PELANGI

FOCUS SMART+

Teacher's Guide SCIENCE

Mathayom 1

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

asean

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: Biological 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 lives 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 lifelong 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:

❖ Biological 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 Science and Space

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 Standards

Strand 1: Biological 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 for Grade 9 Students

- Understand the features and the main elements of cells of organisms, the relationships among the functions of the body systems in humans, plant's life, genetic transmission, the changes in genes or chromosomes and the examples of diseases caused by genetic changes, the benefits and impacts of Genetically Modified Organisms, biodiversity, the interactions between the components of the ecosystem, and the energy transfer in living organisms.

- Understand the components and properties of elements, solvents, pure substances and mixtures, the principles of separation, the changes in substances according to changes of states of matter, solution formation, the chemical reactions, physical properties of matter and the uses of polymers, ceramics and composites.

- Understand motion, resultant force and the effects of the resultant force acting on objects, the moment of a force, forces in daily life, field forces, the relationship of energy, kinetic energy, gravitational potential energy, the law of conservation of energy, energy transfer, heat balance, the relation of electrical quantities and home electrical circuits, electrical energy, and the fundamentals of electronic circuits.

- Understand the properties of waves and the characteristics of different waves, light, reflection and refraction of light and visual equipment.

- Understand the planets around the sun, seasons, the movement and appearance of the sun, lunar phases, the rise and fall of the moon, tides, the benefits of space technology and the development of the space exploration program.

- Understand the characteristics of the atmosphere, the components of weather and factors affecting the weather, the causes and effects of thunderstorms and tropical cyclones, weather forecast, the world climate changes, fossil fuel formation, the utilization renewable energy, the internal structure of the Earth, geological changes on the crust, soil layers, soil formation, surface water, groundwater, the causes and effects of natural disasters and geohazards.

- Understand the key concepts of technology such as technology system and technology change, the relationship between technology and science and mathematics, the analysis, comparison and decision making in selecting and using technologies with consideration for the impacts on life, society and environment. Apply knowledge, skills and resources to design and create solutions for everyday problems or career by using engineering design processes and choosing materials, equipment and tools properly, appropriately and safe, including being aware of the intellectual property rights.

- Take the primary data into the computer system, analyze, evaluate and present the data and information for the purpose to solve problems. Use computational thinking skills to solve real-life problems and write a simple program to help solve problems with the sense of social responsibility.

- Ask questions or identify problems associated with the evidences. Predict many answers and create a hypothesis that can lead to an investigation with controlled variables. Design and investigate using appropriate materials and tools. Use proper tools and information technology to collect both quantitative and qualitative data accurately and safely.

- Analyze and assess the correspondence of the collected data from evidence by using the knowledge and principles of science to interpret, conclude and communicate ideas and knowledge from various investigations or using information technology to facilitate the understanding of the information.

- Show interests, commitment, responsibility, prudence and honesty in the subject being studied. Be creative to study on your own interests by using the right and reliable tools and methods. Further study from various sources of knowledge, show your opinions, listen to other people's comments and accept the changes of knowledge discovered when there are more data and the new testimonies or another argument.

- Realize the values of science and technology knowledge used in daily life. Apply knowledge, technology and scientific processes in life. Praise and respect the rights of the inventors. Understand both positive and negative impacts of scientific development on the environment and other elements. Study more and conduct more projects or create pieces of work according to your own interests.

- Appreciate, concern, care and maintain the balance of ecosystems and biodiversity.

Yearly Teaching Plan

Science **Grade 7 (Mathayom 1)**

7 chapters **120 hours**

Learning areas	Time (hours)
1. Introduction to Science • What is Science? • Science Laboratory • Steps in Scientific Investigations • Physical Quantities and Their Units • The Concepts of Mass • Measuring Tools • The Importance of Standard Units	**16**
2. Cells as the Unit of Life • Understanding Cells • Unicellular and Multicellular Organisms • Diffusion and Osmosis in Cells	**14**
3. Plants • Photosynthesis • Transport System in Plants • Sexual Reproductive System of Flowering Plants • Pollination • Development of Fruits and Seeds in Plants • Dispersal of Seeds and Fruits • Germination of Seeds • Mineral Requirements in Plants • Asexual Reproduction of Plants • STEM Activity	**30**

4. States of Matter • States of Matter • Changes of States of Matter • STEM Activity	**8**
5. Atoms, Elements and Compounds • Atoms • Elements • Compounds and Mixtures • Effects of Impurities	**15**
6. Heat • Heat as a Form of Energy • Effects of Heat on Matter • Thermal Equilibrium and Heat Flow • STEM Activity	**25**
8. Atmosphere and Weather • Layers of the Earth's Atmosphere • Weather • Thunderstorms and Tropical Cyclones • Changes in Global Climate • STEM Activity	**12**

Note: The hours needed for each subtopic can be changed when necessary. The above allocated hours are just a suggestion. Total 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 – Introduction to Science (16 hours)

Learning Standards and Learning Areas

For this special topic, there are no required strands or standards to fulfill. This topic is more on guiding students to understand what Science is, to use the laboratory apparatus, and to understand apply the steps in a scientific investigation.

Learning Objectives

Students will be taught to:

1. Understand what Science is.
2. Name the common laboratory apparatus and their uses.
3. Explain the hazard warning symbols.
4. Observe the steps in a scientific investigation.
5. Understand the physical quantities and their units.
6. Understand the concepts of mass.
7. Know how to use the measuring tools.

Learning Outcomes

Students will be able to:

1. Explain what Science is and its importance.
2. Identify the laboratory apparatus and describe their functions.
3. Understand the rules and safety precautions in the laboratory.
4. Use a Bunsen burner safely and correctly.
5. Explain the hazard warning symbols and the correct handling techniques.
6. List and apply the steps in scientific investigations.
7. List the physical quantities and their units.
8. Explain the difference between weight and mass.
9. Use measuring tools correctly to measure length, area and volume.

10. State the importance of standard units.

Learning Areas

- What is science?
- Science laboratory
- Steps in scientific investigations
- Physical quantities and their units
- The concepts of mass
- Measuring tools
- The importance of standard units

Teaching and Learning Activities

1st – 2nd hours (What is Science?)

1. Explain what natural phenomena are. Use common natural phenomena such as our growth, melting ice cream and rising of bread dough to explain.
2. Ask students to do Question 1 on page 2 of the workbook as their homework.
3. Explain what Science is. What is scientific knowledge? What is technology?
4. Ask students to think of a thing that does not apply scientific knowledge. Have them to imagine life without mobile phones, computers and commuter trains. Will their lives be enjoyable?
5. Show students the importance of science in our lives using various fields such as transportation, medicine and agriculture.
6. Ask students to do Question 2 on page 3 of the workbook as their homework.
7. Ask students to list the careers that they know and identify the careers that involve scientific knowledge.
8. Ask students to do Question 3 on page 3 of the workbook as their homework.
9. Inform students that science is divided into a few areas of study. Conduct a quick quiz to know if the students can name the areas of study.

10. Have students try Test Yourself 1.1 and discuss the answers with them.

3rd – 5th hours (Science Laboratory)

1. Get the students into the science laboratory. Explain that we use a laboratory to carry out experiments.
2. Ask students to do Question 1 on page 4 of the workbook to find out if they understand the rules and safety precautions of a science laboratory.
3. Show the apparatus in the laboratory. Name them. Show and explain their uses.
4. Ask students to do Question 2 on page 4 of the workbook as their homework.
5. Explain them the rules and safety precautions that everyone must follow.
6. Get a Bunsen burner. Name the parts to the students. Show the correct way to light a burner. Emphasize that always light up the match before turning on the gas.
7. Discuss with students the ways to avoid accidents when using a Bunsen burner. Tell them when to use a yellow flame and a blue flame.
8. Show students some chemical bottles with the hazard warning symbols or use the PowerPoint 'Hazard warning symbol Chap 1 Science M1'. Explain that these substances are very dangerous and each symbol represents a different kind of danger. Explain each symbol. Give some examples of substances that are of these dangers and the correct ways to handle them.
9. Have students try Test Yourself 1.2 and discuss the answers with them.

6th – 7th hours (Steps in Scientific Investigation)

1. Explain the science process skills that are used in scientific investigation.
2. Explain to students that there are 7 steps to carry out a scientific investigation. Use the PowerPoint 'Scientific Method Chap 1 Science M1' to explain further.
3. Ask students to do Question 1 on page 5 of the workbook as their homework.

4. Use the example of a science report on page 12. Explain to students that from a science report every detail is stated clearly.
5. Ask students to do Questions 2 and 3 on pages 5 and 6 of the workbook as their homework.
6. Have students try Test Yourself 1.3 and discuss the answers with them.

8th – 9th hours (Physical Quantities and Their Units)

1. Explain that physical quantities are quantities that can be measured, such as length, time, mass, temperature and electric current.
2. Explain that SI units are the standard units used by everyone.
3. Using the SI unit table on page 14, guide students to know the units and the measuring instruments for each physical quantity.
4. Ask students to do Question 1 on page 7 of the workbook as their homework.
5. Ask students what they understand by the terms ‘kilobytes’, ‘megabytes’ and ‘gigabytes’. Explain that giga, mega and kilo are prefixes used to state big values. Ask them if they know the prefixes for smaller values.
6. Guide students to write quantities in the prefixes and standard forms. Refer to table on page 14.
7. Ask students to do Questions 2, 3 and 4 on page 7 of the workbook as their homework.
8. Besides the five physical quantities mentioned, there are actually seven basic physical quantities (including amount of substance and luminous intensity). From these basic quantities, we can obtain many other derived physical quantities such as area, volume, velocity and pressure. For example, velocity = length/time.
9. Have students try Test Yourself 1.4 and discuss the answers with them.

10th hour (The Concept of Mass)

1. Use the PowerPoint 'Mass vs Weight Chap 1 Science M1' to explain that mass and weight are different. The mass of an object is the amount of matter it contains. The more matter it has, the greater its mass. The weight is a force caused by the gravity. So, the weight of an object is the pull of the gravity on the object towards the centre of the Earth. The more mass an object has, the greater its weight will be. Tell students that in outer space, we weigh almost nothing because there is no gravity, but our masses remain the same.
2. Emphasize that the units and the measurement tools are different for both weight and mass. Refer to the table on page 17.
3. Ask students to do Questions 1, 2 and 3 on page 8 of the workbook as their homework.
4. Have students try Test Yourself 1.5 and discuss the answers with them.

11th – 14th hours (Measuring Tools)

1. Ask students to list the units of length that they know and their relations. Ask them to identify the SI unit for length.
2. Ask students to list the measurement tools for measuring a straight line. Get a student to show the correct way to measure a straight line. Highlight the position of the eyes while taking the reading. The eyes should be vertically above the mark on the tool.
3. Draw a curved line on the board. Ask students for ways to measure a curved line. Give a thread and a ruler to a student and ask him to measure the length of the curved line. Guide him. Show them an opisometer and show them how to use it to measure a curved line.
4. Ask students to do Question 1 on page 9 of the workbook as their homework.
5. Get any cylinder. Tell students that there are two diameters for the cylinder. Ask students if they know how to measure the external and internal diameters.

Can they use a ruler? Show students the external and internal calipers. Guide them to measure the diameters of the cylinder.

6. Ask students to do Question 3 on page 10 of the workbook as their homework.
7. Test students if they know the meaning of area. Derive the SI units for area and the relation between other units of area.
8. Give a student a meter ruler and ask him to measure the area of his table.
9. Show students a leaf and ask them to figure a way to measure the area of the leaf. Give them a graph paper and guide them to measure the area of the leaf. Refer to page 20.
10. Ask students to do Question 2 on page 9 of the workbook as their homework.
11. Derive the SI unit for volume and the relation between other units of volume. Give students a dictionary and ask them to measure its volume.
12. Show students some beakers, measuring cylinders, volumetric flasks, burettes and pipettes. Explain to them that we use them to measure the volume of liquids with different accuracy.
13. Ask students to do Question 4 on page 10 of the workbook as their homework.
14. Pour some water into a few measuring cylinders. Ask students to take the readings. Guide them to take the reading with their eyes at the same lever of the meniscus. Explain to them that for all liquids, except mercury, the level of the meniscus bottom is taken as reading. The meniscus of mercury is convex – bulged outwards.
15. Show students how to use a pipette to measure volume of liquid. There are many different sizes of pipettes. Remind students to use a pipette pump to pump up the liquid instead of using our mouth to suck.
16. Set up a burette using a retort stand. Show students how to measure liquid with a burette.
17. Using a string and a measuring cylinder, guide students to measure the volume of an irregular object such as a rock and a light irregular object such as a cork.

18. Ask students to do Questions 5 and 6 on pages 10 and 11 of the workbook as their homework.
19. Show them how to use a Eureka tin too.
20. Emphasize that all measurements should be as accurate as possible. Using the suitable measuring tools, applying the right techniques and taking several readings can help to increase accuracy of measurement.
21. Have students try Test Yourself 1.6 and discuss the answers with them.

15th hour (The Importance of Standard Units)

1. Watch this video by scanning the QR code below.

2. Ask students to think of the disadvantages if the SI units are not used worldwide.
3. Ask students to do Questions 1 and 2 on page 11 of the workbook as their homework.
4. Have students try Test Yourself 1.7 and discuss the answers with them.

16th hour (Conclusion)

1. Use Conceptual Map on page 26 to help students to understand the relationship of all the subtopics learnt in this chapter.
2. Revise the lesson using Basic Recall on page 27.
3. Randomly select 5 objective questions in QR Quiz and 2 subjective questions from the Mastery Practice in the Textbook and have students solve them in the class. Have students work on the rest of the questions at home.
4. Ask students to do the Map It Out and the Enrichment Exercises in the workbook to test their understanding of this chapter as their homework.

Emphasized Skills:

1. Observing
2. Classifying
3. Making inferences
4. Making hypothesis
5. Predicting
6. Communicating
7. Using and handling science apparatus correctly and safely

Learning Materials:

- Focus Smart Plus Textbook Science M1
- Focus Smart Plus Workbook Science M1
- Laboratory apparatus

Learning Outcome Form

Name-Surname: ..... **No.** .....

Mathayom: ..... **Date:** .....

Chapter 1 Introduction to Science

Explanation: Summary of learning outcomes

Feeling after learning this chapter:

.....

.....

.....

.....

Contents that you need for teacher to explain further:

.....

.....

.....

.....

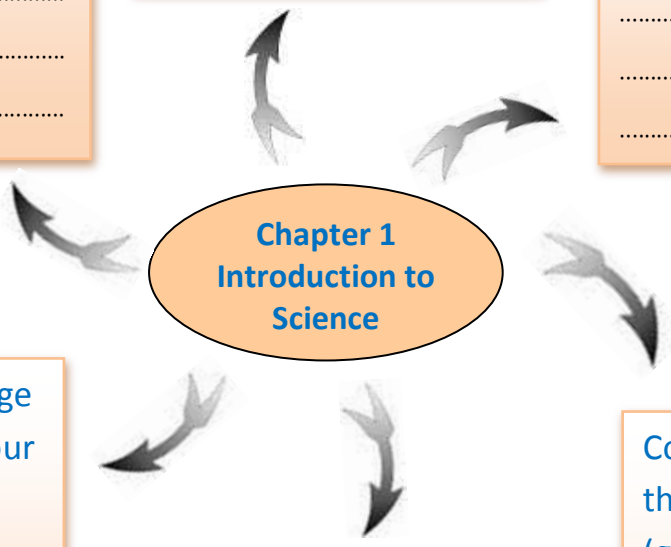
Knowledge gained from this chapter:

.....

.....

.....

.....



Application of knowledge from this chapter on your daily life:

.....

.....

.....

.....

Exercises that you like and want to be selected as the outstanding work:

.....

.....

.....

.....

Contents that you like the most in this chapter (give your reason):

.....

.....

.....

.....

Chapter 2 – Cells as the Unit of Life (14 hours)

Learning Standards and Learning Areas

Learning Standards	Learning Areas
Standard Sc 1.2: **M.1/1** Compare forms and structures of plant and animal cells. Describe functions of cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplasts.	• Understanding cells
M.1/2 Use optical microscope to study the characteristics, structures and the essential components of plant and animal cells.	• Understanding cells
M.1/3 Explain the relationship between form and functions of cells.	• Understanding cells
M.1/4 Explain how living things are organized started from cell, tissue, organ and organ system.	• Unicellular and multicellular organisms
M.1/5 Explain the process of diffusion and osmosis using empirical evidence and give examples of diffusion and osmosis in everyday life.	• Diffusion and osmosis in cells

Learning Objectives

Students will be taught to:

1. Understand the basic structure of cells and the essential components in them.
2. Compare and differentiate a plant cell and an animal cell.
3. Understand the functions of essential components in a plant cell and an animal cell.
4. Understand the relationship between form and functions of different cells.
5. Realise the difference characteristics of cells of unicellular and multicellular organisms.
6. Understand cell organization in living things.
7. Understand the diffusion and osmosis processes in cells.

Learning Outcomes

Students will be able to:

1. Operate a microscope.
2. Identify the important structures in a typical cell and describe their functions.
3. Identify, compare and contrast a plant cell and an animal cell.
4. Carry out experiments to study human cells and plant cells.
5. Identify the important structures in a plant cell and an animal cell, and describe their functions.
6. Explain the relationship between form and functions of different cells.
7. Compare and contrast unicellular organisms and multicellular organisms.
8. Give examples of unicellular organisms and multicellular organisms.
9. Explain cell organization in living things.
10. Describe the diffusion and osmosis processes in cells.
11. Carry out experiments to show osmosis in cells.

Teaching and Learning Activities

1st – 8th hours (Understanding Cells)

1. Explain that all living things are made of cells including humans.
2. Show students a microscope and introduce the functions of the parts of the microscope. Get a slide and let the students get a feel of using the microscope.
3. Ask students to do Questions 1 and 2 on page 19 of the workbook as their homework.
4. Introduce the structures of a typical cell before asking students to carry out the activities to prepare a slide of human cheek cells and onion cells.
5. Ask students to do Questions 3 and 4 on page 20 of the workbook as their homework.
6. Watch 'Animal Cells and Plant Cells Chap 2 Science M1' PowerPoint and ask students to compare between animal cells and plant cells.
7. Ask students to do Questions 5 and 6 on page 21 of the workbook as their homework.
8. Introduce different types of cells in a living organism. Explain to students the shapes and structures of the cells have different functions.
9. Ask students to do Question 7 and 8 on page 21 to 22 of the workbook as their homework.
10. Have students try Test Yourself 2.1 and discuss the answers with them.

9th – 10th hours (Unicellular and Multicellular Organisms)

1. Explain to students what unicellular and multicellular organisms are, with examples.
2. Ask students to do Questions 1 to 4 on pages 22 and 23 of the workbook as their homework.
3. Explain to students the organization of cells in a multicellular organism. Ask students to compare the cell organization between a plant and an animal.
4. Watch this video by scanning the QR code on the next page.

5. Ask students to do Questions 5 on page 23 of the workbook as their homework.
6. Have students try Test Yourself 2.2 and discuss the answers with them.

11th – 13th hours (Diffusion and Osmosis in Cells)

1. Explain diffusion and osmosis and how they differ.
2. Show examples of where these processes take place.
3. To understand further about diffusion and osmosis, visit this website by scanning the QR code below.

4. Ask students to do Questions 1 and 2 on page 24 and 25 of the workbook as their homework.
5. Carry out the activity to further explain osmosis in living animal tissues. Explain the effects of plant cells and animal cells in three different solutions due to osmosis.
6. Ask students to do Questions 3 and 4 on page 25 of the workbook as their homework.
7. Have students try Test Yourself 2.3 and discuss the answers with them.

14th hour (Conclusion)

1. Use Conceptual Map on page 45 to help students to understand the relationship of all the subtopics learnt in this chapter.
2. Revise the lesson using Basic Recall on page 46.

3. Randomly select 5 objective questions in QR Quiz and 2 subjective questions from the Mastery Practice in the Textbook and have students solve them in the class. Have students work on the rest of the questions at home.
4. Ask students to do the Map It Out and the Enrichment Exercises in the workbook to test their understanding of this chapter as their homework.

Emphasized Skills:

1. Observing
2. Classifying
3. Making inferences
4. Making hypothesis
5. Predicting
6. Communicating
7. Using and handling science apparatus correctly and safely
8. Handling specimen correctly and carefully

Learning Materials:

- Focus Smart Plus Textbook Science M1
- Focus Smart Plus Workbook Science M1
- Microscope

Learning Outcome Form

Name-Surname: ..... **No.** .....

Mathayom: ..... **Date:** .....

Chapter 2 Cells as the Unit of Life

Explanation: Summary of learning outcomes

Feeling after learning this chapter:

.....

.....

.....

.....

Contents that you need for teacher to explain further:

.....

.....

.....

.....

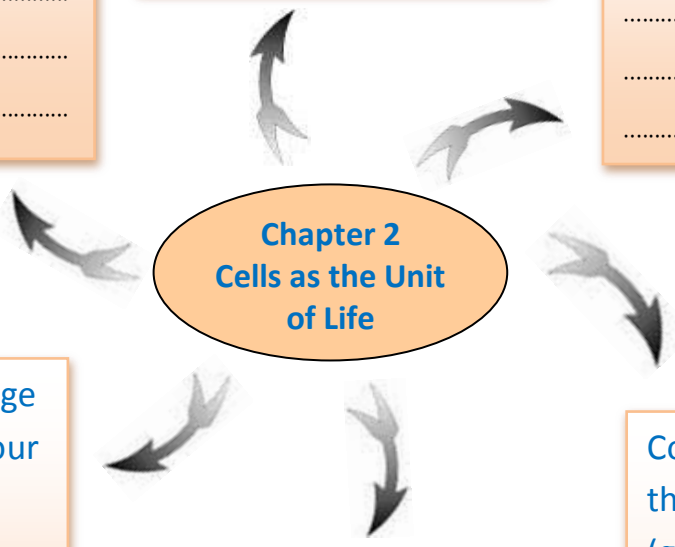
Knowledge gained from this chapter:

.....

.....

.....

.....



Application of knowledge from this chapter on your daily life:

.....

.....

.....

.....

Exercises that you like and want to be selected as the outstanding work:

.....

.....

.....

.....

Contents that you like the most in this chapter (give your reason):

.....

.....

.....

.....

Chapter 3 – Plants (30 hours)

Learning Standards and Learning Areas

Learning Standards	Learning Areas
Standard Sc. 1.2 **M.1/6** Indicate the essential factors of photosynthesis and the outcomes of photosynthesis based on empirical evidence. **M.1/7** Explain the importance of photosynthesis of plants that affects living things and environment. **M.1/8** Realise the values of plants that impact on living things and environment by planting, watering and looking after plants in your school and community.	• Photosynthesis
M.1/9 Describe the features and functions of xylem and phloem. **M.1/10** Draw a diagram describing the direction of transportation in xylem and phloem of plants.	• Transport system in plants
M.1/11 Explain sexual and asexual reproduction in flowering plants.	• Sexual reproductive system of flowering plants

M.1/12 Explain the structure of flowers involving pollination and describe fertilization in flowering plants, formation of fruits and seeds, seed dispersal and germination of seeds. **M.1/13** Realize the importance of animal pollination of flowering plants by not killing them.	• Pollination • Development of fruits and seeds in plants • Dispersal of seeds and fruits • Germination of seeds
M.1/14 Explain the importance of some nutrients that affect plant's life and its growth. **M.1/15** Appropriately choose the right fertilizer and right amount to plants in the given situations.	• Mineral requirements in plants
M.1/16 Choose an appropriate reproduction process that suit to human wants by applying the knowledge of plant propagation. **M.1/17** Explain the importance of plant tissue culture technology and the application of its usefulness in various fields. **M.1/18** Realize the benefits of plant propagation by applying the knowledge in daily life.	• Asexual reproduction of plants

Learning Objectives

Students will be taught to:

1. Understand photosynthesis.
2. Realise the importance of photosynthesis to living things and the environment.
3. Analyse the transport system in plants.
4. Analyse the sexual and asexual reproductive systems of flowering plants.
5. Understand the structures of a flower and their functions.
6. Analyse pollination.
7. Understand the development of fruits and seeds in plants.
8. Understand the dispersal of seeds and fruits in plants.
9. Synthesis the concept of germination of seeds.
10. Realise the importance of nutrients that affect plant's life and its growth.
11. Understand plant propagation and its application.
12. Understand vegetative reproduction methods and its application.
13. Realise the importance of plant tissue culture technology and its application.

Learning Outcomes

Students will be able to:

1. Describe photosynthesis.
2. Carry out experiments to show the factors needed for photosynthesis.
3. List the importance of photosynthesis.
4. Describe how wilting occurs.
5. Describe what transpiration and stomata is.
6. Identify the factors affecting the rate of transpiration.
7. Investigate the pathway of water in plants.
8. Identify the location of xylem and phloem.
9. Describe the functions of xylem and phloem.
10. Describe the flows of water and minerals in plants.

11. Identify the male and female parts of a flower.
12. Describe the functions male and female reproductive parts of a flower.
13. Describe what pollination is.
14. Identify the location where pollination occurs in a flower.
15. Relate the characteristics of the flowers to their agents of pollination.
16. Compare the characteristics between insect-pollinated and wind-pollinated flowers.
17. Compare and contrast self-pollination and cross-pollination.
18. Describe fertilization in plants.
19. Describe the formation of fruits and seeds.
20. Describe the methods of dispersal of seeds and fruits and their characteristics.
21. Identify and describe functions of the structures of a seed.
22. Carry out experiment to study the conditions needed for germination of seeds.
23. Identify the essential nutrients required by plants and describe the effects of nutrient deficiency.
24. Describe the use of fertilizers in agriculture.
25. Describe with examples what vegetative reproduction is.
26. Describe the importance of plant tissue culture and its application.

Teaching and Learning Activities

1st – 7th hours (Photosynthesis)

1. Explain what photosynthesis is.
2. Explain the materials needed and the products produced by photosynthesis.
3. Emphasize the equation to represent photosynthesis and the requirements for photosynthesis.
4. Ask students to do Question 1 on page 33 of the workbook as their homework.
5. Explain the steps to test the presence of starch in leaves before proceeding to the activity to investigate the factors required for photosynthesis.
6. Ask students to do Question 2 on page 33 of the workbook as their homework.

7. Lastly, explain the importance of photosynthesis using the chart on page 54.
8. Ask students to do Question 3 on page 34 of the workbook as their homework.
9. Have students try Test Yourself 3.1 and discuss the answers with them.

8th – 14th hours (Transport System in Plants)

1. Ask students what will happen when we do not water an indoor potted plant for a week. Ask them to make inferences.
2. Use the PowerPoint 'Transport system in plants Chap 3 Science M1'. Explain the terms wilting and transpiration. To know more about transpiration, watch the video by scanning the QR code below.

3. Ask students to do Questions 1 and 2 on pages 34 and 35 of the workbook as their homework.
4. Get students to observe the stomata on the underside of a leave using a good magnifying glass before explaining the function of stomata.
5. Have students do Question 3 on pages 35 and 36 of the workbook as their homework.
6. Discuss with students the factors that affect the rate of transpiration and the roles of transpiration.
7. Explain xylem and phloem to students.
8. Carry out the activities to further explain the function of xylem and phloem.
9. Explain the direction of transportation of xylem and phloem.
10. Have students do Questions 4 and 5 on page 36 of the workbook as their homework.
11. Have students try Test Yourself 3.2 and discuss the answers with them.

15th hour (Sexual Reproductive System of Flowering Plants)

1. Get a fresh hibiscus flower and refresh students' memory of the parts of a flower and their functions.
2. Get a male and a female papaya flower and have students identify the parts of the flower. Remind them of the male and female parts of the flower.
3. Ask students to do Question 1 on page 37 of the workbook as their homework.
4. Explain the functions of the parts of a flower.
5. Ask students to do Questions 2 and 3 on pages 37 and 38 of the workbook as their homework.
6. Have students try Test Yourself 3.3 and discuss the answers with them.

16th – 17th hours (Pollination)

1. Explain to students what pollination is.
2. Describe to students the features of an insect-pollinated flower and a wind-pollinated flower. Ask students to compare the features.
3. To know more about animal-pollinated flower, watch this video by scanning the QR code below.

4. Explain the terms self-pollination and cross-pollination and get students to compare these two methods of pollination.
5. Ask students to do Questions 1, 2 and 3 on pages 38 and 39 of the workbook as their homework.
6. Explain the advantages and the use of cross-pollination in agriculture, using example on page 68.
7. Have students try Test Yourself 3.4 and discuss the answers with them.

18th – 19th hours (Development of Fruits and Seeds in Plants)

1. Explain to students how fertilization occurs in a flower. Use the diagram on page 69. To understand more, watch this video by scanning the QR code below.

2. Explain also how fruits and seeds are developed after a successful fertilization.
3. Ask students to do Questions 1, 2 and 3 on pages 39 and 40 of the workbook as their homework.
4. Have students try Test Yourself 3.5 and discuss the answers with them.

20th – 21st hours (Dispersal of Seeds and Fruits)

1. Explain the purpose of fruit and seed dispersal.
2. Ask students to do Question 1 on page 41 of the workbook as their homework.
3. Get a dandelion and a balsam fruit. Let students observe the structures of the dandelion and the balsam fruit and ask students their dispersal methods.
4. Explain other dispersal methods with examples. Explain the modified structures of a plant that suited to its dispersal method.
5. Ask students to do Questions 2 and 3 on page 41 of the workbook as their homework.
6. Have students try Test Yourself 3.6 and discuss the answers with them.

22nd – 25th hours (Germination of Seeds)

1. Get a mung bean and a maize grain. Discuss the structures of both beans.
2. Ask students to do Questions 1 and 2 on page 42 of the workbook as their homework.

3. Carry out the activity to determine the conditions required for germination of seeds. Emphasize the conditions again to students.
4. Explain the physical changes of seedlings during germination.
5. Discuss the differences between the epigeal germination and hypogeal germination. To compare them, watch this video by scanning the QR code below.

6. Ask students to do Questions 3 and 4 on pages 42 and 43 of the workbook as their homework.
7. Have students try Test Yourself 3.7 and discuss the answers with them.

26th hour (Mineral Requirements in Plants)

1. Explain to students why plants need a variety of minerals and from where they obtain the minerals.
2. Introduce the term ‘macronutrient’ and give examples of macronutrient that plants need. Explain the effects of deficiencies in macronutrients. Refer table on page 77.
3. Introduce the term ‘micronutrient’ and give examples of micronutrients that plants need.
4. Explain to students the purpose of using fertilizers in agriculture.
5. Ask students to do Questions 1 and 2 on page 43 and 44 of the workbook as their homework.
6. Have students try Test Yourself 3.8 and discuss the answers with them.

27th – 29th hours (Asexual Reproduction of Plants)

1. Make students recall the plant propagation method with seeds which is sexual propagation method. Explain the advantage and the disadvantage of sexual propagation.
2. Explain the meaning of asexual and vegetative reproduction. Explain the advantage and disadvantage of vegetative reproduction.
3. Ask students to name plants that propagate vegetatively naturally.
4. Give examples and explain the plants that reproduce through natural vegetative propagation.
5. Ask students to do Questions 1 and 2 on page 44 of the workbook as their homework.
6. Explain the artificial vegetative reproduction methods.
7. Explain plant tissue culture and micropropagation. Explain the advantage of micropropagation.
8. Explain the disadvantages, application and importance of plant tissue culture in various areas, such as to increase crop production, pharmaceutical and medicinal production.
9. To learn more about artificial vegetative reproduction, watch this video by scanning the QR code below.

10. Ask students to do Questions 3, 4 and 5 on page 45 of the workbook as their homework.
11. Have students try Test Yourself 3.9 and discuss the answers with them.

30th hour (Conclusion)

1. Use Conceptual Map on page 81 to help students to understand the relationship of all the subtopics learnt in this chapter.

2. Revise the lesson using Basic Recall page 82.
3. Randomly select 5 objective questions in QR Quiz and 2 subjective questions from the Mastery Practice in the Textbook and have students solve them in the class. Have students work on the rest of the questions at home.
4. Ask students to do the Map It Out and the Enrichment Exercises in the workbook to test their understanding of this chapter as their homework.

Emphasized Skills:

1. Observing
2. Classifying
3. Grouping and classifying
4. Comparing and contrasting
5. Making inferences
6. Making hypothesis
7. Predicting
8. Communicating
9. Using and handling science apparatus correctly and safely
10. Handling specimen correctly and carefully

Learning Materials:

- Focus Smart Plus Textbook Science M1
- Focus Smart Plus Workbook Science M1
- Fresh flowering plants
- Dandelion
- Balsam fruit
- Mung bean
- Maize grain

STEM Activity: Miniature garden

Group size: 3 to 4 persons

Suggested time: 4-5 hours

Overview:

This activity will surprise students how little water plants need in a closed system. It gives them an idea that these plants are able to survive entirely on recycled air, water and nutrients. This encourages them to find out how plants recycle the air, water and nutrients when they are cut off from the outside environment.

Procedure:

1. Review their knowledge of photosynthesis and transpiration, and get students to answer these questions:
   - **a.** Explain photosynthesis and transpiration.
   - **b.** How do these two processes help plants to grow well?
   - **c.** How do plants get water, air and nutrient?
   - **d.** Can plants survive with small amount of water?
   - **e.** If we are able to plant crops in such environment, how will it benefit us?

2. Let students read a situation on page 90 and identify the problem. Tell them to describe their mission and set their goal.

3. Ask students to do some research on the word '*closed system*'. Then, encourage them to explore and integrate their knowledge of Science, Technology, Engineering and Mathematics by asking them these questions:
   - **a.** What does '*closed system*' mean?
   - **b.** How are students going to apply that understanding in their project?
   - **c.** How will they cut the plants from the outside environment?
   - **d.** How will the plants get enough water, air, light and nutrient?

e. What kinds of plants are suitable for their project?

4. Brainstorm their possible solutions and draw their solution plans by labelling all materials needed. Let them explain how they work among their team members on:

a. the materials they need

b. the reasons for using that materials

c. the steps to carry out their project

d. the reasons for each step they take

e. the assessment of their project

f. the achievement criteria

5. Allow students to do further research online about the similar project and let them tell the similarities and differences between their project and the project found on the internet to the class. Ask them whether they want to improve their plan or not. Is it necessary? Will it be better? Why? Guide them by asking these questions:

a. What container will they use - transparent or opaque? Why?

b. Should the container have a small or big opening? Why?

c. How will they prevent the air in the container from mixing with the outside air?

d. What plants will they use?

i. Slow growing plants?

ii. Size of the plants when they are mature?

iii. Amount of water and sunlight needed by the plants?

e. How much water should they use?

f. How will they prevent the soil from becoming too moist and the roots from rotting?

g. Where will they put the plants?

i. Will it be too hot? Remember it is a closed system, air does not circulate.

ii. Will the plants get enough sunlight?

iii. How will they know if the sunlight is sufficient?

h. How will they measure the growth of the plants to know if the plants are growing well?

Then, let them choose the best one.

6. Ask students to draw a prototype in great details and build up their prototype following their plan.

7. When their project has finished, ask them to assess their work; what works and what does not work? How should they make it better?

Conclusion:

8. Get each group to present their projects using digital presentation tools and explain their process of creation.

9. Encourage them to share their experiences by asking these questions:

a. Why did each group come up with the different solutions and designs?

b. Which stage of the production process causes the project to have different outcomes?

c. What are other factors that affect the outcomes?

d. Can they control those factors?

e. If their project is successful, will it be beneficial to humans and the environment in general?

f. Is it possible to carry out in a large scale? How?

10. For groups with plants that do not grow well, encourage them to think the possible causes and ways to improve them, if they are given a chance to repeat the project.

Learning Outcome Form

Name-Surname: ..... **No.** .....

Mathayom: ..... **Date:** .....

Chapter 3 Plants

Explanation: Summary of learning outcomes

Feeling after learning this chapter:

.....

.....

.....

.....

Contents that you need for teacher to explain further:

.....

.....

.....

.....

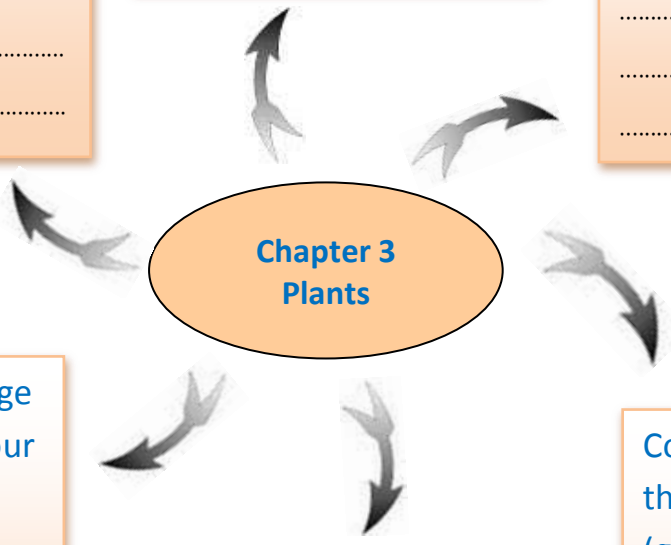
Knowledge gained from this chapter:

.....

.....

.....

.....



Application of knowledge from this chapter on your daily life:

.....

.....

.....

.....

Exercises that you like and want to be selected as the outstanding work:

.....

.....

.....

.....

Contents that you like the most in this chapter (give your reason):

.....

.....

.....

.....

Chapter 4 – States of Matter (8 hours)

Learning Standards and Learning Areas

Learning Standards	Learning Areas
Standard Sc. 2.1 **M.1/9** Explain and compare the arrangement, binding force and movement of particles of a matter in solid, liquid and gas states by using a model.	• States of matter • Changes of states of matter

Learning Objective

Students will be taught to:

1. Understand the three states of matter.
2. Understand the changes of states of matter.

Learning Outcomes

Students will be able to:

1. Describe matter.
2. Describe what matter is made up of.
3. Compare and contrast solids, liquids and gases.
4. Compare and contrast the arrangement and movement of particles in solids, liquids and gases.
5. Carry out experiment to study the arrangement of particles in solids, liquids and gases.
6. Describe with examples the changes of states.

Teaching and Learning Activities

1st – 5th hours (States of Matter)

1. Explain to students what matter is made up of.
2. Do the activity to show that matter is made up of small particles.
3. Explain the three states of matter – solid, liquid and gas. Discuss their properties.
4. Ask students to do Question 1 on page 52 of the workbook as their homework.
5. Compare and contrast the arrangement and movement of particles in the three states.
6. Do the activity to show the arrangement of particles in the three states of matter.
7. Ask students to do Questions 2 and 3 on pages 52 and 53 of the workbook as their homework.
8. Have students try Test Yourself 4.1 and discuss the answers with them.

6th – 7th hours (Changes of States of Matter)

1. Explain to students what happen to the states of matter when the matter is heated or cooled and also if any other changes take place.
2. Ask students to do Questions 1 and 2 on pages 53, 54 and 55 of the workbook as their homework.
3. Have students try Test Yourself 4.2 and discuss the answers with them.

8th hour (Conclusion)

1. Use Conceptual Map on page 96 to help students to understand the relationship of all the subtopics learnt in this chapter.
2. Revise the lesson using Basic Recall page 97.
3. Randomly select 5 objective questions in QR Quiz and 2 subjective questions from the Mastery Practice in the Textbook and have students solve them in the class. Have students work on the rest of the questions at home.

4. Ask students to do the Map It Out and the Enrichment Exercises in the workbook to test their understanding of this chapter as their homework.

Emphasized Skills:

1. Observing
2. Classifying
3. Making inferences
4. Comparing and contrasting
5. Communicating

Learning Materials:

- Focus Smart Plus Textbook Science M1
- Focus Smart Plus Workbook Science M1

STEM Activity: Ice cube challenge

Group size: 3 to 4 persons

Suggested time: 4-5 hours

Overview:

This activity will make students to think of the insulation materials and ways to keep an object cold for a long period. They may be surprised to find the materials that kept a thing cold are the same materials that they would wrap up something in to keep it warm.

Procedure:

1. Review their knowledge of heat transfer and heat insulator. Put a glass of water with ice on the table and get students to observe and answer these questions:
   - **a.** Why is the ice melting?
   - **b.** Where does the heat that melts the ice come from?
   - **c.** When we are preventing the ice from melting, are we preventing the heat from reaching the ice?
   - **d.** How many factors affect the rate of ice melting?
   - **e.** How do we keep the water cold?
   - **f.** How do you slow down the rate of ice melting?

2. Let students read a situation on page 98 and identify the problem. Tell them to describe their mission and set their goal.

3. Ask students to do some research on the word '*insulate'*. Then, encourage them to explore and integrate their knowledge of Science, Technology, Engineering and Mathematics by asking them these questions:
   - **a.** What does '*insulate'* mean?

b. How are students going to apply that understanding in their project?

c. Where does the heat come from?

d. Are we keeping the heat in the container or preventing the heat from entering the container?

e. What kinds of materials can be used to insulate a container?

4. Brainstorm their possible solutions and draw their solution plans by labelling all materials needed. Let them explain how they work among their team members on:

a. the materials they need

b. the reasons for using that materials

c. the steps to carry out their project

d. the reasons for each step they take

e. the assessment of their project

f. the achievement criteria

5. Allow students to do further research online about the similar project and let them tell the similarities and differences between their project and the project found on the internet to the class. Ask them whether they want to improve their plan or not. Is it necessary? Will it be better? Why? Guide them by asking these questions:

a. What container will they use - a container made from a heat insulation material or heat conducting material? Why?

b. How big is the container? Does the size of the container affect the result?

c. Will the container have a lid? Why?

d. What material will they use to wrap the container to prevent heat from reaching the ice?

e. How thick is the material? Does the thickness of the material affect the result?

f. How will they stick the material to the container?

g. Will they cover the container fully or partly with the material? Why?

Then, let them choose the best one.

6. Ask students to draw a prototype in great details and build up their prototype following their plan.

7. After their project has finished, ask them to assess their work; what works and what does not work? How to make it better?

Conclusion:

8. Get each group to present their projects using digital presentation tools and explain their process of creation.

9. Encourage them to share their experiences by asking these questions:

a. Why did each group come up with the different solutions and designs?

b. Which stage of the production process causes the project to have different outcomes?

c. What are other factors that affect the outcomes?

d. Can they control those factors?

e. If their project is successful, will it be beneficial to humans and the environment in general?

f. Is it possible to carry out on a large scale? How?

10. For groups with their inventions that do not work well, encourage them to think the possible causes and ways to improve them, if they are given a chance to repeat the project.

Learning Outcome Form

Name-Surname: ..... **No.** .....

Mathayom: ..... **Date:** .....

Chapter 4 States of Matter

Explanation: Summary of learning outcomes

Feeling after learning this chapter:

.....

.....

.....

.....

Contents that you need for teacher to explain further:

.....

.....

.....

.....

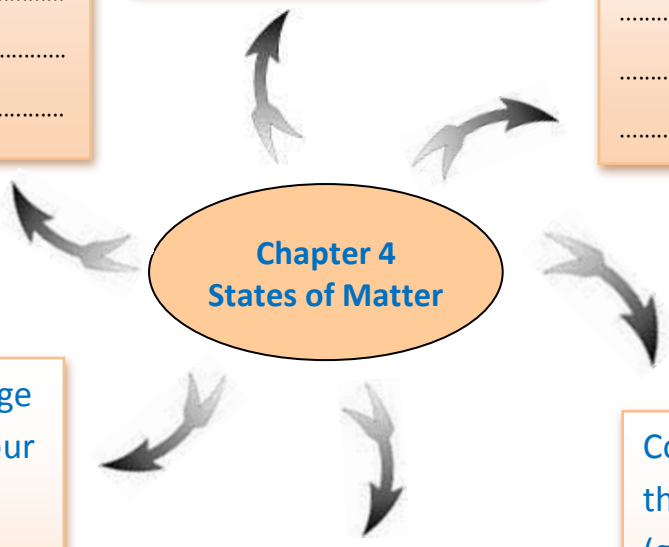
Knowledge gained from this chapter:

.....

.....

.....

.....



Application of knowledge from this chapter on your daily life:

.....

.....

.....

.....

Exercises that you like and want to be selected as the outstanding work:

.....

.....

.....

.....

Contents that you like the most in this chapter (give your reason):

.....

.....

.....

.....

Chapter 5 – Atoms, Elements and Compounds (15 hours)

Learning Standards and Learning Areas

Learning Standards	Learning Areas
Standard Sc. 2.1 **M.1/8** Use a model to explain atomic structure which consists of protons, neutrons and electrons.	• Atoms
M.1/7 Explain the relationship between atoms, elements and compounds by using a model and information. **M.1/1** Explain the physical properties of metals, non-metals, metalloids using empirical evidence based on observation, experiment and collected data from IT and grouping substances into metals, non-metals and metalloids. **M.1/2** Analyse the effects of using metallic, non-metallic, semi metallic and radioactive elements to living things, environment, economy and society based on empirical evidence **M.1/3** Realise the values of metallic, non-metallic, semi metallic and radioactive elements	• Elements • Compounds and mixtures

by introducing how to utilize elements safely, effectively and economically.	
M.1/4 Compare the boiling point and melting point of pure substances and the mixtures based on temperature measurement. Draw graphs and interpret graphs or information. **M.1/5** Explain and compare the density of pure substances and mixtures. **M.1/6** Use equipment to measure mass and volume of pure substances and mixtures.	• Effects of Impurities

Learning Objectives

Students will be taught to:

1. Understand the atomic structure.
2. Understand atoms, elements, compounds and mixture and their relationships.
3. Understand the properties of metals, non-metals, metalloids and radioactive elements.
4. Understand the periodic table.
5. Analyse the effect of using metals, non-metals, metalloids and radioactive elements to living things, environment, economy and society.
6. Realise the safe, effective and economic ways to utilize metals, non-metals, metalloids and radioactive elements.
7. Understand the effect of impurities on boiling point and melting point, mass and density of pure substance and mixtures.

Learning Outcomes

Students will be able to:

1. Describe atomic structure.
2. Describe atoms, elements, compounds and mixture and their relationships.
3. Describe the periodic table.
4. Describe the properties of metals, non-metals, metalloids and radioactive elements.
5. Describe the effect of using metals, non-metals, metalloids and radioactive elements to living things, environment, economy and society.
6. Realise the safe, effective and economic ways to utilize metals, non-metals, metalloids and radioactive elements.
7. Carry out experiments to investigate the effects of impurities on melting and boiling points, mass and density of pure substance and mixtures.

Teaching and Learning Activities

1st hour (Atoms)

1. Ask students to recall the term matter and what it is made up of.
2. Explain that atom is the basic building block of all matter.
3. Explain the subatomic particles of an atom.
4. Ask students to do Question 1, 2 and 3 on page 62 of the workbook as their homework.
5. Have students try Test Yourself 5.1 and discuss the answers with them.

2nd – 8th hours (Elements)

1. Explain to students the term elements and give some examples of elements.
2. Explain that some elements combined to form molecules and give examples of molecules.
3. Explain the abundance of elements in the Earth based on the chart on page 103.

4. Give examples of elements with their symbols and their properties.
5. Ask students to do Question 1, 2 and 3 on page 63 of the workbook as their homework.
6. Explain to students the Periodic Table using the Periodic Table on page 104. Explain that the elements are classified in the table based on their properties, and the table divides the elements into groups and periods. To learn more about the elements in the periodic table, watch this video by scanning the QR code below.

7. Ask students to do Question 4 on pages 63 and 64 of the workbook as their homework.
8. Further explain that the elements can be classified into three groups – metals, non-metals and metalloids and explain their properties.
9. Ask students to do Questions 5, 6 and 7 on pages 63 and 64 of the workbook as their homework.
10. Explain what a radioactive element is. Explain the decay process of radioactive elements. Explain the three types of radioactive radiations.
11. Explain the usage of metals, non-metals, metalloids and radioactive elements in daily life. Explain the effects of using metals, non-metals, metalloids and radioactive elements to living things and environment.
12. Ask students to do Question 8 and 9 on page 65 of the workbook as their homework.
13. Have students try Test Yourself 5.2 and discuss the answers with them.

9^{th} – 10^{th} hours (Compounds and Mixtures)

1. Explain what a compound is and how it is formed by giving examples.

2. Ask students to do Questions 1 and 2 on pages 65 and 66 as their homework.
3. Explain what mixture is and how it is formed by giving examples.
4. Compare between a compound and a mixture using table on page 111.
5. Ask students to do Questions 3 and 4 on pages 66 and 67 of the workbook as their homework.
6. Have students try Test Yourself 5.3 and discuss the answers with them.

11th – 14th hours (Effects of Impurities)

1. Explain what pure substance and impurity are.
2. Carry out the experiments that determine the effects of impurities on melting, boiling points and density of water. Discuss them with students.
3. Do the activity to determine the density of salt water.
4. Ask students to do Questions 1, 2 and 3 on pages 67 and 68 of the workbook as their homework.
5. Have students to try Test Yourself 5.4 and discuss the answers with them.

15th hour (Conclusion)

1. Use Conceptual Map on page 116 to help students to understand the relationship of all the subtopics learnt in this chapter.
2. Revise the lesson using Basic Recall pages 117.
3. Randomly select 5 objective questions in QR Quiz and 2 subjective questions from the Mastery Practice in the Textbook and have students solve them in the class. Have students work on the rest of the questions at home.
4. Ask students to do the Map It Out and the Enrichment Exercises in the workbook to test their understanding of this chapter as their homework.

Emphasized Skills:

1. Observing
2. Classifying

3. Making inferences
4. Making hypothesis
5. Predicting
6. Communicating
7. Using and handling science apparatus correctly and safely
8. Handling specimen correctly and carefully

Learning Materials:

- Focus Smart Plus Textbook Science M1
- Focus Smart Plus Workbook Science M1

Learning Outcome Form

Name-Surname: ..... **No.** .....

Mathayom: ..... **Date:** .....

Chapter 5 Atoms, Elements and Compounds

Explanation: Summary of learning outcomes

Feeling after learning this chapter:

.....

.....

.....

.....

Contents that you need for teacher to explain further:

.....

.....

.....

.....

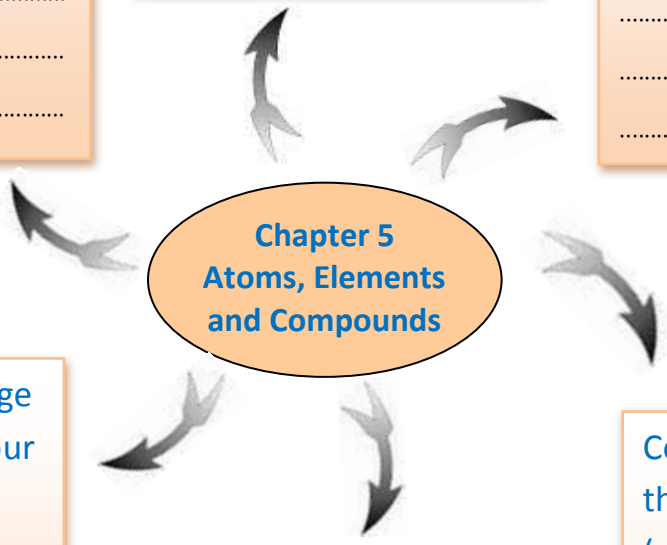
Knowledge gained from this chapter:

.....

.....

.....

.....



Application of knowledge from this chapter on your daily life:

.....

.....

.....

.....

Exercises that you like and want to be selected as the outstanding work:

.....

.....

.....

.....

Contents that you like the most in this chapter (give your reason):

.....

.....

.....

.....

Chapter 6 – Heat (25 hours)

Learning Standards and Learning Areas

Learning Standards	Learning Areas
Standard Sc. 2.3 **M.1/2.** Use thermometer to measure the temperature of matters.	• Heat as a form of energy
M.1/3. Make a model that explains the expansion and contraction of matters when absorb or lost heat. **M.1.4.** Recognize the benefits of knowledge of contraction. And the expansion of the substance due to heat. By analyzing the situation, problems and suggestions. How to bring knowledge to solve everyday problems. **M.1/1.** Analyse, interpret information and calculate the amount of heat used in changing the temperatures and states of matters. Use the formula $Q = mc\Delta t$ and $Q = mL$. **Standard Sc. 2.1** **M.1/10.** Explain the relationship between heat energy and the change of states of matters by using empirical evidence and model.	• Effects of heat on matter

Standard Sc. 2.3 **M.1/5.** Analyse the situation of heat transfer and calculate the quantity of heat transferred between substances resulting in thermal equilibrium using the formula Q (heat lost) = Q (heat absorbed). **M.1/6.** Make a model to explain heat transfer by thermal conduction, convection and radiation. **M.1/7.** Design, choose and create devices in order to solve the problems in everyday life by applying the knowledge of heat transfer.	• Thermal equilibrium and heat flow

Learning Objectives

Students will be taught to:

1. Understand heat as a form of energy.
2. Use a thermometer to measure the temperature of a matter.
3. Analyse the effects of heat on matter.
4. Realise the uses of expansion and contraction of matter.
5. Understand specific heat capacity and calculate the quantity of heat gained or lost by using formula $Q = mc\Delta t$.
6. Realise the application of specific heat capacity in daily life.
7. Understand specific latent heat and calculate the quantity of heat gained or lost when a substance changes its state by using formula $Q = mL$.
8. Realise the application of specific latent heat in daily life.
9. Understand thermal equilibrium.
10. Analyse how heat flow.
11. Realise some natural phenomena caused by heat flow.

12. Understand heat conductors and heat insulators and their uses.
13. Realise the benefit of heat flow.

Learning Outcomes

Students will be able to:

1. Describe heat as a form of energy.
2. List sources of heat.
3. List uses of heat.
4. Compare and contrast heat and temperature.
5. Carry out experiment to show difference between heat and temperature.
6. Describe expansion and contraction of solids, liquids and gases.
7. Carry out activity to observe expansion and contraction of solids, liquids and gases.
8. Describe the applications of expansion and contraction of matter.
9. Describe the use of the principle of expansion and contraction of matter in solving simple problems.
10. Describe specific heat capacity and apply the formula $Q = mc\Delta t$ in calculate the quantity of heat gained or lost by an object.
11. List the applications of specific heat capacity in daily life.
12. Describe the changes in state of matter due to heat.
13. Describe specific latent heat and apply the formula $Q = mL$ to calculate the quantity of heat gained or lost when a substance changes its states.
14. List the application of specific latent heat in daily life.
15. Explain thermal equilibrium.
16. Explain heat transfer through conduction, convection and radiation of heat.
17. Carry out experiments to show transfer of heat by conduction, convection and radiation.
18. Explain some phenomena occur due to heat flow such as warming of Earth by the Sun and land and sea breezes.

19. Describe how to keep building cool using the knowledge of heat flow.
20. Describe with examples heat conductors and heat insulators.
21. List the uses of heat conductors and heat insulators.
22. Carry out experiment to investigate different materials as heat insulators.
23. List the benefits of heat flow.

Teaching and Learning Activities

1st – 5th hours (Heat as a Form of Energy)

1. Carry out an activity to show that the Sun gives out heat. Then explain heat is a form of energy.
2. Ask students to name other sources of heat.
3. Discuss the uses of heat.
4. Ask students to do Question 1 on page 74 of the workbook as their homework.
5. Ask students to compare and contrast between heat and temperature.
6. Carry out an activity to show the difference between heat and temperature.
7. Ask students to do Question 2 on pages 74 and 75 of the workbook as their homework.
8. Have students try Test Yourself 6.1 and discuss the answers with them.

6th – 15th hours (Effects of Heat on Matter)

1. Explain the effects on matter when it gains or loses heat.
2. Discuss the expansion and contraction of solids, liquids and gases with students. Use the PowerPoint 'Expansion and contraction of matter Chap 7 Science M1'.
3. Carry out the activity that observes the effect of heat on solids, liquids and gases.
4. Ask students to do Questions 1 and 2 on page 75 and 76 of the workbook as their homework.

5. Discuss the uses of expansion and contraction of matter in our daily life. Use a few common examples such as mercury in thermometers, bimetallic strip in fire alarms, removing metal lids of a bottle and gaps in railway tracks.
6. Ask students to do Question 3 on pages 76 of the workbook as their homework.
7. Explain the changes in temperature of an object when heat is released or gained. Discuss the factors that affects the change in temperature of an object when it is heated or cooled.
8. Ask students to do Question 4 on page 76 of the workbook as their homework.
9. Explain specific heat capacity and emphasize that different substances have different specific heat capacities.
10. Ask students to do Question 5 on page 77 of the workbook as their homework.
11. Explain the formula $Q = mc\Delta t$ for calculating the quantity of heat gained or lost by an object and show how to apply the formula in calculation using the examples on page 135.
12. Ask students to do Questions 6, 7 and 8 on page 77 of the workbook as their homework.
13. Explain the application of specific heat capacity in daily life and natural phenomena that involve specific heat capacity, such as the materials of cooking pots and kettles, car radiators using water as cooling agent, sea breeze and land breeze. Use the PowerPoint 'Land and sea breezes Chap 7 Science M1'.
14. Explain to students that the temperature of a heated or cooled object remain constant when the object changes its states of mater. Use the graph on page 137.
15. Explain the term specific latent heat. Explain the formula $Q = mL$ for calculation of the quantity of heat gained or lost when a substance changes its states.

16. Ask students to do Question 9 on pages 77 and 78 of the workbook as their homework.
17. Explain specific latent heat of vaporization and specific latent heat of fusion. Explain the reasons why specific latent heat of vaporization of a substance is greater than its specific latent heat of fusion.
18. Show how to apply the formula Q = mL in calculation using examples on page 139.
19. Ask students to do Questions 10, 11 and 12 on pages 78 and 79 of the workbook as their homework.
20. Explain the application of specific latent heat in daily lives.
21. Have students try Test Yourself 6.2 and discuss the answers with them.

16^{th} – 24^{th} hours (Thermal Equilibrium and Heat Flow)

1. Explain that heat flows from a hot object to a cooler object naturally and this will continue until both objects have the same temperature and the objects are said to be in thermal equilibrium.
2. Explain the thermal equilibrium formula $Q_{lost} = Q_{gained}$. Show how to apply the formula using the example on page 142.
3. Ask students to do Questions 1, 2 and 3 on page 79 of the workbook as their homework.
4. Explain the three ways of how heat is transferred – conduction, convection and radiation.
5. Carry out activities to show the three ways of heat transfer.
6. Ask students to conclude by comparing these three ways.
7. Ask students to do Questions 4 on page 80 of the workbook as their homework.
8. Ask students to give examples of heat flow in natural phenomena.

9. Explain the natural phenomena that involve heat flow such as the warming of the Earth by the Sun, sea breeze and land breeze. Watch this video by scanning the QR code below.

10. Ask students to describe the features of our houses that help to keep the houses cool. Explain how these features work.
11. Ask students to recall what heat conductors and heat insulators are, with examples.
12. Ask students to give examples of how we use heat conductors and heat insulators.
13. Carry out the experiment to investigate the different materials as heat insulators.
14. Ask students to do Question 5 on page 80 of the workbook as their homework.
15. Ask students to list the examples of how we benefit from heat flow.
16. Ask students to do Question 6 on page 81 of the workbook as their homework.
17. Have students try Test Yourself 6.3 and discuss the answers with them.

25th hour (Conclusion)

1. Use Conceptual Map on page 153 to help students to understand the relationship of all the subtopics learnt in this chapter.
2. Revise the lesson using Basic Recall page 154.
3. Randomly select 5 objective questions in QR Quiz and 2 subjective questions from the Mastery Practice in the Textbook and have students solve them in the class. Have students work on the rest of the questions at home.
4. Ask students to do the Map It Out and the Enrichment Exercises in the workbook to test their understanding of this chapter as their homework.

Emphasized Skills:

1. Observing
2. Classifying
3. Making inferences
4. Predicting
5. Communicating
6. Using and handling science apparatus correctly and safely
7. Handling specimen correctly and carefully

Learning Materials:

- Focus Smart Plus Textbook Science M1
- Focus Smart Plus Workbook Science M1

STEM Activity: A solar oven

Group size: 3 to 4 persons

Suggested time: 4-5 hours

Overview:

This activity will trigger students to realize that the sun gives out a lot of energy and they can use this free and clean energy to cook.

Procedure:

1. Review their knowledge of reflection and absorption of heat. Get students to answer to these questions:
   - **a.** Why do we feel hot under the Sun?
   - **b.** Can we collect and focus this energy to a point?
   - **c.** What will happen to the point? Will it be very hot?
   - **d.** What color absorbs heat the best?

2. Let students read a situation on page 155 and identify the problem. Tell them to describe their mission and set their goal.

3. Ask students to do some research on the word 'solar heat'. Then, encourage them to explore and integrate their knowledge of Science, Technology, Engineering and Mathematics by asking them these questions:
   - **a.** What does 'solar heat' mean?
   - **b.** How are students going to apply that understanding in their project?
   - **c.** Can the solar heat make water boils?
   - **d.** How do we collect and focus this heat from the sun?

4. Brainstorm their possible solutions and draw their solution plans by labelling all materials needed. Let them explain how they work among their team members on:
   - **a.** the materials they need
   - **b.** the reasons for using that materials
   - **c.** the steps to carry out their project
   - **d.** the reasons for each step they take
   - **e.** the assessment of their project
   - **f.** the achievement criteria

5. Allow students to do further research online about the similar project and let them tell the similarities and differences between their project and the project found on the internet to the class. Ask them whether they want to improve their plan or not. Is it necessary? Will it be better? Why? Guide them by using these questions:
   - **a.** Which box will they use? Why?
   - **b.** Does the box need a lid? How will they use the lid?
   - **c.** What type of cup will they use – a metal cup or a polystyrene cup? Why?
   - **d.** Can they do anything to the cup to make it absorbs more heat? How?
   - **e.** Can they do anything to prevent the heat from escaping the box? How?
   - **f.** Where will they put the box?

   Then, let them choose the best one.

6. Ask students to draw a prototype in great details and build up their prototype following their plan.

7. After their project has finished, ask them to assess their work; what works and what does not work? How to make it better?

Conclusion:

8. Get each group to present their projects using digital presentation tools and explain their process of creation.

9. Encourage them to share their experiences by asking these questions:

- **a.** Why did each group come up with the different solutions and designs?
- **b.** Which stage of the production process causes the project to have different outcomes?
- **c.** What are other factors that affect the outcomes?
- **d.** Can they control those factors?
- **e.** If their project is successful, will it be beneficial to humans and the environment in general?
- **f.** Is it possible to carry out on a large scale? How?

10. For groups with their inventions that do not work well, encourage them to think the possible causes and ways to improve them, if they are given a chance to repeat the project.

Learning Outcome Form

Name-Surname: ..... **No.** .....

Mathayom: ..... **Date:** .....

Chapter 6 Heat

Explanation: Summary of learning outcomes

Feeling after learning this chapter:

.....

.....

.....

.....

Contents that you need for teacher to explain further:

.....

.....

.....

.....

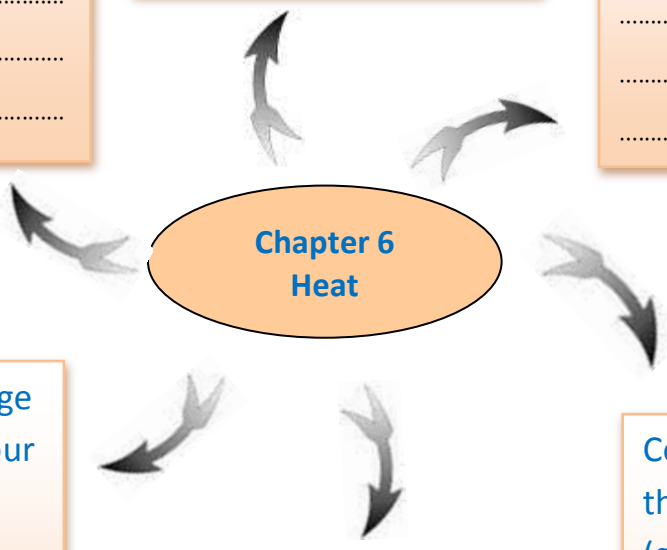
Knowledge gained from this chapter:

.....

.....

.....

.....



Application of knowledge from this chapter on your daily life:

.....

.....

.....

.....

Exercises that you like and want to be selected as the outstanding work:

.....

.....

.....

.....

Contents that you like the most in this chapter (give your reason):

.....

.....

.....

.....

Chapter 7 – Atmosphere and Weather (12 hours)

Learning Standards and Learning Areas

Learning Standards	Learning Areas
Standard Sc. 3.2 **M.1/1.** Make a model that explains the division of atmospheric layers and compare the benefits of each.	• Layers of the Earth's atmosphere
M.1/4. Explain what the weather forecast is and simply forecast the weather from collected data. **M.1.5.** Realise the value of weather forecast by presenting the guidelines on how to behave and make use of the weather forecast. **M.1/2.** Explain the factors that affect the compositions changes of climate and weather from collected information. **Standard Sc. 2.2** **M.1/1.** Make a model to explain the relationship between atmospheric pressure and altitude.	• Weather
M.1.3. Compare the process of a storm, thunderstorm and tropical cyclones that affect organisms and the environment. Provide the	• Thunderstorms and tropical cyclones

guideline on how to behave themselves appropriately and safety.	
M.1/6. Explain the situations and effects of global climate changes based on collected information. **M.1/7.** Realise the impacts of world climate changes by introducing the practical guidelines for self-(health) care under climate change.	• Changes in global climate

Learning Objectives

Students will be taught to:

1. Describe the layers in the Earth's atmosphere.
2. Describe what weather is.
3. Describe weather forecasting and its importance.
4. Describe the weather components and the instruments to collect the information.
5. Understand the relationship between atmospheric pressure and altitude.
6. Describe thunderstorms and tropical cyclones.
7. List ways to protect ourselves during severe weather.

Learning Outcomes

Students will be able to:

1. Describe the five layers in the Earth's atmosphere.
2. Describe weather, meteorology and weather forecast.
3. Explain the six main components of weather and the instrument to collect the information.

4. Explain the relationship between atmospheric pressure and altitude
5. Explain thunderstorms and tropical cyclones.
6. List ways to protect ourselves during severe weather.
7. Explain weather forecasting, station model and weather map.

Teaching and Learning Activities

1st – 2nd hours (Layers of the Earth's Atmosphere)

1. Explain what atmosphere is.
2. Describe the five layers in the atmosphere – troposphere, stratosphere, mesosphere, thermosphere and exosphere.
3. Watch this animation by scanning the QR code below.
4. Ask students to do Questions 1 to 3 on pages 90 and 91 of the workbook as their homework.
5. Have students try Test Yourself 7.1 and discuss the answers with them.

3rd – 5th hours (Weather)

1. Explain what weather and meteorology are.
2. Explain what weather forecast is and explain its importance and applications in daily life.
3. Ask students to do Questions 1, 2 and 3 on page 91 of the workbook as their homework.
4. Explain what weather components is and explain the properties and instrument to measure the weather components.
5. Explain how altitude affects atmospheric pressure.

6. Ask students to do Questions 4, 5 and 6 on page 92 of the workbook as their homework.
7. Have students try Test Yourself 7.2 and discuss the answers with them.

6th – 8th hours (Thunderstorms and Tropical Cyclones)

1. Describe how a thunderstorm is formed. Use the diagram on page 169.
2. Watch this video by scanning the QR code below.

3. Explain the effects of the thunderstorms to life and property.
4. Discuss with students the safety precautions when thunderstorm occurs.
5. Ask students to do Questions 1 on page 93 of the workbook as their homework.
6. Describe how a tropical cyclone is formed. Use the diagram on page 171.
7. Watch this video by scanning the QR code below.

8. Explain the effects of the tropical cyclone to life and property.
9. Discuss with students the safety precautions when tropical cyclone occurs.
10. Ask students to do Question 2 on page 93 of the workbook as their homework.
11. Have students try Test Yourself 7.3 and discuss the answers with them.

9th – 11th hour (Changes in Global Climate)

1. Explain to students what global climate, global warming and greenhouse effect are.
2. Watch these videos by scanning the QR code on the next page.

3. Explain the factors and activities that contribute to global warming.
4. Ask students to do Questions 1, 2 and 3 on pages 93 and 94 of the workbook as their homework.
5. Explain the effects of global warming.
6. Ask students to do Question 4 on page 94 of the workbook as their homework.
7. Discuss with students what we should do to reduce the effects of global warming.
8. Have students try Test Yourself 7.4 and discuss the answers with them.

12th hour (Conclusion)

1. Use Conceptual Map on page 176 to help students to understand the relationship of all the subtopics learnt in this chapter.
2. Revise the lesson using Basic Recall pages 177.
3. Randomly select 5 objective questions in QR Quiz and 2 subjective questions from the Mastery Practice in the Textbook and have students solve them in the class. Have students work on the rest of the questions at home.
4. Ask students to do the Map It Out and the Enrichment Exercises in the workbook to test their understanding of this chapter as their homework.

Emphasized Skills:

1. Predicting
2. Observing
3. Generating ideas
4. Communicating

Learning Materials:

- Focus Smart Plus Textbook Science M1
- Focus Smart Plus Workbook Science M1

STEM Activity: Climate and clothing

Group size: 3 to 4 persons

Suggested time: 4-5 hours

Overview:

This activity will give students an idea that a simple task like choosing a material for clothing involves scientific knowledge for the best outcomes. It is not only about the smoothness of the material but also other scientific properties in order to make it prefect for the wearers.

Procedure:

1. Review their knowledge of heat absorption and reflection, and also absorbency. Get students to answer to these questions:
   - **a.** What do they wear when they need to go out in the rain?
   - **b.** What is the similarity between the materials of the raincoats and umbrellas?
   - **c.** Can we use the material of the raincoats to make a towel? Why?
   - **d.** Have they tried wearing black clothes in the sun? Will they want to do so again? Why? What color will they wear in the sun?
   - **e.** If they intend to go to cold countries like New Zealand, can they wear their common clothes there? Why?

2. Let students read a situation on page 178 and identify the problem. Tell them to describe their mission and set their goal.

3. Ask students to do some research on the word ‘clothing material’. Then, encourage them to explore and integrate their knowledge of Science, Technology, Engineering and Mathematics by asking them these questions:
   - **a.** What does ‘clothing material’ mean?

b. How are students going to apply that understanding in their project?

c. Does each material have different properties?

d. How do they choose the material based on the climate?

e. What climate are they choosing? Why?

4. Brainstorm their possible solutions and draw their solution plans by labelling all materials needed. Let them explain how they work among their team members on:

a. the materials they need

b. the reasons for using that materials

c. the steps to carry out their project

d. the reasons for each step they take

e. the assessment of their project

f. the achievement criteria

5. Allow students to do further research online about the similar project and let them tell the similarities and differences between their project and the project found on the internet to the class. Ask them whether they want to improve their plan or not. Is it necessary? Will it be better? Why? Guide them by using these questions:

a. What climate are they choosing? Is it hot, very cold, windy or rainy?

b. What materials are they choosing?

c. Can the materials

i. prevent heat from escaping the body?

ii. prevent heat from reaching the body?

iii. absorb water?

d. Will many layers of the material or different materials help?

e. Will combination of materials produce better effects?

Then, let them choose the best one.

6. Ask students to draw a prototype in great details and build up their prototype following their plan.

7. After their project is finished, ask them to assess their work; what works and what does not work? How to make it better?

Conclusion:

8. Get each group to present their projects using digital presentation tools and explain their process of creation.

9. Encourage them to share their experiences by asking these questions:
   - **a.** Why did each group come up with the different solutions and designs?
   - **b.** Which stage of the production process causes the project to have different outcomes?
   - **c.** What are other factors that affect the outcomes?
   - **d.** Can they control those factors?
   - **e.** If their project is successful, will it be beneficial to humans and the environment in general?
   - **f.** Is it possible to carry out on a large scale? How?

10. For groups with their inventions that do not work well, encourage them to think the possible causes and ways to improve them, if they are given a chance to repeat the project.

Learning Outcome Form

Name-Surname: ..... **No.** .....

Mathayom: ..... **Date:** .....

Chapter 7 Atmosphere and Weather

Explanation: Summary of learning outcomes

Feeling after learning this chapter:

.....

.....

.....

.....

Contents that you need for teacher to explain further:

.....

.....

.....

.....

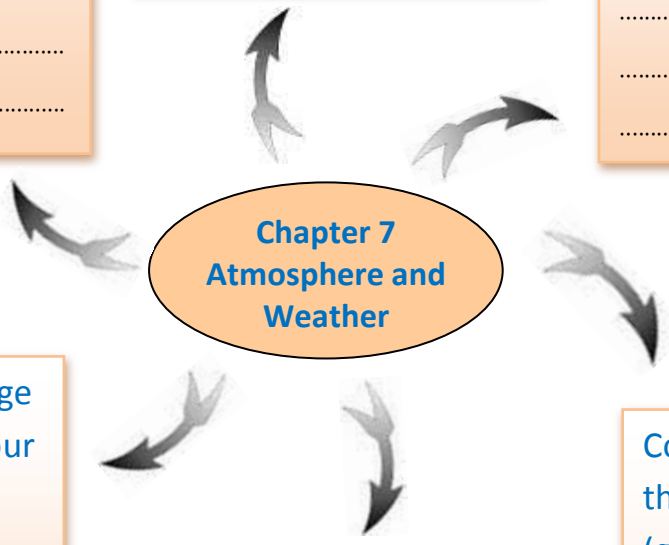
Knowledge gained from this chapter:

.....

.....

.....

.....



Application of knowledge from this chapter on your daily life:

.....

.....

.....

.....

Exercises that you like and want to be selected as the outstanding work:

.....

.....

.....

.....

Contents that you like the most in this chapter (give your reason):

.....

.....

.....

.....