MINISTRY OF EDUCATION MALAYSIA

# Integrated Curriculum for Secondary Schools

## Curriculum Specifications

# SCIENCE
# Form 1

Curriculum Development Centre
Ministry of Education Malaysia
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## THE NATIONAL PHILOSOPHY

Our nation Malaysia is dedicated to achieving a greater unity for all her peoples; maintaining a democratic way of life; creating a just society in which the wealth of the nation shall be equitably distributed; ensuring a liberal approach to her rich and diverse cultural traditions; building a progressive society, orientated towards modern science and technology;

The people of Malaysia pledge their united efforts to attain these ends guided by the following principles:

BELIEF IN GOD
LOYALTY TO KING AND COUNTRY
SUPREMACY OF CONSTITUTION
RULE OF LAW
MUTUAL RESPECT AND GOOD SOCIAL BEHAVIOUR

## NATIONAL PHILOSOPHY OF EDUCATION

Education in Malaysia is an on-going effort towards developing the potential of individuals in a holistic and integrated manner, so as to produce individuals who are intellectually, spiritually, emotionally and physically balanced and harmonious based on a firm belief in and devotion to God. Such an effort is designed to produce Malaysian citizens who are knowledgeable and competent, who possess high moral standards and who are responsible and capable of achieving a high level of personal well being as well as being able to contribute to the harmony and betterment of the family, society and the nation at large.

## NATIONAL SCIENCE EDUCATION PHILOSOPHY

In consonance with the National Education Philosophy,
science education in Malaysia nurtures
a Science and Technology Culture by focusing
on the development of individuals who are competitive,
dynamic, robust and resilient and able
to master scientific knowledge and technological competency.

# PREFACE

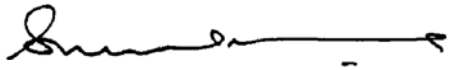
The aspiration of the nation to become an industrialised society depends on science and technology. It is envisaged that success in providing quality science education to Malaysians from an early age will serve to spearhead the nation into becoming a knowledge society and a competitive player in the global arena. Towards this end, the Malaysian education system is giving greater emphasis to science and mathematics education.

The Science curriculum has been designed not only to provide opportunities for students to acquire science knowledge and skills, develop thinking skills and thinking strategies, and to apply this knowledge and skills in everyday life, but also to inculcate in them noble values and the spirit of patriotism. It is hoped that the educational process en route to achieving these aims would produce well-balanced citizens capable of contributing to the harmony and prosperity of the nation and its people.

The Science curriculum aims at producing active learners. To this end, students are given ample opportunities to engage in scientific investigations through hands-on activities and experimentations. The inquiry approach, incorporating thinking skills, thinking strategies and thoughtful learning, should be emphasised throughout the teaching-learning process. The content and contexts suggested are chosen based on their relevance and appeal to students so that their interest in the subject is enhanced.

In a recent development, the Government has made a decision to introduce English as the medium of instruction in the teaching and learning of science and mathematics. This measure will enable students to keep abreast of developments in science and technology in contemporary society by enhancing their capability and know-how to tap the diverse sources of information on science written in the English language. At the same time, this move would also provide opportunities for students to use the English language and hence, increase their proficiency in the language. Thus, in implementing the science curriculum, attention is given to developing students' ability to use English for study and communication, especially in the early years of learning.

The development of this curriculum and the preparation of the corresponding Curriculum Specifications have been the work of many individuals over a period of time. To all those who have contributed in one way or another to this effort, may I, on behalf of the Ministry of Education, express my sincere gratitude and thanks for the time and labour expended.



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# INTRODUCTION

As articulated in the National Education Policy, education in Malaysia is an on-going effort towards developing the potential of individuals in a holistic and integrated manner to produce individuals who are intellectually, spiritually, emotionally and physically balanced and harmonious. The primary and secondary school science curriculum is developed with the aim of producing such individuals.

As a nation that is progressing towards a developed nation status, Malaysia needs to create a society that is scientifically oriented, progressive, knowledgeable, having a high capacity for change, forward-looking, innovative and a contributor to scientific and technological developments in the future. In line with this, there is a need to produce citizens who are creative, critical, inquisitive, open-minded and competent in science and technology.

The Malaysian science curriculum comprises three core science subjects and four elective science subjects. The core subjects are Science at primary school level, Science at lower secondary level and Science at upper secondary level. Elective science subjects are offered at the upper secondary level and consist of Biology, Chemistry, Physics, and Additional Science.

The core science subjects for the primary and lower secondary levels are designed to provide students with basic science knowledge, prepare students to be literate in science, and enable students to continue their science education at the upper secondary level. Core Science at the upper secondary level is designed to produce students who are literate in science, innovative, and able to apply scientific knowledge in decision-making and problem solving in everyday life.

The elective science subjects prepare students who are more scientifically inclined to pursue the study of science at post-secondary level. This group of students would take up careers in the field of science and technology and play a leading role in this field for national development.

For every science subject, the curriculum for the year is articulated in two documents: the syllabus and the curriculum specifications. The syllabus presents the aims, objectives and the outline of the curriculum content for a period of 2 years for elective science subjects and 5 years for core science subjects. The curriculum specifications provide the details of the curriculum which includes the aims and objectives of the curriculum, brief descriptions on thinking skills and thinking strategies, scientific skills, scientific attitudes and noble values, teaching and learning strategies, and curriculum content. The curriculum content provides the learning objectives, suggested learning activities, the intended learning outcomes, and vocabulary.

## AIMS

The aims of the science curriculum for secondary school are to provide students with the knowledge and skills in science and technology and enable them to solve problems and make decisions in everyday life based on scientific attitudes and noble values.

Students who have followed the secondary science curriculum will have the foundation in science to enable them to pursue formal and informal further education in science and technology.

The curriculum also aims to develop a concerned, dynamic and progressive society with a science and technology culture that values nature and works towards the preservation and conservation of the environment.

## OBJECTIVES

The science curriculum for secondary school enables students to:

1. Acquire knowledge in science and technology in the context of natural phenomena and everyday life experiences.

2. Understand developments in the field of science and technology.

3. Acquire scientific and thinking skills.

4. Apply knowledge and skills in a creative and critical manner for problem solving and decision-making.

5. Face challenges in the scientific and technological world and be willing to contribute towards the development of science and technology.

6. Evaluate science- and technology-related information wisely and effectively.

7. Practise and internalise scientific attitudes and good moral values.

8. Realise **the importance of inter-dependence among living things and the management of nature for survival of mankind.**

9. Appreciate the contributions of science and technology towards national development and the well-being of mankind.

10. Realise that scientific discoveries are the result of human endeavour to the best of his or her intellectual and mental capabilities to understand natural phenomena for the betterment of mankind.

11. Create awareness on the need to love and care for the environment and play an active role in its preservation and conservation.

## SCIENTIFIC SKILLS

Science emphasises inquiry and problem solving. In inquiry and problem solving processes, scientific and thinking skills are utilised. Scientific skills are important in any scientific investigation such as conducting experiments and carrying out projects.

Scientific skills encompass science process skills and manipulative skills.

### Science Process Skills

Science process skills enable students to formulate their questions and find out the answers systematically.

Descriptions of the science process skills are as follows:

| | |
|---|---|
| **Observing** | Using the sense of hearing, touch, smell, taste and sight to collect information about an object or a phenomenon. |
| **Classifying** | Using observations to group objects or events according to similarities or differences. |
| **Measuring and Using Numbers** | Making quantitative observations using numbers and tools with standardised units. Measuring makes observation more accurate. |
| **Inferring** | Using past experiences or previously collected data to draw conclusions and make explanations of events. |
| **Predicting** | Stating the outcome of a future event based on prior knowledge gained through experiences or collected data. |
| **Communicating** | Using words or graphic symbols such as tables, graphs, figures or models to describe an action, object or event. |
| **Using Space-Time Relationship** | Describing changes in parameter with time. Examples of parameters are location, direction, shape, size, volume, weight and mass. |
| **Interpreting Data** | Giving rational explanations about an object, event or pattern derived from collected data. |

| | |
|---|---|
| **Defining Operationally** | Defining all variables as they are used in the experiment by describing what must be done and what should be observed. |
| **Controlling Variables** | Identifying the fixed variable, manipulated variable, and responding variable in an investigation. The manipulated variable is changed to observe its relationship with the responding variable. At the same time, the fixed variable is kept constant. |
| **Hypothesising** | Making a general statement about the relationship between a manipulated variable and a responding variable in order to explain an event or observation. This statement can be tested to determine its validity. |
| **Experimenting** | Planning and conducting activities to test a certain hypothesis. These activities include collecting, analysing and interpreting data and making conclusions. |

**Manipulative Skills**

Manipulative skills in scientific investigation are psychomotor skills that enable students to:

- Use and handle science apparatus and laboratory substances correctly.
- Handle specimens correctly and carefully.
- Draw specimens, apparatus and laboratory substances accurately.
- Clean science apparatus correctly, and
- Store science apparatus and laboratory substances correctly and safely.

## THINKING SKILLS

Thinking is a mental process that requires an individual to integrate knowledge, skills and attitude in an effort to understand the environment.

One of the objectives of the national education system is to enhance the thinking ability of students. This objective can be achieved through a curriculum that emphasises thoughtful learning. Teaching and learning that emphasises thinking skills is a foundation for thoughtful learning.

Thoughtful learning is achieved if students are actively involved in the teaching and learning process. Activities should be organised to provide opportunities for students to apply thinking skills in conceptualisation, problem solving and decision-making.

Thinking skills can be categorised into critical thinking skills and creative thinking skills. A person who thinks critically always evaluates an idea in a systematic manner before accepting it. A person who thinks creatively has a high level of imagination, is able to generate original and innovative ideas, and modify ideas and products.

Thinking strategies are higher order thinking processes that involve various steps. Each step involves various critical and creative thinking skills. The ability to formulate thinking strategies is the ultimate aim of introducing thinking activities in the teaching and learning process.

## Critical Thinking Skills

A brief description of each critical thinking skill is as follows:

| | |
|---|---|
| **Attributing** | Identifying criteria such as characteristics, features, qualities and elements of a concept or an object. |
| **Comparing and Contrasting** | Finding similarities and differences based on criteria such as characteristics, features, qualities and elements of a concept or event. |
| **Grouping and Classifying** | Separating and grouping objects or phenomena into categories based on certain criteria such as common characteristics or features. |
| **Sequencing** | Arranging objects and information in order based on the quality or quantity of common characteristics or features such as size, time, shape or number. |
| **Prioritising** | Arranging objects and information in order based on their importance or priority. |
| **Analysing** | Examining information in detail by breaking it down into smaller parts to find implicit meaning and relationships. |
| **Detecting Bias** | Identifying views or opinions that have the tendency to support or oppose something in an unfair or misleading way. |
| **Evaluating** | Making judgements on the quality or value of something based on valid reasons or evidence. |
| **Making Conclusions** | Making a statement about the outcome of an investigation that is based on a hypothesis. |

## Creative Thinking Skills

A brief description of each creative thinking skill is as follows:

| | |
|---|---|
| **Generating Ideas** | Producing or giving ideas in a discussion. |
| **Relating** | Making connections in a certain situation to determine a structure or pattern of relationship. |
| **Making Inferences** | Using past experiences or previously collected data to draw conclusions and make explanations of events. |
| **Predicting** | Stating the outcome of a future event based on prior knowledge gained through experiences or collected data. |
| **Making Generalisations** | Making a general conclusion about a group based on observations made on, or some information from, samples of the group. |
| **Visualising** | Recalling or forming mental images about a particular idea, concept, situation or vision. |
| **Synthesising** | Combining separate elements or parts to form a general picture in various forms such as writing, drawing or artefact. |
| **Making Hypotheses** | Making a general statement on the relationship between manipulated variables and responding variables in order to explain a certain thing or happening. This statement is thought to be true and can be tested to determine its validity. |
| **Making Analogies** | Understanding a certain abstract or complex concept by relating it to a simpler or concrete concept with similar characteristics. |
| **Inventing** | Producing something new or adapting something already in existence to overcome problems in a systematic manner. |

## Thinking Strategy

Description of each thinking strategy is as follows:

| | |
|---|---|
| **Conceptualising** | Making generalisations based on inter-related and common characteristics in order to construct meaning, concept or model. |
| **Making Decisions** | Selecting the best solution from various alternatives based on specific criteria to achieve a specific aim. |
| **Problem Solving** | Finding solutions to challenging or unfamiliar situations or unanticipated difficulties in a systematic manner. |

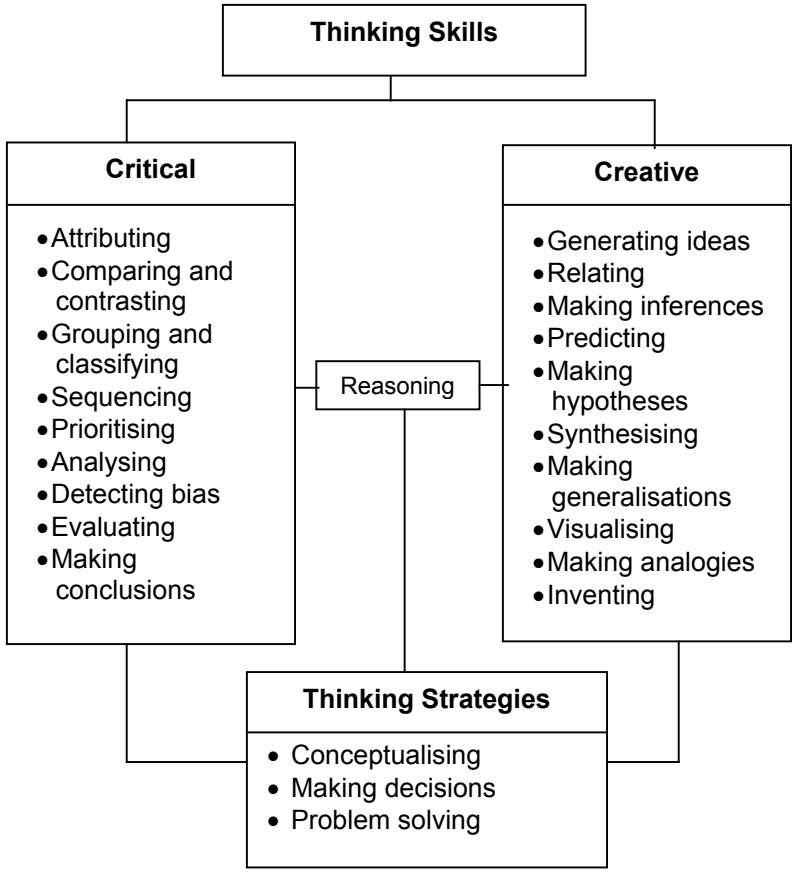
Besides the above thinking skills and thinking strategies, another skill emphasised is reasoning. Reasoning is a skill used in making logical, just and rational judgements. Mastering of critical and creative thinking skills and thinking strategies is made simpler if an individual is able to reason in an inductive and deductive manner. Figure 1 gives a general picture of thinking skills and thinking strategies.

Mastering of thinking skills and thinking strategies (TSTS) through the teaching and learning of science can be developed through the following phases:

1. Introducing TSTS.
2. Practising TSTS with teacher's guidance.
3. Practising TSTS without teacher's guidance.
4. Applying TSTS in new situations with teacher's guidance.
5. Applying TSTS together with other skills to accomplish thinking tasks.

Further information about phases of implementing TSTS can be found in the guidebook *"Buku Panduan Penerapan Kemahiran Berfikir dan Strategi Berfikir dalam Pengajaran dan Pembelajaran Sains"* (Curriculum Development Centre, 1999).

Figure 1 : TSTS Model in Science




**Relationship between Thinking Skills and Science Process Skills**

Science process skills are skills that are required in the process of finding solutions to a problem or making decisions in a systematic manner. It is a mental process that promotes critical, creative, analytical and systematic thinking. Mastering of science process skills and the possession of suitable attitudes and knowledge enable students to think effectively.

The mastering of science process skills involves the mastering of the relevant thinking skills. The thinking skills that are related to a particular science process skill are as follows:

| Science Process Skills | Thinking Skills |
|---|---|
| Observing | Attributing<br>Comparing and contrasting<br>Relating |
| Classifying | Attributing<br>Comparing and contrasting<br>Grouping and classifying |
| Measuring and Using Numbers | Relating<br>Comparing and contrasting |
| Making Inferences | Relating<br>Comparing and contrasting<br>Analysing<br>Making inferences |
| Predicting | Relating<br>Visualising |

| Science Process Skills | Thinking Skills |
|---|---|
| Using Space-Time Relationship | Sequencing<br>Prioritising |
| Interpreting data | Comparing and contrasting<br>Analysing<br>Detecting bias<br>Making conclusions<br>Generalising<br>Evaluating |
| Defining operationally | Relating<br>Making analogy<br>Visualising<br>Analysing |
| Controlling variables | Attributing<br>Comparing and contrasting<br>Relating<br>Analysing |
| Making hypothesis | Attributing<br>Relating<br>Comparing and contrasting<br>Generating ideas<br>Making hypothesis<br>Predicting<br>Synthesising |
| Experimenting | All thinking skills |
| Communicating | All thinking skills |

## Teaching and Learning based on Thinking Skills and Scientific Skills

This science curriculum emphasises thoughtful learning based on thinking skills and scientific skills. Mastery of thinking skills and scientific skills are integrated with the acquisition of knowledge in the intended learning outcomes. Thus, in teaching and learning, teachers need to emphasise the mastery of skills together with the acquisition of knowledge and the inculcation of noble values and scientific attitudes.

The following is an example and explanation of a learning outcome based on thinking skills and scientific skills.

*Example:*

| | |
|---|---|
| Learning Outcome: | Compare and contrast metallic elements and non-metallic elements. |
| Thinking Skills: | Comparing and contrasting |

Explanation:

To achieve the above learning outcome, knowledge of the characteristics and uses of metals and non-metals in everyday life are learned through comparing and contrasting. The mastery of the skill of comparing and contrasting is as important as the knowledge about the elements of metal and the elements of non-metal.

## SCIENTIFIC ATTITUDES AND NOBLE VALUES

Science learning experiences can be used as a means to inculcate scientific attitudes and noble values in students. These attitudes and values encompass the following:

- Having an interest and curiosity towards the environment.
- Being honest and accurate in recording and validating data.
- Being diligent and persevering.
- Being responsible about the safety of oneself, others, and the environment.
- Realising that science is a means to understand nature.
- Appreciating and practising clean and healthy living.
- Appreciating the balance of nature.
- Being respectful and well-mannered.
- Appreciating the contribution of science and technology.
- Being thankful to God.
- Having critical and analytical thinking.
- Being flexible and open-minded.
- Being kind-hearted and caring.
- Being objective.
- Being systematic.
- Being cooperative.
- Being fair and just.
- Daring to try.
- Thinking rationally.
- Being confident and independent.

The inculcation of scientific attitudes and noble values generally occurs through the following stages:

- Being aware of the importance and the need for scientific attitudes and noble values.
- Giving emphasis to these attitudes and values.
- Practising and internalising these scientific attitudes and noble values.

When planning teaching and learning activities, teachers need to give due consideration to the above stages to ensure the continuous and effective inculcation of scientific attitudes and values. For example, during science practical work, the teacher should remind pupils and ensure that they carry out experiments in a careful, cooperative and honest manner.

Proper planning is required for effective inculcation of scientific attitudes and noble values during science lessons. Before the first lesson related to a learning objective, teachers should examine all related learning outcomes and suggested teaching-learning activities that provide opportunities for the inculcation of scientific attitudes and noble values.

The following is an example of a learning outcome pertaining to the inculcation of scientific attitudes and values.

*Example:*

| | |
|---|---|
| Year: | Form One |
| Learning Area: | 1. Matter |
| Learning Objective: | 2.3 Appreciating the importance of the variety of earth's resources to man. |
| Learning Outcome: | |

| | |
|---|---|
| | Practise reducing the use, reusing and recycling of materials, e.g. using old unfinished exercise books as notebooks and collecting old newspaper for recycling. |
| Suggested Learning Activities | Carry out projects, campaigns, or competitions on reducing the use, reusing and recycling of materials. |
| Scientific attitudes and noble values | Love and respect for the environment. |
| | Being responsible for the safety of oneself, others and the environment. |
| | Appreciating the balance of nature. |
| | Being systematic. |
| | Being cooperative. |

**Inculcating Patriotism**

The science curriculum provides an opportunity for the development and strengthening of patriotism among students. For example, in learning about the earth's resources, the richness and variety of living things and the development of science and technology in the country, students will appreciate the diversity of natural and human resources of the country and deepen their love for the country.

## TEACHING AND LEARNING STRATEGIES

Teaching and learning strategies in the science curriculum emphasise thoughtful learning. Thoughtful learning is a process that helps students acquire knowledge and master skills that will help them develop their minds to the optimum level. Thoughtful learning can occur through various learning approaches such as inquiry, constructivism, contextual learning, and mastery learning. Learning activities should therefore be geared towards activating students' critical and creative thinking skills and not be confined to routine or rote learning. Students should be made aware of the thinking skills and thinking strategies that they use in their learning. They should be challenged with higher order questions and problems and be required to solve problems utilising their creativity and critical thinking. The teaching and learning process should enable students to acquire knowledge, master skills and develop scientific attitudes and noble values in an integrated manner**.**

**Teaching and Learning Approaches in Science**

***Inquiry-Discovery***

nquiry-discovery emphasises learning through experiences. Inquiry generally means to find information, to question and to investigate a phenomenon that occurs in the environment. Discovery is the main characteristic of inquiry. Learning through discovery occurs when the main concepts and principles of science are investigated and discovered by students themselves. Through activities such as experiments, students investigate a phenomenon and draw conclusions by themselves. Teachers then lead students to understand the science concepts through the results of the inquiry. Thinking

skills and scientific skills are thus developed further during the inquiry process. However, the inquiry approach may not be suitable for all teaching and learning situations. Sometimes, it may be more appropriate for teachers to present concepts and principles directly to students.

***Constructivism***

Constructivism suggests that students learn about something when they construct their own understanding. The important attributes of constructivism are as follows:

- Taking into account students' prior knowledge.
- Learning occurring as a result of students' own effort.
- Learning occurring when students restructure their existing ideas by relating new ideas to old ones.
- Providing opportunities to cooperate, sharing ideas and experiences, and reflecting on their learning.

***Science, Technology and Society***

Meaningful learning occurs if students can relate their learning with their daily experiences. Meaningful learning occurs in learning approaches such as contextual learning and Science, Technology and Society (STS).

Learning themes and learning objectives that carry elements of STS are incorporated into the curriculum. STS approach suggests that science learning takes place through investigation and discussion based on science and technology issues in society. In the STS approach, knowledge in science and technology is to be learned with the application of the principles of science and technology and their impact on society.

***Contextual Learning***

Contextual learning is an approach that associates learning with daily experiences of students. In this way, students are able to appreciate the relevance of science learning to their lives. In contextual learning, students learn through investigations as in the inquiry-discovery approach.

***Mastery Learning***

Mastery learning is an approach that ensures all students are able to acquire and master the intended learning objectives. This approach is based on the principle that students are able to learn if they are given adequate opportunities. Students should be allowed to learn at their own pace, with the incorporation of remedial and enrichment activities as part of the teaching-learning process.

**Teaching and Learning Methods**

Teaching and learning approaches can be implemented through various methods such as experiments, discussions, simulations, projects, and visits. In this curriculum, the teaching-learning methods suggested are stated under the column "Suggested Learning Activities." However, teachers can modify the suggested activities when the need arises.

The use of a variety of teaching and learning methods can enhance students' interest in science. Science lessons that are not interesting will not motivate students to learn and subsequently will affect their performance. The choice of teaching methods should be based on the curriculum content, students' abilities, students' repertoire of intelligences, and the availability of resources and infrastructure. Besides playing the role of knowledge presenters and experts, teachers need to act as facilitators in the process of teaching and learning. Teachers

need to be aware of the multiple intelligences that exist among students. Different teaching and learning activities should be planned to cater for students with different learning styles and intelligences.

The following are brief descriptions of some teaching and learning methods.

### *Experiment*

An experiment is a method commonly used in science lessons. In experiments, students test hypotheses through investigations to discover specific science concepts and principles. Conducting an experiment involves thinking skills, scientific skills, and manipulative skills.

Usually, an experiment involves the following steps:

- Identifying a problem.
- Making a hypothesis.
- Planning the experiment
  - controlling variables.
  - determining the equipment and materials needed.
  - determining the procedure of the experiment and the method of data collection and analysis.
- Conducting the experiment.
- Collecting data.
- Analysing data.
- Interpreting data.
- Making conclusions.
- Writing a report.

In the implementation of this curriculum, besides guiding students to do an experiment, where appropriate, teachers should provide students with the opportunities to design their own experiments. This involves students drawing up plans as to how to conduct experiments, how to measure and analyse data, and how to present the outcomes of their experiment.

### *Discussion*

A discussion is an activity in which students exchange questions and opinions based on valid reasons. Discussions can be conducted before**,** during or after an activity. Teachers should play the role of a facilitator and lead a discussion by asking questions that stimulate thinking and getting students to express themselves.

### *Simulation*

In simulation, an activity that resembles the actual situation is carried out**.** Examples of simulation are role-play, games and the use of models. In role-play, students play out a particular role based on certain pre-determined conditions. Games require procedures that need to be followed. Students play games in order to learn a particular principle or to understand the process of decision-making. Models are used to represent objects or actual situations so that students can visualise the said objects or situations and thus understand the concepts and principles to be learned.

### *Project*

A project is a learning activity that is generally undertaken by an individual or a group of students to achieve a certain learning objective. A project generally requires several lessons to complete. The outcome of the project either in the form of a

report, an artefact or in other forms needs to be presented to the teacher and other students. Project work promotes the development of problem-solving skills, time management skills, and independent learning.

### *Visits and Use of External Resources*

The learning of science is not limited to activities carried out in the school compound. Learning of science can be enhanced through the use of external resources such as zoos, museums, science centres, research institutes, mangrove swamps, and factories. Visits to these places make the learning of science more interesting, meaningful and effective. To optimise learning opportunities, visits need to be carefully planned. Students may be involved in the planning process and specific educational tasks should be assigned during the visit. No educational visit is complete without a post-visit discussion.

### Use of Technology

Technology is a powerful tool that has great potential in enhancing the learning of science. Through the use of technology such as television, radio, video, computer, and Internet, the teaching and learning of science can be made more interesting and effective.

Computer simulation and animation are effective tools for the teaching and learning of abstract or difficult science concepts.

Computer simulation and animation can be presented through courseware or Web page. Application tools such, as word processors, graphic presentation software and electronic spreadsheets are valuable tools for the analysis and presentation of data.

The use of other tools such as data loggers and computer interfacing in experiments and projects also enhance the effectiveness of teaching and learning of science.

## CONTENT ORGANISATION

The science curriculum is organised around themes. Each theme consists of various learning areas, each of which consists of a number of learning objectives. A learning objective has one or more learning outcomes.

Learning outcomes are written based on the hierarchy of the cognitive and affective domains. Levels in the cognitive domain are: knowledge, understanding, application, analysis, synthesis and evaluation. Levels in the affective domain are: to be aware of, to be in awe, to be appreciative, to be thankful, to love, to practise, and to internalise. Where possible, learning outcomes relating to the affective domain are explicitly stated. The inculcation of scientific attitudes and noble values should be integrated into every learning activity. This ensures a more spontaneous and natural inculcation of attitudes and values. Learning areas in the psychomotor domain are implicit in the learning activities.

Learning outcomes are written in the form of measurable behavioural terms. In general, the learning outcomes for a particular learning objective are organised in order of complexity. However, in the process of teaching and learning, learning activities should be planned in a holistic and integrated manner that enables the achievement of multiple learning outcomes according to needs and context. Teachers should

avoid employing a teaching strategy that tries to achieve each learning outcome separately according to the order stated in the curriculum specifications.

The Suggested Learning Activities provide information on the scope and dimension of learning outcomes. The learning activities stated under the column Suggested Learning Activities are given with the intention of providing some guidance as to how learning outcomes can be achieved. A suggested activity may cover one or more learning outcomes. At the same time, more than one activity may be suggested for a particular learning outcome. Teachers may modify the suggested activity to suit the ability and style of learning of their students. Teachers are encouraged to design other innovative and effective learning activities to enhance the learning of science.

**THEME: INTRODUCING SCIENCE**

**Learning Area: 1. Introduction to Science**

| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| 1.1 Understanding that science is part of everyday life. | Describe examples of natural phenomena that students see around them:<br>a) growth of human from a baby to an adult,<br>b) fall of a ball to the ground,<br>c) melting of ice.<br><br>Discuss the uses and benefits of science in everyday life.<br><br>Attend talks on careers in science. | A student is able to:<br><br>• list what he sees around him that is related to science,<br>• explain the importance of science in everyday life,<br>• name some careers in science such as:<br>a) science teachers<br>b) doctors<br>c) engineers<br>d) environmental scientists | During learning activities, bring out the science concepts and principles students have learned in primary school.<br><br>Talks on careers in science by professionals. | benefit – *faedah*<br>career – *kerjaya*<br>discuss – *bincangkan*<br>educator – *pendidik*<br>importance – *kepentingan*<br>professional – *profesional*<br>related – *berkaitan*<br>role play – *main peranan*<br>talks – *ceramah*<br>**natural phenomena – *fenomena alam*** |
| 1.2 Understanding the steps in scientific investigation. | Carry out a scientific investigation/experiment,<br>e.g. 'To find out what affects the number of times a pendulum swings back and forth in a given time (oscillations)'. | A student is able to:<br><br>• state the steps in a scientific investigation/experiment,<br>• carry out a scientific investigation. | Scientific investigation involves the use of science process skills. | affect – *mempengaruhi*<br>determine – *menentukan*<br>hypothesis – *hipotesis*<br>identify – *mengenal pasti*<br>investigation – *penyiasatan*<br>involve – *melibatkan*<br>measure – *mengukur*<br>observe – *memerhat*i |

| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| | Students will be:<br><br>a) determining what they want to find out (identifying the problem),<br>b) making a smart guess (forming a hypothesis),<br>c) planning how to test the hypothesis (planning the experiment)<br>• identifying the variables,<br>• determining the apparatus and materials required,<br>• determining the procedure to carry out the experiment, method to collect and analise data.<br>d) carrying out the experiment,<br>e) writing down what has been observed (collecting data),<br>f) finding a meaning for what has been observed (analysing and interpreting data),<br>g) deciding whether the hypothesis is true (making conclusions),<br>h) writing a report on the investigation (reporting). | | There should be a guided discussion for steps (a) to (c) before students carry out the experiment.<br><br>This activity helps the teacher to identify students' capabilities to carry out a scientific investigation. | oscillations – *ayunan lengkap*<br>swings back and forth – *berayun ulang alik*<br>pendulum – *bandul*<br>variable – *pemboleh ubah* |

| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| | Students can be asked to report their investigations to the class. They should emphasise the steps they have taken; what they have changed; what they have kept the same and what they have measured. | | | |
| 1.3 Knowing physical quantities and their units. | Identify physical quantities (length, mass, time, temperature and electric current), their values and units found on product descriptions.<br><br>Find words with the prefixes used in measurements such as kilo-, centi-, and milli- .<br><br>Find the symbols used for these units of measurement.<br><br>Find the values of these prefixes. | A student is able to:<br><br>• state the physical quantities length, mass, time, temperature and electric current,<br>• state the S.I. units and the corresponding symbols for these physical quantities,<br>• state the symbols and values of prefixes for unit of length and mass: milli-, centi-, and kilo-,<br>• identify and use appropriate prefixes in the measurement of length and mass. | Product descriptions can be found on labels, boxes of electrical appliances, food packets, etc.<br><br>S.I. is an abbreviation for the French term *Systéme International d'Unités* which means international system for units. | abbreviation – *singkatan*<br>appropriate – *sesuai*<br>corresponding symbol – *simbol berpadanan*<br>electric current – *arus elektrik*<br>length – *panjang*<br>mass – *jisim*<br>measurement – *ukuran*<br>physical quantity – *kuantiti fizik*<br>prefix – *imbuhan*<br>symbol – *simbol*<br>value – *nilai* |

| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| 1.4 Understanding the use of measuring tools. | Measure the lengths of straight lines, curves and the diameters of objects using rulers, threads and calipers.<br><br>Estimate the areas of regular and irregular shapes using graph paper.<br><br>Measure the volume of liquids using measuring cylinders, pipettes and burettes.<br><br>Determine the volume of regular and irregular solids using the water displacement method.<br><br>Measure the body temperature and the temperature of water.<br><br>Discuss the right choice of tools in making measurements.<br><br>Apply the above measuring skills in the context of experiments. | A student is able to:<br><br>• choose the right tool and measure length,<br>• estimate the area of regular and irregular shapes using graph paper,<br>• choose the right tool and measure the volume of liquid,<br>• choose the right tool to measure the body temperature and the temperature of a liquid,<br>• determine the volume of solid using the water displacement method. | Make sure students take measurements correctly and accurately. | calipers – *angkup*<br>curve – *garis lengkung*<br>displacement – *sesaran*<br>estimate – *menganggarkan*<br>irregular – *tidak sekata*<br>regular – *sekata*<br>volume – *isi padu* |

| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| 1.5 Understanding the concept of mass. | Find the weights of different objects using a spring balance.<br><br>Discuss weight as the pull of the earth (gravitational force) on an object.<br><br>Discuss mass as quantity of matter.<br><br>Find the mass of different objects using beam balance or lever balance.<br><br>Discuss the difference between mass and weight.<br><br>Apply the skills of using spring balance and beam/lever balance in the context of an experiment. | A student is able to:<br><br>• determine the weight of an object,<br>• explain the concept of weight,<br>• explain the concept of mass,<br>• determine the mass of an object,<br>• explain the difference between mass and weight,<br>• apply the use of spring and beam/lever balance in the context of an experiment. | Unit for weight: newton<br>Unit for mass: kilogram<br><br>Carry out an experiment in which students have to apply the skill of measuring mass and weight. | beam balance – *neraca alur*<br>determine – *menentukan*<br>difference – *perbezaan*<br>force – *daya*<br>lever balance – *neraca tuas*<br>mass – *jisim*<br>matter – *jirim*<br>pull – *tarikan*<br>spring balance – *neraca spring*<br>weight – *berat* |
| 1.6 Realising the importance of standard units in everyday life. | Discuss the various units of measurements, e.g. units for length (foot, yard, chain, mile, meter, kilometer), units for weight (pound, ounce, kati, tahil, gram, kilogram).<br><br>Act out a scene to show the problems caused by not using | A student is able to:<br><br>• give examples of problems that may arise if standard units are not used. | | act out – *lakonkan*<br>advantage – *kebaikan*<br>arise – *timbul*<br>disadvantage – *keburukan*<br>realising – *menyedari*<br>standard – *piawai*<br>scene – *babak*<br>various – *pelbagai* |

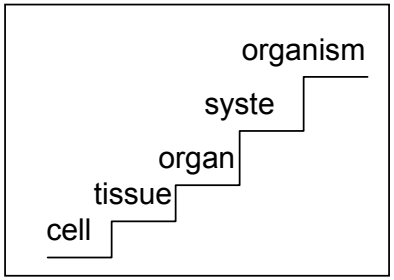
| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| | standard units e.g. buying things at the market.<br><br>Discuss the advantages and disadvantages of using different units of measurement. | | | |

**THEME: MAN AND THE VARIETY OF LIVING THINGS**

**Learning Area: 1. Cell as a Unit of Life**

| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| 1.1 Understanding cells. | Gather information on living organisms and identify the smallest living unit that makes up the organism.<br><br>Prepare slides of cheek cells and onion cells.<br><br>Study the general structure of cheek cells and onion cells under a microscope using the correct procedure.<br><br>Draw and label the different structures of an animal cell and a plant cell.<br><br>Compare an animal cell to a plant cell.<br><br>Gather information on cell structures and discuss their functions. | A student is able to:<br><br>• identify that cell is the basic unit of living things,<br>• prepare slides following the proper procedure,<br>• use a microscope properly,<br>• identify the general structures of animal cells and plant cells,<br>• draw the general structure of an animal cell and a plant cell,<br>• label the general structure of an animal cell and a plant cell,<br>• state the function of each cell structure,<br>• state the similarities and differences between an animal cell and a plant cell. | General structure of a cell may include cell wall, cell membrane, protoplasm (cytoplasm and nucleus), chloroplast and vacuole.<br><br>The usage and handling of a microscope is introduced in this learning area.<br><br>Remind pupils of the safety precautions to be taken when preparing samples of cheek cells. | animal cell – *sel haiwan*<br>cell wall – *dinding sel*<br>cheek cells – *sel pipi*<br>chloroplast – *kloroplas*<br>cytoplasm – *sitoplasma*<br>handling – *mengendali*<br>general – *umum*<br>microscope – *mikroskop*<br>nucleus – *nukleus*<br>onion – *bawang*<br>plant cell – *sel tumbuhan*<br>precaution – *langkah keselamatan*<br>prepare – *sediakan*<br>protoplasm – *protoplasma*<br>remind – *ingatkan*<br>sample – *sampel*<br>slide – *slaid*<br>structure – *struktur*<br>vacuole – *vakuol* |

| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| 1.2 Understanding unicellular organism and multicellular organism. | Gather information about unicellular organisms and multicellular organisms.<br><br>Provide students with picture cards, name cards, cards with the labels 'unicellular' and 'multicellular'. Students match the three cards for each organism.<br><br>Observe examples of unicellular organisms and multicellular organisms under a microscope. | A student is able to:<br><br>• state the meaning of unicellular organism and multicellular organism,<br>• give examples of unicellular organism and multicellular organism. | Use prepared slides or fresh specimens.<br><br>Introduce the term 'microorganisms'. | multicellular organism – *organisma multisel*<br>unicellular organism – *organisma satu sel*<br>microorganism – *mikroorganisma* |
| 1.3 Understanding that cells form tissues, organs and systems in the human body. | Gather information and discuss the following:<br>a) types of human cells,<br>b) functions of different types of human cells. | A student is able to:<br><br>• name the different types of human cells,<br>• state the function of different types of human cells,<br>• arrange sequentially cell organisation from simple to complex using the terms cell, tissue, organ, system and organism. | | arrange sequentially – *susun mengikut urutan*<br>cell – *sel*<br>function – *fungsi*<br>human being – *manusia*<br>ladder – *tangga*<br>organ – *organ*<br>organisation of cells – *organisasi sel*<br>system – *sistem*<br>simple – *mudah*<br>tissue – *tisu* |

| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| | Use a graphic organiser (e.g. ladder of hierarchy) to show the hierarchy of cell organisation:<br><br>cell → tissue → organ → system → organism<br><br>  <br> | | | |
| 1.4<br>Realising that humans are complex organisms. | Discuss why human beings are complex organisms. | A student is able to:<br><br>• explain why human beings are complex organisms. | | complex organism – *organisma kompleks*<br>human being – *manusia*<br>realising – *menyedari* |

**THEME: MATTER IN NATURE**

**Learning Area: 1. Matter**

| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| 1.1 Understanding that matter has mass and occupies space. | Through activities, show that things such as book, air, water, soil and living things have mass and occupy space.<br><br>Discuss what matter is.<br><br>List examples of matter. | A student is able to:<br><br>• state that things have mass and occupy space,<br>• explain what matter is,<br>• relate things and matter,<br>• carry out activities to show that air, water, soil and living things have mass and occupy space. | | air – *udara*<br>living things – *benda hidup*<br>mass – *jisim*<br>matter – *jirim*<br>occupies – *memenuhi*<br>water – *air*<br>soil – *tanih* |
| 1.2 Understanding the three states of matter. | Gather information and discuss<br>a) what matter is made up of,<br>b) what the three states of matter are.<br><br>Compare the three states of matter in terms of:<br>a) the arrangement of particles,<br>b) the movement of particles.<br><br>Simulate the arrangement and movement of particles in the three states of matter. | A student is able to:<br><br>• state that matter is made up of particles,<br>• state the three states of matter,<br>• state the arrangement of particles in the three states of matter,<br>• state the differences in the movement of particles in the three states of matter. | | particle – *zarah*<br>simulate – *membuat simulasi*<br>arrangement – *susunan*<br>movement – *gerakan*<br>state of matter – *keadaan jirim* |

| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| 1.3 Understanding the concept of density. | Recall the definition of density.<br><br>Through activities, find the densities of:<br>a) objects with regular shape and objects with irregular shape,<br>b) different liquids.<br><br>Discuss why some objects and liquids float by relating to density. | A student is able to:<br><br>• define density,<br>• explain why some objects and liquids float,<br>• solve simple problems related to density,<br>• carry out activities to explore the densities of objects and liquids. | Archimedes Principle need not be introduced. | definition – *takrifan*<br>explain – *menerangkan*<br>float – *timbul*<br>liquid – *cecair*<br>object with irregular shape – *objek berbentuk tak sekata*<br>object with regular shape – *objek berbentuk sekata*<br>recall – *ingat semula*<br>solve – *selesaikan* |
| 1.4 Appreciating the use of properties of matter in everyday life. | Gather information and discuss how:<br><br>a) man uses his knowledge of different states of matter to store and transport gases and liquids,<br>b) man uses the concept of density in making rafts, floats etc.<br><br>Carry out an activity to explore the applications of the concept of floating and sinking related to density. | A student is able to:<br><br>• describe how man uses the different states of matter,<br>• describe how man applies the concept of density,<br>• carry out an activity to explore the applications of the concept of floating and sinking related to density. | | aplication – *aplikasi*<br>appreciating – *menghargai*<br>applies – *mengaplikasi*<br>build – *bina*<br>float – *pelampung*<br>gas – *gas*<br>property – *sifat*<br>raft – *rakit*<br>store – *menyimpan*<br>transport – *mengangkut* |

**Learning Area:** **2. The Variety of Resources on Earth**

| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| 2.1<br>Knowing the different resources on earth. | Gather information about the resources on earth, i.e. water, air, soil, minerals, fossil fuels and living things. | A student is able to:<br><br>• list the resources on earth needed to sustain life,<br>• list the resources on earth used in everyday life. | | life – *kehidupan*<br>knowing – *mengetahui*<br>resource – *sumbe*r<br>to sustain life – *menyokong kesinambungan kehidupan* |
| 2.2<br>Understanding elements, compounds and mixtures. | Gather information and discuss<br>a) what elements, compounds and mixtures are,<br>b) what metals and non-metals are,<br>c) examples of elements, compounds, mixtures, metals and non-metals.<br><br>Compare and contrast the properties of elements, compounds and mixtures.<br><br>Carry out activities to compare the properties of metals and non-metals in terms of appearance, hardness, conductivity of heat and conductivity of electricity. | A student is able to:<br><br>• state what elements, compounds and mixtures are,<br>• give examples of elements, compounds and mixtures,<br>• state the differences between elements, compounds and mixtures,<br>• carry out activities to compare and contrast the properties of different metals and non-metals,<br>• classify elements as metals and non-metals based on their characteristics,<br>• give examples of metals and non-metals, | | appearance – *rupa*<br>characterstic – *ciri*<br>classify – *mengelaskan*<br>compound – *sebatian*<br>component – *komponen*<br>conductivity – *kekonduksian*<br>electricity – *elektrik*<br>element – *unsur*<br>hardness – *kekerasan*<br>heat – *haba*<br>mixture – *campuran*<br>separate – *mengasingkan*<br>understanding – *memahami* |

| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| | Carry out activities to separate the components of mixtures e.g.<br>a) mixture of iron filings and sulphur powder,<br>b) mixture of sand and salt. | • carry out activities to separate the components of a mixture. | | |
| **2.3**<br>Appreciating the importance of the variety of earth's resources to man. | Discuss the importance of earth's resources (water, air, soil, minerals, fossil fuels and living things) to man.<br><br>Draw a concept map to show the relationship between these resources to the basic needs of life.<br><br>Gather information on the preservation and conservation of resources on earth.<br><br>Discuss the importance of the preservation and conservation of resources on earth (e.g. recycling of paper reduces the cutting down of trees; conserving clean water prevents water shortage). | A student is able to:<br><br>• explain the importance of variety of earth's resources to man,<br>• state the meaning of the preservation and conservation of resources on earth,<br>• state the importance of the preservation and conservation of resources on earth,<br>• practise reducing the use, reusing and recycling of materials. | | appreciating – *menghargai*<br>concept map – *peta konsep*<br>conservation – *pemuliharaan*<br>needs of life – *keperluan hidup*<br>preservation – *pemeliharaan*<br>resource – *sumber*<br>relationship – *hubung kait*<br>sustainable development – *pembangunan lestari* |

| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| | Carry out a project, campaign or competition on reducing the use, reusing and recycling of materials e.g. using old unfinished exercise books as note books and collecting old newspapers. | | | |

**Learning Area: 3. The Air Around Us**

| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| 3.1 Understanding what air is made up of. | Gather information on:<br>a) the composition of air,<br>b) the percentage of nitrogen, oxygen and carbon dioxide in air.<br><br>Carry out activities to show:<br>a) the percentage of oxygen in air,<br>b) that air contains water vapour, microorganisms and dust. | A student is able to:<br><br>• state what air is made up of,<br>• explain why air is a mixture,<br>• state the percentage of nitrogen, oxygen and carbon dioxide in air,<br>• carry out activities to show:<br>a) the percentage of oxygen in air,<br>b) that air contains water vapour, microorganisms and dust. | Air is a mixture of nitrogen, oxygen, carbon dioxide, inert gases, water vapour, microorganisms and dust. | carbon dioxide – *karbon dioksida*<br>composition – *komposisi*<br>dust – *habuk*<br>microorganism – *mikroorganisma*<br>nitrogen – *nitrogen*<br>oxygen – *oksigen*<br>inert gas – *gas nadir*<br>water vapour – *wap air* |
| 3.2 Understanding the properties of oxygen and carbon dioxide. | Gather information on the properties of oxygen and carbon dioxide.<br><br>Carry out activities to show the properties of oxygen and carbon dioxide in the following aspects:<br><br>a) solubility in water,<br><br>b) reaction with sodium hydroxide, | A student is able to:<br><br>• list the properties of oxygen and carbon dioxide,<br>• identify oxygen and carbon dioxide based on their properties,<br>• choose a suitable test for oxygen and carbon dioxide | | lime water – *air kapur*<br>glowing – *berbara*<br>indicator – *penunjuk*<br>reaction – *tindak balas*<br>solubility – *keterlarutan*<br>wooden splint – *kayu uji* |

| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| | c) the effect on:<br>glowing and burning wooden splinter, litmus paper, lime water, bicarbonate indicator. | | | |
| 3.3 Understanding that oxygen is needed in respiration. | Gather information and discuss respiration.<br><br>Carry out an experiment to show that during respiration, living things<br>(a) use oxygen,<br>(b) give out carbon dioxide. | A student is able to:<br><br>• state that energy, carbon dioxide and water vapour are the products of respiration,<br>• relate that living things use oxygen and give out carbon oxide during respiration,<br>• compare and contrast the content of oxygen in inhaled and exhaled air in humans,<br>• state that oxygen is needed for respiration,<br>• carry out an experiment to show that living things use oxygen and give out carbon dioxide during respiration. | | energy – *tenaga*<br>exhaled air – *udara hembusan*<br>inhaled air – *udara sedutan*<br>role – *peranan*<br>rate of respiration – *kadar respirasi*<br>yeast – *yis* |

| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| 3.4 Understanding that oxygen is needed for combustion (burning). | Gather information and discuss combustion.<br><br>Carry out experiments to:<br>a) show that oxygen is needed for combustion,<br>b) investigate the effect of the size of a container on the length of time a candle burns.<br><br>Carry out activity to test for the products of combustion of charcoal and candle. | A student is able to:<br><br>• state what combustion is,<br>• state that oxygen is needed for combustion,<br>• list the products of combustion,<br>• carry out experiments to investigate combustion. | Charcoal is an example of carbon. | candle – *lilin*<br>charcoal – *arang*<br>combustion – *pembakaran*<br>carbon – *karbon*<br>product – *hasil* |
| 3.5 Analysing the effects of air pollution. | Gather information and discuss:<br><br>a) hat air pollution is,<br>b) xamples of air pollutants,<br>c) he sources of air pollutants,<br>d) he effects of air pollution on man and the environment,<br>e) he steps needed to control air pollution. | A student is able to:<br><br>• explain what air pollution is,<br>• list examples of air pollutants,<br>• list the sources of air pollutants,<br>• escribe the effects of air pollution,<br>• xplain the steps needed to prevent and control air pollution. | | air pollution –<br>control – *kawalan*<br>effect – *kesan*<br>analysing – *menganalisis*<br>environment – *alam sekitar*<br>prevent – *mencegah*<br>pollutant – *bahan cemar*<br>source – *sumber* |

| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| | Carry out a project to study:<br><br>a) ir pollution in an area around the school,<br>b) he effects of air pollution. | | | |
| 3.6<br>Realising the importance of keeping the air clean. | Gather information and discuss:<br><br>a) how life would be without clean air,<br>b) ways to keep the air clean,<br>c) habits that keep the air clean.<br><br>Carry out an activity to show the pollutants in cigarette smoke. | A student is able to:<br><br>• escribe how life would be without clean air,<br>• suggest ways to keep the air clean,<br>• practise habits that keep the air clean. | | describe – *perihalkan*<br>habit – *amalan*<br>suggest – *cadangkan* |

**THEME:** **ENERGY**

**Learning Area:** **1. Sources of Energy**

| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| 1.1 **Understanding various forms and sources of energy.** | Gather information about the various forms and sources of energy, and energy changes.<br><br>Discuss the sun as the primary source of energy.<br><br>Carry out activity to see the change of energy change<br>• from potential to kinetic energy, e.g. a ball rolling down a slope.<br>• from kinetic to potential energy, e.g. the winding of the spring in a toy car. | A student is able to:<br><br>• list the various forms of energy,<br>• list the various sources of energy,<br>• identify energy changes,<br>• identify the sun as the primary source of energy,<br>• carry out an activity to investigate the change of energy from potential to kinetic energy and vice versa. | | energy change – *perubahan bentuk tenaga*<br>form – *bentuk*<br>slope – *satah condong*<br>kinetic energy – *tenaga kinetik*<br>potential energy – *tenaga keupayaan*<br>primary source – *sumber primer*<br>various – *pelbagai*<br>vice versa – *sebaliknya* |
| 1.2 Understanding renewable and non-renewable energy. | Gather information and discuss the meaning of renewable and non-renewable energy sources. | A student is able to:<br><br>• define renewable and non-renewable sources of energy,<br>• roup the various sources of energy into renewable and non-renewable, | Project includes the making of scrap books, models and posters. | efficient – *cekap*<br>conserve – *memulihara*<br>non-renewable – *tidak boleh diperbaharui*<br>renewable – *boleh diperbaharui*<br>solar energy – *tenaga suria* |

| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| | Carry out a project on:<br>a) renewable and non-renewable energy sources,<br>b) the uses of solar energy,<br>c) the ways to increase efficient use of energy. | • explain why we need to conserve energy,<br>• suggest ways to use energy efficiently. | | |
| 1.3<br>Realising the importance of conserving energy sources. | ***Discuss the importance of conserving energy sources.***<br><br>Discuss the use and management of energy sources. | A student is able to:<br><br>• describe the importance of conserving energy sources,<br>• explain the use and management of energy sources. | Discussion can be in the form of forum, brain storming etc. | management – *pengurusan* |

**Learning Area : 2. Heat**

| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| 2.1 Understanding heat as a form of energy. | ***Carry out activities to show:***<br><br>a) the sun gives out heat,<br>b) ways to produce heat,<br>c) heat and temperature are not the same e.g. ask students to predict and observe how the temperatures change when hot and cold water are mixed.<br><br>Discuss:<br>a) that heat is a form of energy,<br>b) the uses of heat in our daily life<br>c) what temperature is,<br>d) the difference between temperature and heat. | A student is able to:<br><br>• state that the sun gives out heat,<br>• state other sources of heat,<br>• state that heat is a form of energy,<br>• give examples of the uses of heat,<br>• state the meaning of temperature,<br>• state the difference between heat and temperature. | | daily life – *kehidupan harian*<br>difference – *perbezaan*<br>example – *contoh*<br>gives out – *mengeluarkan*<br>heat – *haba*<br>meaning – *maksud*<br>temperature – *suhu* |
| | | | | |

| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| 2.2 Understanding heat flow and its effect. | ***Carry out activities to show that heat causes solids, liquids and gases to expand and contract.*** (ball and ring, mercury in thermometer and air in round-bottomed flask)<br><br>Carry out activities to show how heat flows by conduction, convection and radiation.<br><br>Carry out group activities to discuss:<br>a) natural phenomena such as land breeze, sea breeze and the warming of the earth by the sun,<br>b) how buildings can be kept cool,<br>c) what a heat conductor is,<br>d) what a heat insulator is,<br>e) the uses of heat conductors and heat insulators in daily life.<br><br>Carry out an experiment to investigate the use of different materials as heat insulators. | A student is able to:<br><br>• state that heat causes solids, liquids and gases to expand and contract,<br>• state that heat flows in three different ways (conduction, convection and radiation),<br>• state that heat flows from hot to cold,<br>• give examples of heat flow in natural phenomena,<br>• state what a heat conductor is,<br>• state what a heat insulator is,<br>• list uses of heat conductors and heat insulators in daily life,<br>• carry out an experiment to investigate the use of different materials as heat insulators. | Explain the effect of heating and cooling on solids, liquids and gases. | conduction – *konduksi*<br>contract – *mengecut*<br>convection – *perolakan*<br>expand – *mengembang*<br>flow – *mengalir*<br>gas – *gas*<br>insulator – *penebat*<br>land breeze – *bayu darat*<br>liquid – *cecair*<br>natural phenomena – *fenomena alam*<br>radiation – *sinaran*<br>sea breeze – *bayu laut*<br>solid – *pepejal* |

| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| 2.3<br>Analysing the effect of heat on matter. | Carry out activities to show the change in state of matter in physical processes.<br><br>Discuss:<br>(i) the effects of heat on the state of matter,<br>(ii) examples of daily observations which show a change in state of matter. | A student is able to:<br><br>• state the change in state of matter in physical processes,<br>• explain that change in state of matter involves the absorption and release of heat,<br>• give examples of daily observations which show a change in state of matter. | Physical processes include melting, boiling, freezing, evaporation, condensation and sublimation. | boiling – *pendidihan*<br>condensation – *kondensasi*<br>evaporation – *penyejatan*<br>freezing – *penyejukbekuan*<br>melting – *peleburan*<br>process – *proses*<br>reference – *rujukan*<br>sublimation – *pemejalwapan* |
| 2.4<br>Applying the principle of expansion and contraction of matter. | Discuss the use of expansion and contraction of matter in the following:<br><br>a) mercury in a thermometer,<br>b) bimetallic strip in a fire alarm,<br>c) gaps in railway tracks,<br>d) rollers in steel bridges.<br><br>Discuss the use of the principle of expansion and contraction of matter to solve simple problems. | A student is able to:<br><br>• explain with examples the use of expansion and contraction of matter in daily life,<br>• apply the principle of expansion and contraction of matter in solving simple problems. | | bimetallic strip – *jalur dwilogam*<br>expansion – *pengembangan*<br>contraction – *pengecutan*<br>fire alarm – *alat penggera kebakaran*<br>roller – *penggolek*<br>steel bridge – *jambatan keluli* |

| Learning Objectives | Suggested Learning Activities | Learning Outcomes | Notes | Vocabulary |
|---|---|---|---|---|
| 2.5 Understanding that dark, dull objects absorb and give out heat better. | ***Carry out experiments to show that:***<br><br>a) dark, dull objects absorb heat better than white, shiny objects,<br>b) dark, dull objects give out heat better than white, shiny objects. | A student is able to:<br><br>• state that dark, dull objects absorb heat better than white, shiny objects,<br>• state that dark, dull objects give out heat better than white, shiny objects,<br>• carry out experiments to investigate heat absorption and heat release. | | absorb – *menyerap*<br>dull – *pudar*<br>dark – *gelap*<br>shiny – *berkilat* |
| 2.6 Appreciating the benefits of heat flow. | Discuss and put into practice activities such as the opening of windows in the classroom or laboratory to improve air circulation. | A student is able to:<br><br>• put into practice the principle of heat flow to provide comfortable living. | | improve air circulation – *memperbaiki pengudaraan*<br>comfortable living – *kehidupan yang selesa* |

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