product by using the criteria in #3. Teacher may use the following questions:
    (a) What works or what does not work?
    (b) How will you modify your solution to make it better?

6. Let them improve their design. (Teacher can skip this step if you do not have enough time.)
7. Each group prepares and presents their creative work and explains their journey of creating.

Conclusion:

1. Each group presents their ideas and results. Teacher should encourage peers to ask or give some comments.
2. End the lesson by asking the students:
   (a) What are the steps of your design?
   (b) What are the benefits of this activity?
   (c) Do all of you make the same house with the same idea? Why or why not?

Assessment:

Refer to Scoring Rubric for STEM Activities.

Chapter 6 Stars

Time: 8 hours

Strand 3: Earth and Space Science

Standard Sc.3.1

Indicator

Sc.3.1 Gr.5/1. Compare the differences of planets and stars from the model.

Sc.3.1 Gr.5/2. Use a star map to locate and route the rise and fall of the constellations in the sky and describe the patterns of rise and fall of the constellations in the sky yearly.

Introduction:

We can see many stars on a clear night sky. Our nearest star is the Sun. A star is a celestial body which produces its own light. Stars are seen as tiny bright dots in the night sky. They are all in space that is outside the atmosphere of the Earth.

The Earth rotates anti-clockwise from the West to the East. Therefore, when observed from the Earth, the Sun, the stars and other objects in the sky appear to rise from the East and set in the West. Star charts facilitate observation of the star positions in the sky.

Learning objectives:

Students will be able to:

- Explain and compare characteristics of stars and planets based on the model.
- State the meaning of constellation with examples.
- State the meaning of zodiac with examples.
- State the uses of stars.

Competency:

Communication skill, thinking skill, applying life skills,

Concept:

The stars in the sky are in space. Both stars and planets are outside the atmosphere of the Earth. Stars are light sources so they can be seen. The planets are not light sources, but they can be seen because the light from the Sun hits the planets and then reflects into our eyes.

Different people view constellations as various patterns. This is due to the observers' imagination. Each constellation appearing in the sky has its own stars and each star appears to be in the same position and in the same plane. They stay in the same pattern. They rise and fall in the same route every night.

A star map is used to observe the positions of the stars and constellations. We can describe their position using azimuth and altitude. Observers can use their hands and combinations of fingers to estimate the azimuth and altitude when locating the stars in the sky.

Start up:

1. Assess prior knowledge of students about stars by asking what they knew and what they want to know.
2. Write all their prior knowledge in Part K column on page 102 and have students share what they know about stars. Then, ask students to write some questions which they want to know in Part W column on page 102.
3. Talk about students' prior experience of stars such as:
   (a) What is a star? What is a planet? What are the differences between a star and a planet?
   (b) What is a constellation?
   (c) How do stars and constellations rise and fall every night?

Teaching/Learning activities:

1st – 2nd hours (Stars and planets)

1. Ask students to recall what a star is. Why is our Sun a star?
2. Have students carry out Let's Try activity on page 104 to understand the differences between a star and a planet.
3. Explain more about stars and planets. The difference between a star and a planet is that a star gives out heat and light, but a planet does not. Planets can be seen because they reflect the light from the Sun into our eyes. Refer to page 105.

3rd – 7th hours (Constellations)

1. Explain that constellations are groups of stars observed from the Earth. Different people view them as having different patterns. Why? Show them a few constellations and ask them what shapes they see. Refer to page 106.
2. Discuss a few constellations such as Crux, Orion and Ursa Major. Refer to pages 106 and 107.
3. Guide them to differentiate between as an asterism and a constellation.
4. Explain more about Polaris which is more than 2,500 times brighter than the Sun. Refer to Let's Know More on page 107.
5. Using the diagrams on page 108, explain the zodiac. Each constellation of this group of constellations can be viewed at different months from the Earth. Refer to page 108.
6. Guide students to carry out Let's Try activity on page 109 to find out whether stars rise and set just like the Sun.
7. Explain why stars rise and set just like the Sun. Refer to pages 109 and 110.
8. Have students carry out Let's Try activity on pages 111 and 112 to find out why some constellations are seasonal.
9. Explain that the Earth changes its position around the Sun throughout the year causing some constellations are seen on different months. Refer to page 112.
10. Have students carry out Let's Try activity on page 113 to find out shape of a celestial sphere.

11. Explain more about celestial sphere. Refer to page 113.
12. Discuss with students that if a constellation is located on the North sky of the Earth, can the people on the South Pole view it? Why? Refer to Let's Think activity on page 113.
13. Explain what North Celestial Pole, South Celestial Pole and celestial equator are. Refer to page 114.
14. Explain what a star map is. Refer to page 114.
15. Have students carry out Let's Try activity on page 115 to find out how to use a star map to locate the constellations.
16. Explain how we can estimate the position of a star in the sky using azimuth and altitude. Refer to page 116.
17. Have students carry out Let's Try activity on pages 117 and 118 to find out how we estimate the position of stars in the sky.
18. Have students to do the questions on pages 83 and 84 of the Workbook as their homework.

8th hour (Conclusion)

1. Wrap up the class by using the following sample questions:
   (a) According to the model, what are the differences between a star and a planet?
   (b) Do stars rise from the East and set in the West as the Sun does? How? Why?
   (c) Does each star appear to be in the same position and in the same plane? Why?
   (d) How do we use a star map?
2. To test their understanding of this chapter, have students fill in the blanks in Part L column on page 119.
3. Encourage them to watch a video by scanning the QR code on page 119.
4. Guide the whole class to discuss what they want to know more about stars in Part W column on page 120.

5. Use the Mind Map on page 120 to help students to understand the relationships between all the subtopics learnt in this chapter.
6. Ensure students understand the terms used in this chapter by referring to the Glossary.
7. Have students to do the questions in Mastery Practice on pages 85 to 88 of the Workbook as their homework.

Learning materials:

- Primary Education Smart Plus Science Textbook Prathomsuksa 5
- Primary Education Smart Plus Science Workbook Prathomsuksa 5

Assessment:

1. Assessing cognitive behavior; test on page 119 (Part L).
2. Assessing affective behavior (refer to Scoring Rubric for Affective Domain).
3. Assessing thinking process (refer to Scoring Rubric for Scientific Thinking).

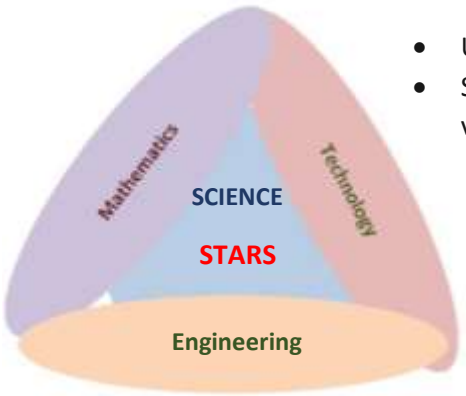
STEM Activity

Overview

A constellation can be viewed as different patterns due to the observer's imagination. In this chapter, students will create a constellation jar. They may design their constellation different from the officially recognized constellations. They also need to create a story about their constellation. The story can be based on scientific facts, scientific tools or scientists.

Subject integration

- Angle
- Distance
- Estimation



- Using simple tools
- Searching information via internet

Engineering Design Process

Time: 5 hours

Start up:

1. Divide students into groups of 3 or 4.
2. Review their prior knowledge from the previous activity about the engineering design process. Teacher may use these suggested questions:
   (a) What did you design and create in the last chapter?
   (b) How was it? Are you satisfied with your work? Why? Why not?
   (c) What are the steps for designing and creating your product?

Lesson development:

1. Students read the situation on page 121. Then, the whole class discusses and identifies a problem by answering the following questions:
   (a) What is the problem of this situation?
   (b) What are our missions?
   (c) What do you need to know to get started?
2. Let them explore and make connections between science, technology, engineering and mathematics by posing these suggested questions:
   (a) What are the 88 officially recognized constellations?
   (b) What science concept is connected to your constellation jar?
   (c) Will the pattern of a constellation be view as different to different people?
   (d) What is the factor that can effect seeing the constellations in various patterns?
   (e) What tools and materials should be selected for creating a constellation jar?
3. Ask students to think about how to assess their project. Discuss in class and set their criteria with the following question:
   (a) What are the success criteria? (story is based on scientific facts, scientific tools or scientists., etc.)
4. Students brainstorm and draw their designs. Then, let them follow their plans and create. (Teacher may ask each group to present some brief ideas before they start so that teacher can give some suggestions for their possible solution or prevent trial and error.)
5. After they finish their mission, ask them to test their product by using the criteria in #3. Teacher may use the following questions:
   (a) What works or what does not work?
   (b) How will you modify your solution to make it better?

6. Let them improve their design. (Teacher can skip this step if you do not have enough time.)
7. Each group prepares and presents their creative work and explains their journey of creating.

Conclusion:

1. Each group presents their ideas and results of testing. Teacher should encourage peers to ask or give some comments.
2. End the lesson by asking the students:
   (a) What did you design and create? What is its name?
   (b) What are the steps of your design?
   (c) Do all of you have the same ideas? Why or why not?
   (d) Should we copy ideas from friends or from other sources? Why or why not?

Assessment:

Refer to Scoring Rubric for STEM Activities.

Chapter 7 Water

Time: 12 hours

Strand 2: Physical Science

Standard Sc.3.2

Indicator

Sc.3.2 Gr.5/1. Compare the amount of water in each source and identify the amount of water that humans can utilize for the useful purposes based on collected data.

Sc.3.2 Gr.5/2. Recognize the value of water by offering the practice of water economically use and water conservation.

Sc.3.2 Gr.5/3. Create a model that describes the rotation of water in the water cycle

Sc.3.2 Gr.5/4. Compare the formation processes of cloud, fog, dew and frost from the models.

Sc.3.2 Gr.5/5. Compare the formation processes of rain, snow and hail from collected data.

Introduction:

There are few phenomena in nature that involve water such as the water cycle, formations of dew, fog and cloud, and precipitation.

Water on the Earth moves in a continuous cycle called the water cycle. Clouds are made of tiny water droplets. They are part of the water cycle. There are four main kinds of clouds including cirrus clouds, stratus clouds, cumulus clouds and cumulonimbus clouds.

Dew is formed at night when the water vapor in the air condenses onto any exposed surfaces. When the water vapor in the air near the ground is cooled and condenses into tiny water droplets, fog is formed. Precipitation is any moisture

that falls from the air to the ground. Examples of precipitation are rain, snow and hailstones.

Learning objectives:

Students will be able to:

- Compare the amount of water in each source.
- Collect and interpreted data of using water in daily life.
- List the ways of using water economically and of water conservation.
- Create a model that describes the rotation of water in the water cycle.
- Explain the formation processes of cloud, fog, dew and frost from the models.

Competency:

Communication skill, thinking skill, applying life skills, technological application skill

Concept:

On the Earth, we can find water on the ground surface and underground. Water vapor in the air condenses and becomes water droplets, resulting in formation of fog and clouds. Water droplets come together forming dew and rain. The frozen water droplets that are blown by storms to circulate in high altitude clouds become larger ice masses, and then fall to the ground as hail. The water cycle involves continuous circulation of water on the Earth's surface and in the atmosphere.

Start up:

1. Assess prior knowledge of students about water by asking them what they knew and what they want to know.

2. Write all their prior knowledge in Part K column on page 123 and have students share what they know about water. Then, ask students write some questions which they want to know in Part W column on page 123.
3. Talk about students prior experience of water such as:
   (a) How much water does a human use?
   (b) What are the water resources in Thailand?
   (c) What are the natural phenomena involving water?
   (d) Have you ever seen snow?

Teaching/Learning activities:

1st – 3rd hours (Water sources)

1. Ask students to list places where we find plenty of water. Explain about water resources on the Earth. Refer to pages 124 to 129.
2. Assign students to find out the percentage of water found in different water sources on the Earth. From there, find out the percentage of fresh water from freshwater sources. Make a chart to present your findings. Do a presentation of your findings.

4th – 5th hours (Conservation of water)

1. Ask students why we need to conserve water. Why is fresh water priceless?
2. Discuss ways to conserve water. Ask students to list how to conserve water and the way of using water economically. Refer to pages 130 to 131.

6th – 11th hours (Natural phenomena involving water)

1. Help students to understand the water cycle using the picture on page 132. Make sure they understand each stage in the water cycle by using these sample questions.
   (a) What is the important factor of water cycle?
   (b) What are the factors related to evaporation?

(c) What can you do to speed up evaporation?

(d) What do evaporation and condensation happen?

2. Then, emphasize that evaporation and condensation are involved in the water cycle.
3. Have students carry out Let's Try activity to understand the formation of water cycle on page 133.
4. Have students carry out Let's Try activity to understand the formation of clouds on page 134.
5. Explain the formation of clouds. Refer to page 135.
6. Explain the four main types of clouds. Refer to pages 135 and136.
7. Carry out Let's Try activity to understand shapes of cloud on pages 136 and 137. Let students go outside the classroom or assign them when they are free to observe clouds, and tell students not to look directly at the Sun. Teacher may guide them to observe clouds when there is strong wind. Then, talk about the shapes of cloud.
8. Explain the formation of fog. Refer to page 137.
9. Have students carry out Let's Try activity to understand the formation of dew and frost on page 138.
10. Guide students to differentiate between dew and frost using the text on page 139. Explain that frost can form when the water vapor in the air turns directly into ice without going through the liquid state too. Refer to Let's Know More on page 139.
11. Explain the precipitation process. Refer to page 140.
12. Have students carry out Let's Try activity to observe and measure rainfall for a week on pages 140 and 141.
13. Rain, snow and hail are examples of precipitation. What is precipitation? What are the differences between them? Refer to pages 141 to 143.

    Teacher may use these sample questions after explanation:

    - What are the differences between snow and hail?

- Do both heavy rain and heavy snow cause traffic problems? How? Why?
- Why in some parts of Thailand have hail but do not have snow?
- What are the benefits of rain and snow?

14. Guide students to complete the assignment in Let's Find Out on page 143.
15. Have students to do the questions on pages 94 to 97 of the Workbook as their homework.

12th hours (Conclusion)

1. Wrap up the class by using the following sample questions:
   (a) Where do we find water?
   (b) How can we use water economically?
   (c) List the way to of water conservation.
   (d) What is the water cycle and how does it affect us?
2. To test their understanding of this chapter, have students fill in the blanks in Part L column on page 144.
3. Encourage them to watch a video by scanning the QR code on page 144.
4. Let the whole class discuss what they want to know more about water in Part W column on page 145.
5. Use the Mind Map on page 145 to help students to understand the relationships between all the subtopics learnt in this chapter.
6. Ensure students understand the terms used in this chapter by referring to the Glossary.
7. Have students to do the questions in Mastery Practice on pages 98 to 101 of the Workbook as their homework.

Learning materials:

- Primary Education Smart Plus Science Textbook Prathomsuksa 5
- Primary Education Smart Plus Science Workbook Prathomsuksa 5

Assessment:

1. Assessing cognitive behavior; test on page 144 (Part L).
2. Assessing affective behavior (refer to Scoring Rubric for Affective Domain).
3. Assessing thinking process (refer to Scoring Rubric for Scientific Thinking).

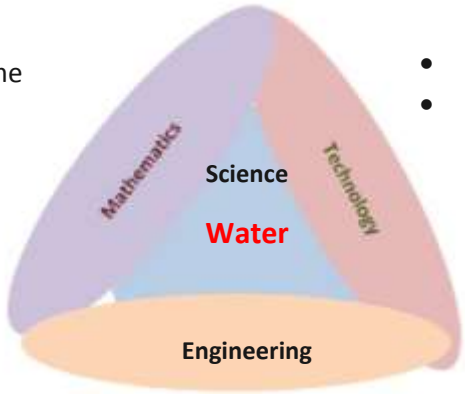
STEM Activity

Overview

This activity asks students to think and create a way to keep water in a cup from evaporating. Students will apply their knowledge and prevent water evaporation at room temperature. Teacher can challenge and give each group different conditions such as room temperature, hot water, or coffee cup.

Subject integration

- Measurement time and volume
- Data collection



- Using simple tools
- Construction simple devices

Engineering design process

Time: 4 hours

Start up:

1. Divide students into groups of 3 or 4.
2. Review their knowledge about engineering design process and technology by asking some of these sample questions:
   (a) In our daily life, can we use engineering design process for solving problems? How?
   (b) Give an example of using engineering design process for solving problems in your daily life.

Lesson development:

1. Students read the situation on page 146. Then, guide the whole class to discuss and identify the problem by answering to these questions:
   (a) What is the problem of this situation?
   (b) What are our missions?
   (c) What do you need to know to get started?
2. Enhance students to explore and make connections between science, technology, engineering and mathematics by posing these following questions:
   (a) Can you explain the water cycle?
   (b) Can we prevent some steps in the water cycle such as evaporation?
   (c) Can you search for more information about factors which are related to water evaporation?
   (d) How do we know that water in a cup has evaporated?
   (e) What does the phase *keep water in a cup from evaporating* mean?
3. Ask students to think about how to assess their project. Discuss in class and set their criteria by these following questions:
   (a) What are the success criteria? (the amount of water left after 1 week, etc.)
4. Students brainstorm and draw their designs including label materials. Then, let them follow their plans and create. (Teacher may ask each group to present some brief ideas before they start so that teacher can give some suggestions for their possible solution or prevent trail and errors.)
5. After they finish their mission, ask them test their product by using the criteria in #3. Teacher may use these following questions;
   (a) What works or what does not work?
   (b) How will you modify your solution to make it better?
6. Let them improve their design. (Teacher can skip this step if you do not have enough time.)

7. Each group prepares their creative work and explains their journey of creating.

Conclusion:

1. Each group presents their ideas and results of testing. Teacher should encourage peers to ask or give some comments.
2. End the lesson by asking students:
    - Do you have the same or different ideas? Why or why not?
    - Should we copy ideas from friends or from other sources? Why or why not?
    - Can we use the engineering design process for solving problems in our daily life?

Assessment:

Refer to Scoring Rubric for STEM Activities.

Scoring Rubric for Affective Domain

Skill	Needs improvement (1)	Partially proficient (2)	Proficient (3)	Advanced (4)
Self-motivation	Consistently fail to meet established deadlines	Take initiative to complete assignments and improve or correct behaviors	Occasionally complete and turn in assignments before the scheduled deadline	Never miss a deadline and often complete assignments well ahead of deadlines
Communication	Unable to speak or write clearly and is unable to correct their behaviors despite intervention by instructors, does not actively listen	Needs work to speak or write clearly, sometimes able to identify alternative communication strategies	Speak clearly, write legibly, listen actively, and adjust communication strategies to various situations	Comfortable utilize a variety of communication styles, write legibly, speak clearly, and listen actively
Teamwork	Manipulate the team or act with disregard to the team, disrespectful to team members, resistant to change or refuse to cooperate in attempts to work out solutions	Sometimes act for personal interest at the expense of the team, act independent of the team or appear non-supportive, and occasionally unwilling to work out a solution	Place the success of the team above self-interest, do not undermine the team, help and support other team members, and show respect for all team members	Place success of the team above self-interest, take a leadership role and use good management skills while leading, and involve all team members in the decision-making process
Neatness	The work appears sloppy and unorganized. It is hard to know what information goes together	The work is organized but may be hard to read at times	The work is neat and organized. It is easy to read	The work is neat, clear, and organized. It is easy to read
Completion	Most of the work is not complete even additional time or suggestions were given	Some work is not complete and need additional suggestions	Some work is not complete and additional time	All works are complete
Responsibility	Always relies on others to complete assignments	Rarely does the work and needs constant reminders to stay on task	Usually does the work and seldom needs reminders to stay on task	Always does assigned work without being reminded

Scoring Rubric for Scientific Thinking

Skill	Needs improvement (1)	Partially proficient (2)	Proficient (3)	Advanced (4)
State problem / question	Need assistant to state the problem or identify the information	Sometimes state the problem or identify the information correctly	Occasionally state the problem or identify the information correctly	Work alone and correctly state the problem and identify the information and the steps needed to arrive at a solution
Conclusion/Synthesis thinking ability	Conclusions drawn were lacking, incomplete, or confused and need help to write conclusion or answer questions	Sometimes ask for guidance to write or complete a conclusion	Occasionally answer questions and complete a conclusion in complete sentences	Always writes response to whether hypothesis was wrong or wrong and answer in complete sentences
Using scientific reasoning for explanation	No evidence of scientific reasoning was used	Some evidence of scientific reasoning was used	Effective scientific reasoning was used	Employed refined and complex reasoning and demonstrated understanding of cause and effect
Using scientific concepts and related content	Always relies on others in using scientific concepts	Minimal reference to relevant scientific concepts, principles, or big ideas	Provided evidence of understanding of relevant scientific concepts, principles, or big ideas	Provided evidence in depth and sophisticated understanding of relevant scientific concepts, principles, or big ideas

Scoring Rubric for STEM Activities

Skill	Needs improvement (1)	Partially proficient (2)	Proficient (3)	Advanced (4)
Creativity	The project has little creative and unique aspects	The project has some creative and unique aspects	The project adequate has creative and unique aspects	The project has plenty of creative and unique aspects
Communication and collaboration	The information is not organized. Data is presented inaccurately. There is no drawing plan	Some information is clear and organized. There is a drawing plan without any label	Most information is clear and organized. There is a clearly labeled drawing plan	All information and data are clear and organized. They are presented accurately. There is a clearly labeled drawing plan
Technology operations	No technological resource was used in the project or was used incorrectly	Little technological resource was used in the project or was not used correctly	Technological resource was used in the project correctly	Multiple technological resources were used appropriately
Teamwork	Pupils demonstrate no cooperation, courtesy, enthusiasm, confidence, and accuracy	Pupils demonstrate little cooperation, courtesy, enthusiasm, confidence, and accuracy	Most pupils demonstrate some cooperation, courtesy, enthusiasm, confidence, and accuracy	All pupils demonstrate high level of cooperation, courtesy, enthusiasm, confidence, and accuracy
Presentation	Presentation lacks detail needed to understand the team's solution	Presentation provides adequate explanation of how the solution was developed and how it works	Presentation or visual aids provide clear, effective, and creative explanation of how solution was developed and how it works	Presentation and visual aids provide very clear, effective, and creative explanation of how solution was developed and how it works