MINISTRY OF EDUCATION MALAYSIA

Integrated Curriculum for Secondary Schools

Curriculum Specifications

SCIENCE
Form 2

Curriculum Development Centre
Ministry of Education Malaysia
2002

Ministry of Education Malaysia
Pesiaran Duta Off Jalan Duta
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THE NATIONAL PHILOSOPHY

Our nation, Malaysia, is dedicated to achieving a greater unity of all her peoples; maintaining a democratic way of life; creating a just society in which the wealth of the nation shall be equitably shared; ensuring a liberal approach to her rich and diverse cultural traditions; building a progressive society which shall be 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
UPHOLDING THE CONSTITUTION
RULE OF LAW
GOOD BEHAVIOUR AND MORALITY

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

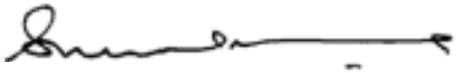
The aspiration of the nation to become an industrialised society depends on science and technology. It is envisaged that success in providing quality science education to Malaysians from an early age will serve to spearhead the nation into becoming a knowledge society and a competitive player in the 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 concepts 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

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.

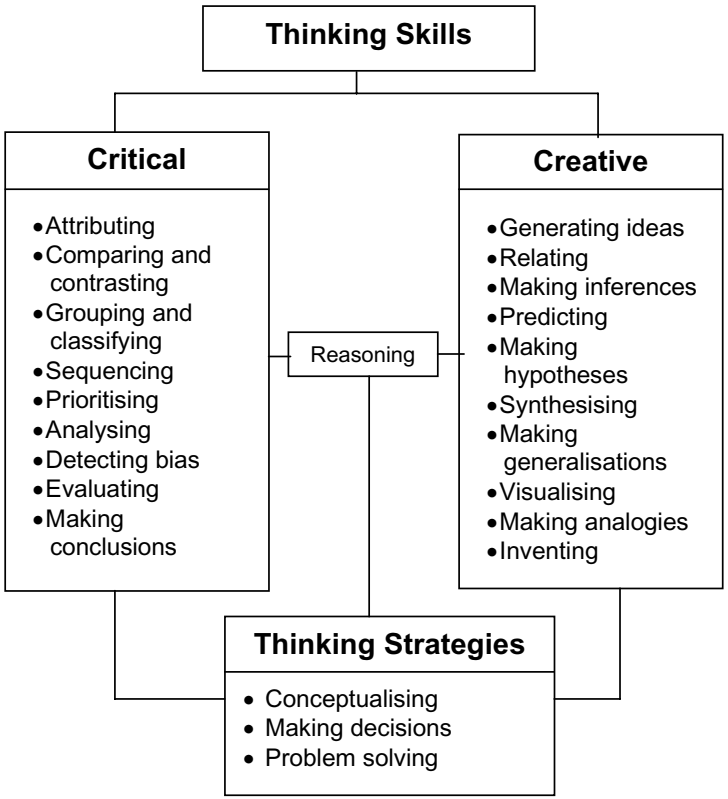
Besides the above thinking skills and thinking strategies, another skill emphasised is reasoning. Reasoning is a skill used in making logical, just and rational judgements. Mastering of critical and creative thinking skills and thinking strategies is made simpler if an individual is able to reason in 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 Comparing and contrasting Relating
Classifying	Attributing Comparing and contrasting Grouping and classifying
Measuring and Using Numbers	Relating Comparing and contrasting
Making Inferences	Relating Comparing and contrasting Analysing Making inferences

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

Science Process Skills	Thinking Skills
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Controlling variables	Attributing Comparing and contrasting Relating Analysing
Making hypothesis	Attributing Relating Comparing and contrasting Generating ideas Making hypothesis Predicting Synthesising

Science Process Skills	Thinking Skills
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

Inquiry-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: MANAGEMENT AND CONTINUITY OF LIFE

LEARNING AREA: 1. THE WORLD THROUGH OUR SENSES

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
1.1 Understanding the sensory organs and their functions.	Carry out activities to make connection between the five senses, the sensory organs and the stimuli. Discuss what happens in our body after a stimulus is detected.	A student is able to: • identify and relate a sensory organ to its stimulus, • state the pathway from stimulus to response: Stimulus→ Sensory organs → Nerves→ Brain→ Nerves → Response	The five sensory organs have been introduced in Primary Science.	brain – *otak* nerve – *saraf* response – *gerakbalas* stimuli – *rangsangan* sensory organ – *organ deria*
1.2 Understanding the sense of touch.	Carry out activities to study the following: a) structure of the human skin involved in stimuli detection, b) sensitivity of the skin at different parts of the body towards stimuli. Discuss the sensitivity of the skin in connection to the following situations: a) receiving an injection, b) using Braille.	A student is able to: • identify the structure of the human skin involved in stimuli detection, • state the function of different receptors – pressure, heat, pain, • draw conclusion on the sensitivity of the skin at different parts of the body towards stimuli.	The structures of the receptors are not required.	cold – *kesejukan* heat – *kepanasan* pain – *kesakitan* pressure – *tekanan* receptor – *hujung saraf* sensitivity – *kepekaan* skin – *kulit* touch – *sentuhan*

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
1.3 Understanding the sense of smell.	Discuss the structure of the nose and the position of the sensory cells using models, charts, computer software and other teaching aids.	A student is able to: • identify the structure of the nose, • identify the position of the sensory cells in the detection of smell.		nose – *hidung* sensory cells – *sel deria*
1.4 Understanding the sense of taste.	Carry out activities to detect the different areas of the tongue that respond to different tastes. Carry out activities to find how taste is related to smell.	A student is able to: • identify the different areas of the tongue that respond to different taste, • relate the sense of taste with the sense of smell.		bitter – *pahit* salty – *masin* sour – *masam* sweet – *manis* taste – *rasa* tongue – *lidah*
1.5 Understanding the sense of hearing.	Observe and identify the structure of the human ear. Discuss the function of each part of the ear. Discuss the hearing mechanism.	A student is able to: • identify the structure of the human ear, • explain the function of the different parts of the ear, • describe how we hear.	Teacher is encouraged to use computer simulation to illustrate the hearing mechanism.	cochlea – *koklea* ear – *telinga* ear drum – *gegendang telinga*

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
1.6 Understanding the sense of sight.	Examine the cow's eye or model of a human eye. Collect information on structure and function of each part of the eye. Discuss how we see.	A student is able to: • identify the structure of the human eye, • explain the functions of different parts of the eye, • describe how we see.		
1.7 Understanding light and sight.	Carry out activities to study: a) reflection of light, b) refraction of light between two mediums of different density. Collect information about the types of defects of vision and the contribution/use of technology to rectify them.	A student is able to: • describe the properties of light i.e. reflection and refraction, • state the various defects of vision, • explain ways to correct vision defects, • state and give examples of the limitations of sight, • connect stereoscopic and monocular visions with the survival of animals, • identify the appropriate device to overcome the limitations of sight.	Relate the properties of light to natural phenomena and daily usage. Angles of incidence, reflection, refraction and normal are not required. Astigmatism, optical illusions, blind-spot, monocular and stereoscopic visions should be introduced.	density – *ketumpatan* medium – *bahantara*/*medium* reflection – *pantulan* refraction – *pembiasan*

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
	Carry out activities to show what short sightedness and long sightedness are and how to correct them. Discuss what astigmatism is and the way to correct it. Carry out activities to investigate the following: a) optical illusion, b) blind-spot. Discuss the connection between stereoscopic vision and monocular vision with the survival of animals. Gather information about the device to overcome the limitation of sight.		Microscope, magnifying glass, telescope, binoculars, ultrasound scanning device, X-ray, periscope should be included.	astigmatism – *astigmatisme* blind spot – *bintik (or titik) buta* long sightedness – *rabun dekat* monocular vision – *penglihatan monokular* optical illusion – *ilusi optik* periscope – *periskop* short sightedness – *rabun jauh* stereoscopic vision – *penglihatan stereoskopik*

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
1.8 Understanding sound and hearing.	Carry out activities to investigate: a) the production of sound, b) the need of medium for sound to travel, c) the reflection and absorption of sound. Collect information about a) the defects of hearing, b) ways to rectify the defects of hearing. Discuss the limitations of hearing and ways of improving it. Carry out activities to investigate the need for stereophonic hearing in determining the direction of sound.	A student is able to: • describe the properties of sound, • explain the reflection and absorption of sound, • explain the defects of hearing, • explain ways of rectifying the defects in hearing, • state the limitations of hearing, • state the device used to overcome the limitations of hearing, • explain stereophonic hearing.	Include devices such as hearing aids and stethoscope.	

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
1.9 Understanding the stimuli and responses in plants.	Carry out experiments to investigate and identify: a) stimuli detected by plants, b) the parts of the plants sensitive to specific stimulus. Discuss in what ways the response of plants towards stimuli are important for their survival.	A student is able to: • state the stimuli that cause response in plants, • identify the parts of plants sensitive to specific stimulus, • relate the response in plants to their survival.	Responses in plants should include phototropism, geotropism, hydrotropism, nastic movement, tigmotropism.	

LEARNING AREA: 2. NUTRITION

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
2.1 Analysing the classes of food.	Discuss the classes of food i.e. carbohydrate, protein, fats, vitamins, minerals, fibre and water and state their functions. Carry out activities to test for starch (iodine solution), glucose (Benedict solution), protein (Millon's reagent) and fats (alcohol-emulsion test).	A student is able to: • explain through examples the classes of food, • state the function of each class of food, • test for starch, glucose, protein and fats.	Only the major vitamins (A, B, C, D, E and K) and minerals (calcium, sodium, iron, iodine, phosphorus and potassium) are required. Vitamin B need not be classified into B_1, B_2 and so on. Introduce alcohol-emulsion test for fat.	fats – *lemak* fibre – *pelawas* potassium – *kalium* starch – *kanji* sodium – *natrium*
2.2 Evaluating the importance of a balanced diet.	Discuss: a) what a balanced diet is, b) the factors that determine a person's balanced diet: age, size, sex, job, climate, state of health. Collect food wrappers that show calorific value of food and make a list to show the calorific value for each type of food.	A student is able to: • state what a balanced diet is, • state the factors that must be considered when planning a balanced diet, • explain how the factors affect a balanced diet, • state the quantity of energy in each gram of carbohydrate, protein and fats,	The unit of energy in food can be measured either in joules or calories.	balanced diet – *gizi seimbang* calorific value – *nilai kalori* climate – *cuaca* food wrapper – *bungkusan makanan*

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
	Discuss to estimate the calories of food taken in a meal. Plan a balanced diet for a day. (breakfast, lunch and dinner)	• estimate the calories of food taken in a meal, • plan a balanced diet.		
2.3 Understanding the digestive system in man.	Discuss that digestion is the breakdown of large food molecules into smaller soluble molecules that can be readily absorbed by the body. Identify parts of the digestive system and the flow of food particles in the alimentary canal using model/chart/CD ROM. Discuss the functions of the various organs in the digestive system and the enzymes found. Carry out activities to show the action of the enzyme in the saliva on starch.	A student is able to: • explain what digestion is, • identify the parts of the digestive system, • describe the flow of food particles in the alimentary canal, • state the functions of the organs in the digestive system, • describe the process of digestion in the alimentary canal, • list the end products of digestion of carbohydrate, protein and fats.	Enzymes should only include amylase, protease and lipase.	alimentary canal – *salur penghadaman* anus – *dubur* appendix – *umbai usus* bile – *jus hempedu* digestion – *penghadaman* enzyme – *enzim* gall bladder – *pundi hempedu* gut – *salur penghadaman* insoluble – *tidak larut* large intestine – *usus besar* liver – *hati* saliva – *air liur* small intestine – *usus kecil* stomach – perut

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
2.4 Understanding the process of absorption of digested food.	Discuss the process of absorption of the products of digestion in the small intestine. Carry out an experiment to show the absorption of glucose through a Visking tube.	A student is able to: • explain the process of absorption of the products of digestion, • make inference about the absorption of glucose through a Visking tube.	The structure of vilus is not required. Need only mention vilus increases the surface area for absorption.	absorption – *penyerapan* analogise – *membuat analogi* blood stream – *aliran darah* diffusion – *resapan*
2.5 Understanding the reabsorption of water and defecation.	Discuss the reabsorption of water by the large intestine and the process of defecation. Discuss the importance of good eating habits to avoid constipation.	A student is able to: • state how water is reabsorbed in the large intestine, • explain defecation, • relate the problem of defecation with eating habits.		constipation – *sembelit* defecation – *penyahtinjaan* large intestine – *usus besar* reabsoption – *penyerapan semula*

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
2.6 Put into practice the habits of healthy eating.	Plan and carry out a healthy eating habit. Discuss the following topics : a) practicing good eating habits i.e. eating nutritious food and eating in moderation, b) the generous distribution of food to the underprivileged / needy, c) cultural practices in dining conforming to sensitivities and religious beliefs.	A student is able to: • justify the importance of eating nutritious food, • put in practice good eating habits, • justify the generous distribution of food to the underprivileged / needy, • relate the dining culture of different people conforming to sensitivities and religious beliefs.		habits – *amalan* needy – *sangat miskin* nutritious food – *makanan berkhasiat* underprivileged – *kurang bernasib baik* religious beliefs – *kepercayaan agama*

THEME: MAN AND THE VARIETY OF LIVING THINGS

LEARNING AREA: 1. BIODIVERSITY

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
1.1 Understanding variety of living organisms and their classification.	Discuss the diversity in the general characteristics of living organisms. Collect and classify various plants and animals into a system based on common characteristics. - Animal: Invertebrate, vertebrate, mammal, fish, bird, amphibian, reptile. - Plant : Flowering plant, non-flowering plant, monocotyledon, dicotyledon. - Build a concept map on living organisms based on the classification above. Discuss the importance of maintaining the biological diversity as one of the country's natural heritage.	A student is able to: • explain the diversity of living organisms in a habitat, • classify various animals based on common characteristics, • classify various plants based on common characteristics, • explain the importance of biodiversity to the environment.	Basic concept on variety of living organisms has been introduced in primary science. Emphasize only on the classification in the suggested learning activities. Malaysia is one of the twelve mega-biodiversity countries in the world should be highlighted.	amphibian – *amfibia* bird – *burung* dicotyledon – *dikotiledon* diversity – *kepelbagaian* fish – *ikan* flowering plant – *tumbuhan berbunga* invertebrate – *invertebrata* living organism – *organisma hidup* mammal – *mamalia* monocotyledon – *monokotiledon* non-flowering plant – *tumbuhan tidak berbunga* reptile – *reptilia* vertebrates – *vertebrata*

LEARNING AREA: 2. INTERDEPENDENCE AMONG LIVING ORGANISMS AND THE ENVIRONMENT

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
2.1 Analysing the interdependence among living organisms.	Carry out a field work to study species, habitat, population, community in an ecosystem. Carry out a discussion on interdependence among living organisms and the environment to create a balanced ecosystem.	A student is able to: • state what species, population and community are, • state what habitat and ecosystem are, • identify various habitats in one ecosystem, • explain through examples the interdependence among living organisms and the environment to create a balanced ecosystem.	Basic concept of habitat has been introduced in primary school. During the field work the concept of ecology will be constructed through contextual learning.	community – *komuniti* ecosystem – *ekosistem* environment – *persekitaran* habitat – *habitat* interdependence – *saling bersandaran* predict – *meramal* population – *populasi* species – *spesis*

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
2.2 Evaluating the interaction between living organisms.	Collect and interpret data on the types of interactions between living organisms as follows: a) prey-predator, b) symbiosis: commensalism, mutualism and parasitism e.g. remora and shark, algae and fungi, tape worm and man, c) competition. Conduct an activity to show the importance of the interaction between organisms and the environment. Discuss the advantages of biological control in regulating the numbers of pests in certain areas.	A student is able to: • list the types of interactions between living organisms, • explain with examples the interactions between living organisms, • justify the importance of interaction between living organisms and the environment, • explain through examples the advantages and disadvantages of biological control in regulating the number of pest in certain areas.	Basic concept of prey predator and competition has been taught in primary school. Refer to local issues like the crow problem in Kelang.	advantage – *kebaikan* biological control – *kawalan biologi* competition – *persaingan* disadvantage – *keburukan* interaction – *interaksi* parasitism – *parasitisme* pest – *perosak* prey predator – *mangsa pemangsa* regulate – *mengawal* symbiosis – *simbiosis*

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
2.3 Synthesizing food web.	Collect and interpret data on the producer, consumer, decomposer and pyramid number. Construct a food web from a few food chains and identify the producer, consumer and decomposer. Discuss the energy flow in the food web constructed. Conduct a game to show the effects of an increase or decrease in the number of organisms in a pyramid number. Discuss the consequences if a component of living organisms in an ecosystem is missing.	A student is able to: • explain what producers, consumers and decomposers are, • combine a few food chains to construct a food web, • identify the producer, consumer and decomposer in a food web, • construct a pyramid number from a food chain, • relate the food web and the pyramid number to energy flow, • predict the consequences if a certain component of living organisms in the ecosystem is missing.	Food chain has been taught in primary science. Refer to the crown of thorn problem in the coral reef in the marine parks.	balance in nature-*keseimbangan alam* consumer- *pengguna* decomposer-*pengurai* food web-*siratan makanan* primary consumer – *pengguna primer* producer-*pengeluar* pyramid number-*piramid nombor* secondary consumer – *pengguna sekunder* tertiary consumer – *pengguna tertier*

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
2.4 Analysing photosynthesis.	Carry out discussion on what photosynthesis is. Carry out experiments to determine the factors needed for photosynthesis i.e. carbon dioxide, water, light and chlorophyll. Discuss the importance of photosynthesis in maintaining a balanced ecosystem. Discuss the carbon and oxygen cycles.	A student is able to: • state what photosynthesis is, • state the factors required for photosynthesis, • state the products of photosynthesis, • control the variables that are required for photosynthesis, • explain the role of photosynthesis in maintaining a balanced ecosystem.	The carbon and oxygen cycles should be included.	balanced ecosystem – *ekosistem yang seimbang* oxygen cycle - *kitar oksigen* carbon cycle – *kitar karbon* photosynthesis-*fotosintesis*

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
2.5 Evaluating the importance of conservation and preservation of living organisms.	Collect and interpret data on the conservation and preservation of living organisms. Carry out a field work in a natural forest reserve (wetlands, highland forest or tropical rain forest) or an animal sanctuary to study the conservation and preservation of living organisms. Carry out a discussion on how the improvement in science and technology helps in the conservation and preservation of living organisms. Run a campaign to stress on the importance of conservation and preservation / Carry out a role play involving the parties concerned in solving problems related to the conservation and preservation of living organisms.	A student is able to: • explain what conservation and preservation are, • explain the steps taken to preserve and conserve living organisms, • justify the importance of conservation and preservation of living organisms, • support activities organised by various parties to preserve and conserve the living organisms.	The role of man in conservation and preservation has been highlighted in primary school. Forest is also home to some indigenous people should be included.	conservation-*pemuliharaan* reserve forest – *hutan simpan* highland forest – *hutan tanah tinggi* indigenous people – *orang asli* preservation-*pemeliharaan* sanctuary-*santuari* tropical rainforest – *hutan hujan tropika* wetlands – *tanah bencah* / *lembap*

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
2.6 Evaluating the role of man in maintaining the balance in nature.	Carry out a brainstorming session to discuss the environmental issues affecting the balance in nature and how to solve it. Carry out a discussion to justify that man needs stable and productive ecosystem to ascertain a harmonious life.	A student is able to: • explain the effects of human activities on the balance in nature, • describe how man solves problems related to environment, • justify that human need a stable, productive and balanced ecosystem.	Examples of environmental issues: Global climate change, habitat destruction, species extinction, air, soil and water pollution, loss of wetlands, solid waste management, deforestation, land overuse, over fishing, toxin in the environment, (release of excessive chemicals into our environment – includes pesticides, fertilizers and pollutants).	acid rain – *hujan asid* brainstorming – *sumbangsaran* climate change – *perubahan iklim* deforestation – *penebangan hutan* excessive – berlebihan land overuse – *penggunaan tanah yang tidak terkawal* green house effect – *kesan rumah hijau* over fishing – *penangkapan ikan tidak terkawal* pollution – *pencemaran* solid waste management – *pengurusan sisa pepejal* pesticides – *pestisid* species extinction – *kepupusan spesis* toxin – *toksin*

THEME: MATTER IN NATURE

LEARNING AREA: 1.0 WATER AND SOLUTION

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
1.1 Analysing the physical characteristics of water.	Carry out activities to determine the following: • the freezing point of water, • the boiling point of water. Carry out an activity to observe the effects of impurities on the physical characteristics of water.	A student is able to: • state the meaning of the freezing point of water, • state the meaning of the boiling point of water, • describe the physical characteristics of water, • explain through examples the effects of impurities on the physical characteristics of water.	The Kinetic Theory should be introduced. Relate the freezing and boiling point of water to the Kinetic Theory.	boiling point – *takat didih* freezing point – *takat beku* impurities – *bendasing* inference – *inferens* physical characteristics – *ciri-ciri fizikal*

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
1.2 Analysing the composition of water.	Carry out an electrolysis to determine the ratio of hydrogen to oxygen in a molecule of water.	A student is able to: • determine the composition of water, • test the presence of hydrogen and oxygen.	**The ionic theory on electrolysis is not needed**. Understanding that hydrogen is discharged at the cathode and oxygen at the anode is adequate. The ratio of gases is required.	anode – *anod* cathode – *katod* composition – *komposisi* ionic theory – *teori ionik* electrolysis – *elektrolisis* discharge – terhasil

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
1.3 Analysing the process of evaporation of water.	Carry out experiments to study the factors affecting the rate of evaporation of water i.e. humidity, the temperature of the surrounding, surface area and the movement of air. Discuss the factors affecting the rate of evaporation in relation to the Kinetic Theory. Discuss the similarities and differences between evaporation and boiling. Gather information on evaporation process and its application in daily life.i.e. drying of clothes, preservation of agricultural products and processing of food.	A student is able to: • explain what evaporation is, • explain through examples the factors that affect the rate of evaporation of water with reference to the Kinetic Theory, • compare and contrast between evaporation and boiling, • describe the application of the evaporation of water in daily life.		agricultural product – *hasil pertanian* evaporation – *penyejatan* evaporation of water – *penyejatan air* humidity – *kelembapan* movement of air – *pergerakan udara* preservation – *pengawetan* processing of food – *pemprosesan makanan* rate of evaporation – *kadar penyejatan* surface area – *luas permukaan* temperature of the surrounding – *suhu sekeliling*

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
1.4 Analysing solution and solubility.	Discuss the differences between solute, solvent and solution. Carry out activities to prepare a dilute solution, a concentrated solution and a saturated solution. Discuss the similarities and differences between dilute solution, concentrated solution and saturated solution. Carry out activities to illustrate the differences between a solution and a suspension. Carry out experiments to determine the factors affecting the solubility of a solute. • Nature of solvent, • Nature of solute, • Temperature.	A student is able to: • explain what solute, solvent and solution are, • contrast and compare between dilute solution, concentrated and saturated solution, • explain what suspension is, • explain what solubility is, • explain the factors affecting the solubility of solutes in water, • explain the importance of water as a universal solvent in life, • give examples on the uses of organic solvents in our everyday life.	Introduce insoluble sediments are known as residue.	concentrated solution – *larutan pekat* dilute solution – *larutan cair* nature of solute – *jenis zat pelarut* nature of solvent – *jenis pelarut* organic solvent – *pelarut organik* residue – *baki*/*sisa* suspension – *bahan terampai* saturated solution – *larutan tepu* sediment – *bahan mendapan* solubility – *kelarutan* solute – *zat pelarut* solution – *larutan* solvent – *pelarut* universal solvent – *pelarut universal* volume of solvent – *isipadu pelarut*

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
	Carry out experiments to determine the factors affecting the rate of dissolving: • temperature, • rate of stirring, • size of solute particle. Discuss the importance of water as a universal solvent in life. Gather information on the application of organic solvents in daily life.			

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
1.5 Analysing acid and alkali.	Carry out activities to study: • the properties of acid in terms of pH value, taste, corrosive nature, effect on litmus paper, reaction with metals such as magnesium and zinc, • the characteristics of alkali in terms of pH value, taste, corrosive nature, effect on litmus paper, • carry out a discussion to define acid and alkali operationally. Carry out activities to determine the acidic and alkaline substances in daily life.	A student is able to: • identify the properties of acid, identify the properties of alkali, • state that acid and alkali only show their properties in the presence of water, • explain through examples the definition of acid and alkali, • identify the substances which are acidic or alkaline in everyday life, • state the uses of acid and alkali in daily life, • explain the meaning of neutralisation, • write an equation in words to describe the neutralisation process, • explain through examples the uses of neutralisation in daily life.	**Caution**: Chemicals in the laboratory should not be tasted. Use only dilute acid and dilute alkali. Do not use active metals such as Potassium and Sodium in the reaction with acid.	active metal – logam aktif alkaline substance –*bahan beralkali* concentration – *kepekatan* concentrated acid – *asid pekat* concentrated alkali – *alkali pekat* corrosive – *mengkakis* dilute acid – *asid cair* dilute alkali – alkali cair equation in words – *persamaan perkataan* hydrochloric acid – *asid hidroklorik* litmus paper – *kertas litmus* metal – *logam* neutralization – *peneutralan* operational definition – *definisi secara operasi* potassium – *kalium* sodium – *natrium* sodium hydroxide – *natrium hidroksida*

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
	Gather information on the usage of acid and alkali in everyday life such as in agriculture and industry. Discuss on the meaning of neutralisation. Carry out an activity to show neutralisation using the hydrochloric acid and sodium hydroxide of the same concentration. Discuss the application of neutralisation in daily life e.g. using shampoo and conditioner and, insect bite.			

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
1.6 Analysing the methods of water purification.	Make a visit to a water purification site. Brainstorming on the following: • natural resources of water, • the reasons for water purification. Discuss the various types of water purification such as filtration, boiling, chlorination and distillation. Carry out activities to study the various types of water purification such as filtration, boiling and distillation. Pupils present their findings to discuss the strengths and weaknesses of the various types of water purification.	A student is able to: • list the natural sources of water, • state the reasons for water purification, • describe the various types of water purification, • compare the strengths and weaknesses of the various types of water purification.	The latest developments in water purification e.g. ultra-violet treatment can be discussed.	boiling – *pendidihan* chlorination – *pengklorinan* distillation – *penyulingan* filtration – *penurasan* natural resources – *sumber semula jadi* water purification site – *loji pembersihan air*

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
1.7 Analysing the water supply system.	Make a visit to a water processing plant to study the water supply system and stages involved in water purification. Discuss the ways to save water. Do a project on how much water the average household uses.	A student is able to: • describe how the water supply system works, • explain ways to save water.		domestic uses – *penggunaan domestik* usage of water – *penggunaan air* water supply system – *sistem bekalan air*

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
1.8 Understanding the preservation of water quality.	Collect and interpret data on types of water pollutants which include: • industrial waste such as chemical and radioactive residues, • domestic waste such as garbage and sewage, • chemicals from the agricultural activities such as fertilisers and pesticides, • siltation caused by constructions and deforestation, • accidental spillage from tankers. Conduct discussion on the effect of water pollution on living things. Generate ideas on ways to control water pollution. Discuss ways to conserve and preserve water and its quality. Run a campaign on 'Love Our Rivers'.	A student is able to: • give examples of water pollutants, • explain the effect of water pollution on living things, • explain ways to control water pollution, • explain ways to preserve water and its quality.		construction – *pembinaan* deforestation – *penebangan hutan* domestic waste – *bahan buangan domestik* fertiliser – *baja* garbage – *sampah-sarap* industrial waste – *bahan buangan industri* pesticide – *pestisid* preservation – *pemeliharaan* radioactive residue – *sisa radioaktif* siltation – *pengelodakan* sewage – *sisa* / *bahan kumbahan* water pollutant – *bahan cemar air*

LEARNING AREA: 2. AIR PRESSURE

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
2.1 Understanding air pressure.	Carry out an activity to discuss the kinetic theory of gases. Carry out an activity to show that air exerts pressure. Carry out activities to show the factors affecting air pressure, i.e. volume and temperature.	A student is able to : • explain the existence of air pressure with reference to the Kinetic Theory, • explain the factors affecting air pressure.		air pressure – *tekanan udara* appliances – *peralatan* existence – *kewujudan* temperature – *suhu* volume – *isipadu*

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
2.2 Applying the principle of air pressure in daily life.	Collect and interpret data on appliances that use the principle of air pressure. Gather information and discuss the application of air pressure in syringe, siphon, spraying pump and drinking straw. Discuss ways of using the principle of air pressure to solve daily problems such as blockage in sinks and pouring condensed milk from a can. Gather information on how a gas tank containing gas under high pressure works. Discuss the safety precautions taken when using gas under high pressure.	A student is able to: • explain with examples things that use the principle of air pressure, • generate ideas to solve problems using the principle of air pressure, • relate the safety measures taken when using gas under high pressure.	**Caution:** Do not place tank containing gas under high pressure near heat.	syringe – *picagari* siphon – *sifon* spray – *penyembur* drinking straw – *penyedut minuman* blockage – *tersumbat* gas under high pressure – *gas di bawah tekanan tinggi* safety measures – *langkah keselamatan*

THEME: FORCE AND MOTION

LEARNING AREA: 1. DYNAMICS

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
1.1 Understanding force.	Carry out activities to show pushing and pulling are forces. Carry out activities to show the effects of force (changes in shape, position, speed and direction). Carry out activities to show different types of forces (frictional, gravitational, electrostatic and magnetic force).	A student is able to: • state that a force is a push or a pull, • explain the effects of forces, • explain the various types of forces.		electrostatic force – *daya elektrostatik* frictional force – *daya geseran* gravitational force – *daya graviti* magnetic force – *daya magnetik* speed – *kelajuan*
1.2 Understanding the measurement of force.	Discuss the unit of force and the principle of a spring balance. Carry out activity to measure the magnitude of force.	A student is able to: • state the unit of force, • explain how a spring balance works, • measure the magnitude of force.		magnitude – *magnitud* spring balance – *neraca spring*

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
1.3 Application of frictional force.	Discuss with examples to show the existence of frictional force. Carry out activities to identify the direction of frictional force and measure the magnitude of the force. Carry out an experiment to show how different types of surfaces affect the magnitude of frictional force. Gather information and discuss the advantages and disadvantages of friction. Carry out activities on ways to a) increase friction, b) reduce friction. Discuss the application of increasing and decreasing friction in our daily life.	A student is able to: • explain with example the existence of frictional force, • state the direction and the magnitude of frictional force, • carry out an experiment to show how different types of surfaces affect frictional force, • explain the advantages and disadvantages of friction, • explain ways to increase friction, • explain ways to reduce friction, • explain with examples the application of friction in daily life.	Ignore static frictional force.	existence – *kewujudan* surface – *permukaan*

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
1.4 Application of work.	Discuss with examples to show work is done when an object is moved by a force. Carry out activities to determine the work done by using: Work (J) = Force (N) X Distance (m)	A student is able to: • explain with examples how work is done, • state the unit of work, • calculate the work done.		distance – jarak work – kerja
1.5 Application of power.	Carry out activities to determine power by using: Power (W) = Work (J) / Time (s)	A student is able to: • state the meaning of power, • state the unit of power, • calculate power on the work done.		power – *kuasa*
1.6 Analysing the importance of force in life.	Create an activity e.g. drawing a poster, sketching or acting to show how life would be without force.	A student is able to: • describe how life will be if force does not exist.		sketch – *lakaran*

LEARNING AREA: 2. SUPPPORT AND MOVEMENT

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
2.1 Understanding the support systems in animals.	Gather information and discuss the various support systems in a) land and aquatic vertebrates, b) land and aquatic invertebrates. Carry out discussions on the following: a) similarities and differences between support systems in land and aquatic vertebrates, b) similarities and differences between support systems in land and aquatic invertebrates.	A student is able to: • explain the support system in vertebrates and the various support systems in invertebrates, • compare and contrast the support system between land and aquatic vertebrates, • compare and contrast the support system between land and aquatic invertebrates.	For invertebrates introduce exoskeleton, endoskeleton, hydrostatic skeleton.	aquatic – *akuatik* buoyancy – *keapungan* chitin – *kitin* cuticle – *kutikel* endoskeleton – *rangka dalam* exoskeleton – *rangka luar* hydrostatic – *hidrostatik* shell – *cangkerang* skeletal system – *sistem rangka* support system – *sistem sokongan*
2.2 Understanding the support systems in plants.	Carry out field work to study various support systems of plants. Carry out activities to classify plants based on their support systems.	A student is able to: • explain the various support systems in woody and non-woody plants, • classify plants based on their support systems.	Features that help non-woody plants include tendrils, thorns, air sacs in aquatic plants.	

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
2.3 Appreciating the support system in living things.	Discuss issues e.g. a) inability of whales to move back to sea after being washed ashore, b) a crippled person using crutches for support.	A student is able to: • justify the importance of the support system to living things.		beached whale – *paus yang terdampar di pantai* crippled – *tempang* crutches – *tongkak ketiak* inability – *ketidakupayaan*

THEME: TECHNOLOGICAL AND INDUSTRIAL DEVELOPMENT IN SOCIETY

LEARNING AREA: 1. STABILITY

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
1.1 Understanding that the centre of gravity affects stability.	Carry out activities to find the point of equilibrium in regular and irregular shapes. Carry out an experiment to find out how the centre of gravity affects the stability of an object by manipulating the a) height, b) base area. Discuss the relationship between the centre of gravity and stability.	A student is able to: • determine the point of equilibrium in regular and irregular shapes, • relate the point of equilibrium as the centre of gravity of objects, • relate the centre of gravity to the stability of objects.		base area – *luas tapak* center of gravity – *pusat graviti* height – *ketinggian* manipulating – *mengubah* point of equilibrium – *titik keseimbangan* stability – *kestabilan*

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
1.2 Appreciating the importance of stability.	Carry out a brainstorming session on ways to improve stability. Carry out activities like doing projects or playing games to build models by applying the concept of stability.	A student is able to: • suggest ways to improve the stability of objects around them, • explain with examples the application of stability in life.		

LEARNING AREA: 2. SIMPLE MACHINE

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
2.1 Analysing levers.	Discuss how a small effort can overcome a large load with the use of a lever. Make an observation on devices that use the principles of levers. Identify the load, force and fulcrum, and then classify the systems into first, second and third class levers. Discuss how humans apply the principles of levers to help them overcome large load. Discuss that the moment of force = force X perpendicular distance from the pivot to force. Carry out an activity to show the relationship between moment and the product of force and distance.	A student is able to: • list things around them that use the principle of the lever, • state what a lever can do, • identify load, force and fulcrum in the lever, • classify levers, • explain what is meant by the moment of a force, • solve problems related to levers.	When we open the door or use a wrench to loosen a nut, we are applying a force that causes a turning effect to accomplish the desired task. The turning effect is called the **moment of a force**.	fulcrum – *fulcrum* force – *daya* lever – *tuas* load – *beban* perpendicular distance – *jarak tegak*

Learning Objectives	Suggested Learning Activities	Learning Outcomes	Notes	Vocabulary
	Solving problems related to levers using the following formulae: Load (N) X distance of the load from fulcrum (m) = Force (N) X distance of the force from the fulcrum (m)			
2.2 Appreciating the innovative efforts in the design of machine to simplify work.	Carry out a project to build a device using the principle of a lever.	A student is able to: • design or improvise a device that use the principle of a lever.		design – *reka* innovative – *inovatif*

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