KEMENTERIAN PENDIDIKAN MALAYSIA

KURIKULUM STANDARD SEKOLAH MENENGAH

Sains

Dokumen Standard Kurikulum dan Pentaksiran

Tingkatan 1

(EDISI BAHASA INGGERIS)

KEMENTERIAN PENDIDIKAN MALAYSIA

KURIKULUM STANDARD SEKOLAH MENENGAH

Sains

DOKUMEN STANDARD KURIKULUM DAN PENTAKSIRAN

Tingkatan 1

(Edisi Bahasa Inggeris)

Bahagian Pembangunan Kurikulum

Mei 2016

Terbitan 2016

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Themes

RUKUN NEGARA

BAHAWASANYA Negara kita Malaysia mendukung cita-cita hendak:
Mencapai perpaduan yang lebih erat dalam kalangan seluruh masyarakatnya;
Memelihara satu cara hidup demokratik;
Mencipta satu masyarakat yang adil di mana kemakmuran negara
akan dapat dinikmati bersama secara adil dan saksama;
Menjamin satu cara yang liberal terhadap tradisi-tradisi
kebudayaannya yang kaya dan berbagai corak;
Membina satu masyarakat progresif yang akan menggunakan sains
dan teknologi moden;

MAKA KAMI, rakyat Malaysia, berikrar akan menumpukan seluruh tenaga dan usaha kami untuk mencapai cita-cita tersebut berdasarkan prinsip-prinsip yang berikut:

KEPERCAYAAN KEPADA TUHAN
KESETIAAN KEPADA RAJA DAN NEGARA
KELUHURAN PERLEMBAGAAN
KEDAULATAN UNDANG-UNDANG
KESOPANAN DAN KESUSILAAN

FALSAFAH PENDIDIKAN KEBANGSAAN

"Pendidikan di Malaysia adalah suatu usaha berterusan ke arah lebih memperkembangkan potensi individu secara menyeluruh dan bersepadu untuk melahirkan insan yang seimbang dan harmonis dari segi intelek, rohani, emosi dan jasmani, berdasarkan kepercayaan dan kepatuhan kepada Tuhan. Usaha ini adalah bertujuan untuk melahirkan warganegara Malaysia yang berilmu pengetahuan, berketerampilan, berakhlak mulia, bertanggungjawab dan berkeupayaan mencapai kesejahteraan diri serta memberikan sumbangan terhadap keharmonian dan kemakmuran keluarga, masyarakat dan negara"

Sumber: Akta Pendidikan 1996 (Akta 550)

FALSAFAH PENDIDIKAN SAINS KEBANGSAAN

Selaras dengan Falsafah Pendidikan Kebangsaan,
pendidikan sains di Malaysia memupuk
budaya Sains dan Teknologi dengan memberi tumpuan
kepada perkembangan
individu yang kompetitif,
dinamik, tangkas dan berdaya tahan
serta dapat menguasai ilmu sains dan
keterampilan teknologi.

Sumber: MOSTI

KATA PENGANTAR

Kurikulum Standard Sekolah Menengah (KSSM) yang dilaksanakan secara berperingkat mulai tahun 2017 akan menggantikan Kurikulum Bersepadu Sekolah Menengah (KBSM) yang mula dilaksanakan pada tahun 1989. KSSM digubal bagi memenuhi keperluan dasar baharu di bawah Pelan Pembangunan Pendidikan Malaysia (PPPM) 2013-2025 agar kualiti kurikulum yang dilaksanakan di sekolah menengah setanding dengan standard antarabangsa. Kurikulum berasaskan standard yang menjadi amalan antarabangsa telah dijelmakan dalam KSSM menerusi penggubalan Dokumen Standard Kurikulum dan Pentaksiran (DSKP) untuk semua mata pelajaran yang mengandungi Standard Kandungan, Standard Pembelajaran dan Standard Pentaksiran.

Usaha memasukkan Standard Pentaksiran di dalam dokumen kurikulum telah mengubah landskap sejarah sejak Kurikulum Kebangsaan dilaksanakan di bawah Sistem Pendidikan Kebangsaan. Menerusinya murid dapat ditaksir secara berterusan untuk mengenalpasti tahap penguasaannya dalam sesuatu mata pelajaran, serta membolehkan guru membuat tindakan susulan bagi mempertingkatkan pencapaian murid.

DSKP yang dihasilkan juga telah menyepadukan enam tunjang Kerangka KSSM, mengintegrasikan pengetahuan, kemahiran dan nilai, serta memasukkan secara eksplisit Kemahiran Abad Ke-21 dan Kemahiran Berfikir Aras Tinggi (KBAT). Penyepaduan tersebut dilakukan untuk melahirkan insan seimbang dan harmonis dari segi intelek, rohani, emosi dan jasmani sebagaimana tuntutan Falsafah Pendidikan Kebangsaan.

Bagi menjayakan pelaksanaan KSSM, pengajaran dan pembelajaran guru perlu memberi penekanan kepada KBAT dengan memberi fokus kepada pendekatan Pembelajaran Berasaskan Inkuiri dan Pembelajaran Berasaskan Projek, supaya murid dapat menguasai kemahiran yang diperlukan dalam abad ke-21.

Kementerian Pendidikan Malaysia merakamkan setinggi-tinggi penghargaan dan ucapan terima kasih kepada semua pihak yang terlibat dalam penggubalan KSSM. Semoga pelaksanaan KSSM akan mencapai hasrat dan matlamat Sistem Pendidikan Kebangsaan.

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Pengarah
Bahagian Pembangunan Kurikulum

INTRODUCTION

As articulated in the National Education Philosophy, 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. The primary and secondary school science curriculum standard is developed with the aim of producing such individuals.

Malaysia, moving towards becoming a developed nation, should foster a community that is scientific, progressive, inventive and visionary, while using latest technologies. This community must be able to contribute to the advancement of science and the sustainability of technological civilisation. To achieve this, we need to develop critical, creative, innovative and competent citizens who practice the culture of Science, Technology, Engineering and Mathematics (STEM).

The Malaysian science curriculum encompasses three core science subjects and four elective science subjects. The Core Science Subjects are Primary School Science, Lower Secondary Science and Upper Secondary Science. The Elective Science subjects offered in upper secondary are Biology, Physics, Chemistry and Additional Science.

The core science subjects for lower secondary is designed to equip pupils with science knowledge and STEM skills to be science literate and able to do science in upper secondary. Higher order thinking skill will also be developed so that the pupils will be able to apply the scientific knowledge to make decision and solve problems in real life creatively and innovatively.

Meanwhile, the upper secondary science and the elective science subjects will empower and strengthen their knowledge and skills in STEM towards preparing pupils for long-life learning experience. This group of pupils will embark on careers in science and technology which plays a role in national development.

AIMS

The science curriculum for secondary schools aims is to cultivate interest and develop creativity amongst pupil; through experience and investigation; so as to master knowledge in science, scientific skills, thinking skills and, scientific attitudes and values; enabling them to solve problems and make decisions in daily life.

OBJECTIVES

The Science Standard Curriculum (KSSM) aim for pupils to achieve the following objectives to :

1. use the inquiry approach to fulfil their curiosity and their interest in science;
2. acquire knowledge and understanding to explain phenomena scientifically;
3. communicate information relating to science and technology intelligently and effectively;
4. design and carry out scientific investigation, evaluate evidence and make conclusions;
5. apply scientific knowledge, procedural knowledge and epistemic knowledge in posing questions, interpreting data, problem solving and decision making in context of real life;
6. create awareness that discoveries through scientific research is a result of the ability of the human mind to understand natural phenomena towards a better life;
7. create awareness that development of science and technology has an implication on the mores, social, economic and environment issues in the local and global context.

FRAMEWORK OF THE STANDARD CURRICULUM FOR SECONDARY SCHOOL

Standard Curriculum for Secondary School (KSSM) is built based on six strands, which are Communication; Spiritual, Attitude and Value; Humanity; Personal Development; Physical Development and Aesthetic; and Science and Technology. The six strands are the main domain that support each other and are integrated with critical, creative and innovative thinking. This integration is aimed at developing human capital that appreciate noble values based on religion, being knowledgeable, competent, think creatively, critically and innovatively as illustrated in Figure 1.

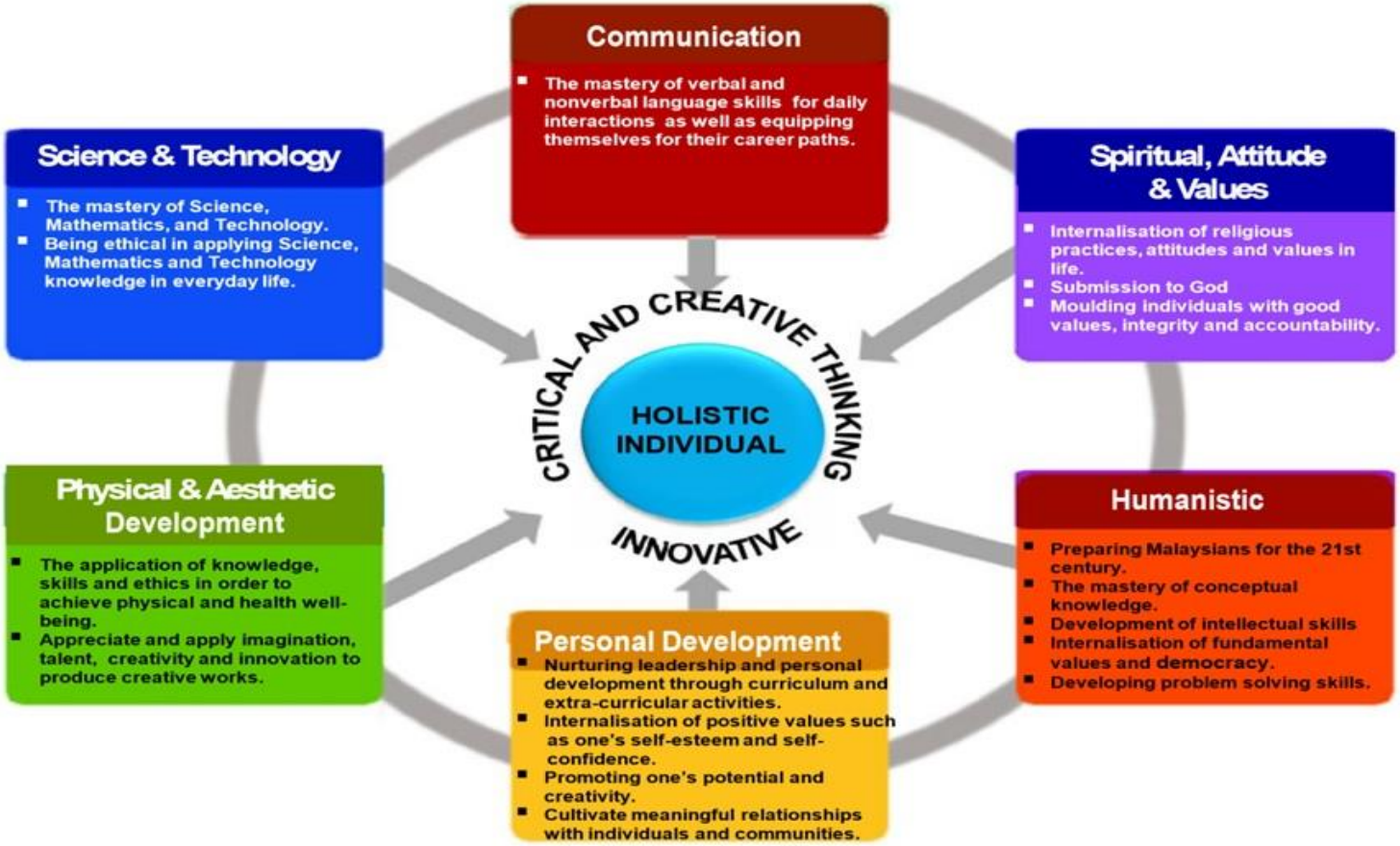

Figure 1: The Framework of Secondary School Standard-Based Curriculum

FOCUS

The science subject for secondary schools focuses on thoughtful learning involving scientific and thinking skills for the acquisition of knowledge through inquiry as the main approach in science education. The science curriculum also aims to prepare pupils to face rapid technological development and various challenges of the 21st century. The group of pupils that have gone through this curriculum will become human resource in the field of science and technology, and will contribute towards national development.

Content Standards of the Science Curriculum from Year 1 to Form 5 are developed based on the three domains which are knowledge, skills and values. The development of these domains will be experienced by pupils through the inquiry method to becoming a thoughtful science learners (Figure 2). The inquiry approach includes pupil-centred learning, constructivism, contextual learning, problem-based learning, mastery learning as well as related strategies and methods.

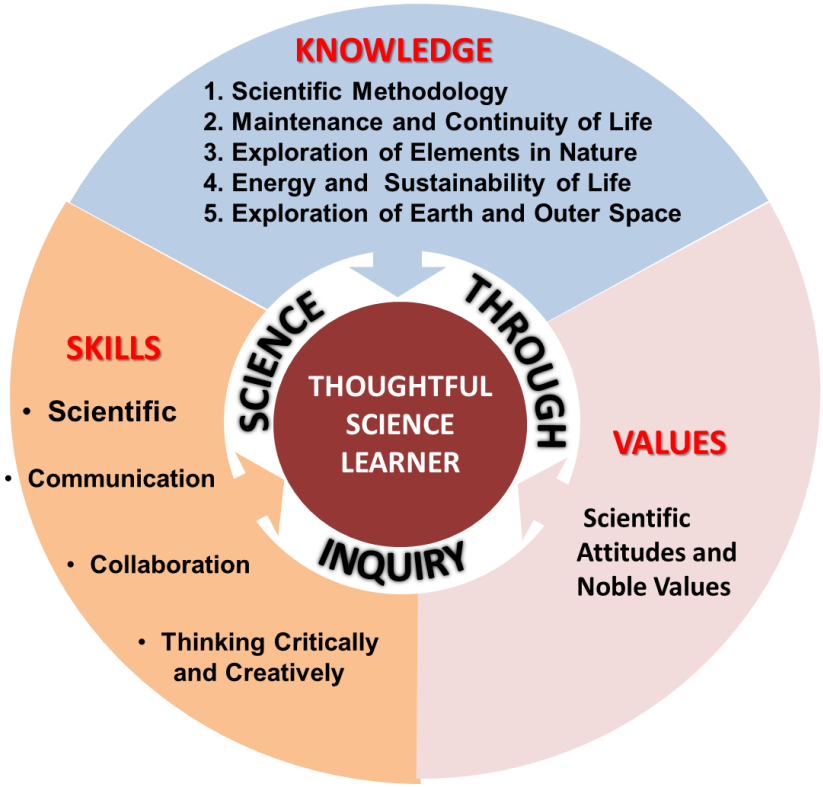

Figure 2: The Conceptual Framework for Science Curriculum

Thoughtful Science

According to the Fourth Edition (2005) of Kamus Dewan, thoughtful has the same meaning as the ability to think and reflect. In the context of science education, thoughtful science refers to the quality of pupils desired to be produced by the national science education system.

Thoughtful science learner are those who can understand scientific ideas and are able to communicate using scientific language; can evaluate as well as apply scientific knowledge and skills responsibly in daily life that involves science and technology, based on attitudes and values. Thoughtful science also intends to produce creative and critical individuals to fulfil the 21st century needs, in which the country's ability is highly dependent upon the ability of human capital that can think and generate ideas.

Thoughtful Learning

Thoughtful learning can be achieved if pupils are actively involved in the teaching and learning process. In this process, the teaching and learning activities are planned to encourage pupils to think so that they are able to conceptualize, solve
problems and make decisions. Thus, thinking skills should be assimilated by pupils.

Thinking skills can be categorised as critical and creative thinking. A person who thinks critically always evaluates ideas systematically before accepting them. A person who thinks creatively is highly imaginative, generates original innovative ideas, and is also able to modify existing ideas and products.

Thinking strategy is a higher level of thinking process that involves several steps where each step involves a number of critical and creative thinking skills. Thinking strategy is the main function and final aim of the thinking process.

Critical Thinking Skills

A brief description of each critical thinking skill is as in Table 1:

Table 1 : Critical Thinking Skills

Attributing	Identifying 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 objects or events.
Grouping and Classifying	Separating and grouping objects or phenomena into groups 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 or information in order based on their importance or urgency.
Analysing	Processing information in detail by breaking it down into smaller parts to understand concepts or events as well as to find the implicit meanings.
Detecting Bias	Detecting views or opinions that have the tendency to support or oppose something.
Evaluating	Making considerations on the good and bad qualities of something based on valid evidences or propositions.
Making Conclusions	Making a statement about the outcome of an investigation based on a hypothesis or strengthening something based on an investigation.

Creative Thinking Skills

A brief description of each creative thinking skill is as in Table 2.

Table 2 : Creative Thinking Skills

Generating Ideas	Producing ideas related to something.
Relating	Making connections in certain situations or events to find a structure or pattern of relationship.
Making Inferences	Making an initial conclusion and explaining an event using data collection and past experiences.
Predicting	Making forecast about events based on observations and previous experiences or collected data.
Making Generalisations	Making a general statement about certain matter from a group of observations on samples or some information from that group.
Visualising	Forming perception or making mental images about a particular idea, concept, situation or vision.
Synthesising	Combining separate elements to produce an overall picture in the form of writing, drawing or artifact.
Making Hypotheses	Making a general statement about the relationship between the variables that is assumed to be true to explain an observation or event. The statement can be tested to determine its validity.
Making Analogies	Forming an understanding about a complex or abstract concept by relating it to simple or concrete concepts with similar characteristics.
Inventing	Producing something new or modifying something already in existence to overcome problems in a systematic manner.

Thinking Strategy

Description of each thinking strategy is as in Table 3.

Table 3 : Thinking Strategy

Conceptualising	Making generalisations towards building of meaning, concept or model based on inter-related specific common characteristics.
Making Decisions	Selecting the best solution from several alternatives based on specific criteria to achieve the intended aims.
Problem Solving	Finding the right solutions in a systematic manner for situations that are uncertain or challenging or unanticipated difficulties.

Besides thinking skills and thinking strategies, another skill that is emphasised is reasoning. **Reasoning** is a skill used in making logical, rational, fair and just consideration. Mastery of critical and creative thinking skills and thinking strategies is made easier if an individual is able to provide reasoning in inductive and deductive manner. Figure 3 gives an overall picture of the thinking skills and thinking strategies. Mastery of TSTS through the teaching and learning of science can be developed through the following stages:

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

Further information about the stages on the implementation of TSTS can be referred to the guidebook "*Buku Panduan Penerapan Kemahiran Berfikir dan Strategi Berfikir dalam Pengajaran dan Pembelajaran Sains (Curriculum Development Centre, 1999)"*

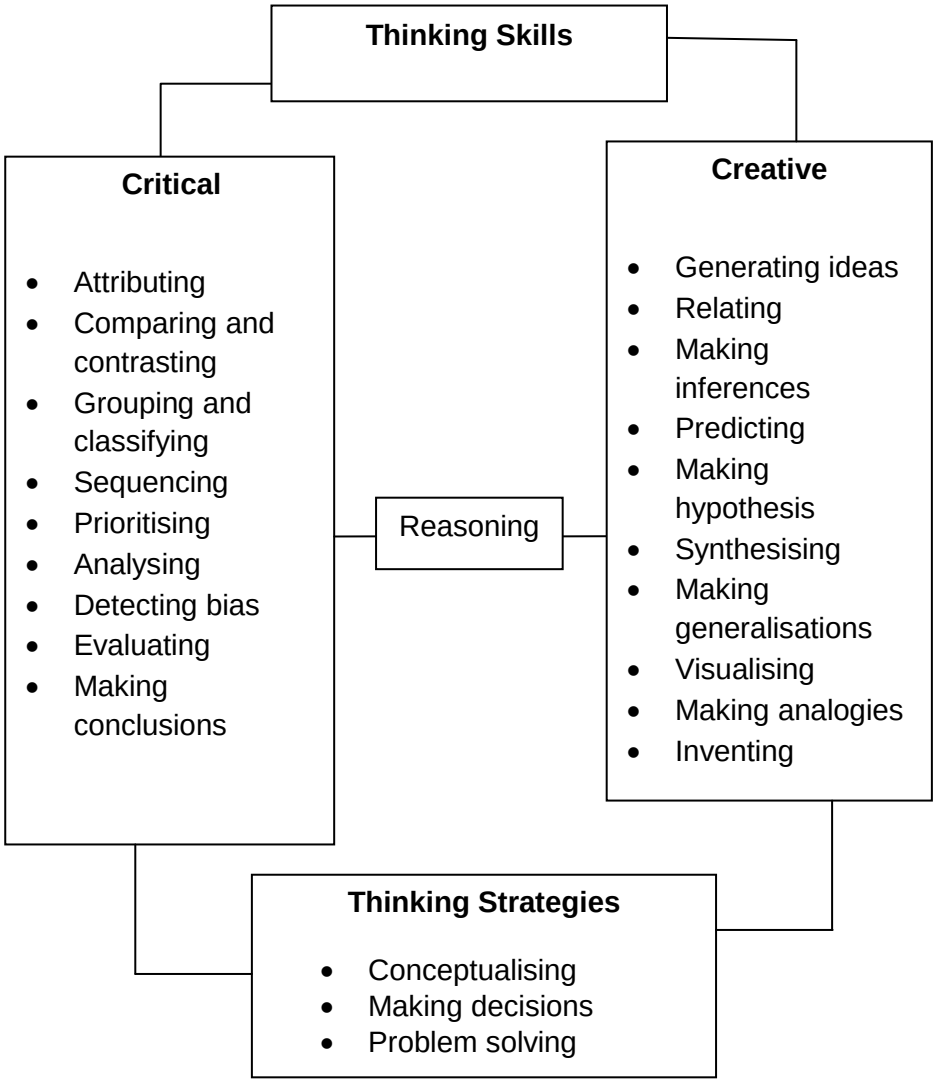

Figure 3: TSTS Model in Science

SCIENTIFIC SKILL

Science emphasizes inquiry and problem solving. In the process of inquiry and solving problem, scientific skills and thinking skills are used. Scientific skill is an important skill when carrying out activities by using scientific methods such as conducting experiments and projects.

Scientific skill consists of science process skills and manipulative skills.

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. Mastery of Science Process Skills together with knowledge and suitable attitudes ensure pupils to think effectively.

Description of each science process skill is as in Table 4.

Table 4 : Science Process Skills

Observing	Using the sense of sight, hearing, touch, taste or smell to gather information about objects and phenomena.
Classifying	Using observations to group objects or phenomena according to similar characteristics.
Measuring and Using Numbers	Making quantitative observations using numbers or tools with standard units or tools standardised with reference units.
Making Inferences	Making initial conclusions that are reasonable, that may be true or false to explain events or observations.
Predicting	Making forecast about events based on observations and previous experiences or collected data.
Communicating	Accepting, choosing, arranging, and presenting information or ideas in the form of writing, verbal, tables, graphs, figures or models.
Using Space-Time Relationship	Describing changes in parameters such as location, direction, shape, size, volume, weight and mass with time.
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 manipulated variables, responding variables and fixed variables. In an investigation, a variable is manipulated to observe its relationship with the responding variable. At the same time, the other variables are kept the same.
Making Hypothesis	Making a general statement about the relationship between the variables that is assumed to be true to explain an observation or event. The statement can be tested to determine its validity.
Experimenting	Planning and conducting an investigation to test a hypothesis, collecting and interpreting data until a conclusion can be obtained.

Manipulative Skills

In a scientific investigation, manipulative skills are psychomotor skills that enable pupils to:

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

Relationship between Science Process Skills and Thinking Skills

The mastery of Science Process Skills requires pupils to master the relevant thinking skills. The relevant thinking skills that are related to each science process skill are as in Table 5.

Table 5 : Science Process Skills and Thinking Skills

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
Predicting	Relating Visualising
Using Space-Time Relationship	Sequencing Prioritising
Interpreting data	Comparing and contrasting Analysing Detecting bias Making conclusions Making Generalisations Evaluating
Defining operationally	Relating Making analogies Visualising Analysing
Controlling variables	Attributing Comparing and contrasting Relating Analysing
Making hypothesis	Attributing Relating Comparing and contrasting Generating ideas Making hypothesis Predicting Synthesising
Experimenting	All thinking skills
Communication	All thinking skills

Teaching and Learning Based on Thinking Skills and Scientific Skills

This Science Curriculum Standard emphasises thoughtful learning based on thinking skills and scientific skills. In this curriculum, the intended learning standard is written by integrating acquisition of knowledge with mastery of thinking skills and scientific skills. Thus in teaching and learning, teachers need to integrate mastery of skills together with acquisition of knowledge and the inculcation of scientific attitudes and noble values.

SPS implementation in Science exclusively encompass intended skills in the 21st century, indirectly encouraging and developing pupils' higher order thinking skills.

Science Process Skills Standard

The guide of the development of science process skills from primary school to secondary school are as shown in Table 6.

Table 6 : Science Process Skills

	Science Process Skills	Level 1	Level 2	Level 3	Level 4
1	Observing	• Use limbs and senses to make observations about the phenomena or changes that occur.	• Use all the senses to make qualitative observations with the appropriate tools to explain phenomena or changes that occur.	• Make accurate and relevant qualitative and quantitative observations to identify patterns or sequences of objects or phenomena. • Use complex equipment suitable for making observations proficiently.	• Make qualitative and quantitative observations to make generalisations based on a pattern or sequence on an object or phenomenon. • Present futher findings based on observation of objects or phenomena analytically and specifically.
2	Classifying	• Collect / isolate evidens / data / objects / phenomena based on the observed characteristics.	• Compare / identify similarities and differences based on categories that are based on common characteristics.	• Compare / identify similarities and differences to determine the selection criteria for category evidens / data / object /the phenomenon being studied.	• Identify characteristics used to differentiate, collect, select and explain the object or phenomenon in greater detail.
3	Measuring and using numbers	• Measure with the correct instrument in the correct standard unit.	• Measure with the correct instrument in the correct standard unit and using the right technique.	• Measure with the correct instrument in the correct standard unit, using the right technique while recording in a complete and systematic way. • Change the base unit with the correct quantity • Use the correct units.	• Demonstrate how measurements are taken with the correct instrument in the correct standard unit, using the right technique; while recording in a systematic and complete way. • Using more complex derived units in the right manner.

	Science Process Skills	Level 1	Level 2	Level 3	Level 4
4	Making inferences	• Give a reasonable explanation for the observations.	• Concluded the initial grounds for the observation using the information obtained	• Create more than one initial conclusion that is reasonable for an event or observation using the information obtained.	• Generate a variety of possibilities to explain complex situations • Explain the relationship or pattern between variables observed with measurements made for an investigation.
5	Predicting	• Describe a possible outcome for an event or data.	• Make a reasonable assumption of an event based on observation, past experience or data.	• Students can analyse trends / the flow / simple developments based on the data obtained to predict the future state of an object or phenomenon.	• Students can analyse trends / the flow / simple developments based on the data obtained to predict the future state of an object or phenomenon. • Forecasts made can also be tested.
6	Communicating	• Record information or ideas in any form.	• Record information or ideas in a suitable form and present the information or the ideas systematically.	• Able to present the results of an experiment or data observed in various forms such as simple graphics, pictures or tables	• Able to present the results of anexperiment or data observed in various forms such as graphics, pictures or tables that are more complex to show how the patterns are related.

	Science Process Skills	Level 1	Level 2	Level 3	Level 4
7	Use time-space relationships	Not assessed	• Arrange occurrences of a phenomenon or event in chronological order.	• Arrange occurrences of a phenomenon or event in chronological order. • Interpret and explain the meaning of mathematical relationships.	• Use, analyse and interpret numbers and numerical relationships efficiently while solving problems and conducting investigations.
8	Interpreting data	Not assessed	• Select relevant ideas about objects, events or patterns on the data to make an explanation.	• Give information rationally by making an intrapolation or an extrapolation of the data collected.	• Analyse data and suggest improvements. • Identify and explain the anomalies in the set of data obtained
9	Define operationally	Not assessed	• Describe an interpretation of what is carried out and observed in a situation according to particular specifications.	• Describe the most appropriate interpretation of a concept by stating what is carried out and observed for a situation.	• Explain the interpretation made about the selection of instruments or methods on what is observed.
10	Controlling variables	Not assessed	• Determine the responding and constant variable after the manipulated variable is determined in an investigation.	• Determine all variables i.e. responding variable, manipulated variable and constant variable.	• Change the constant variable to the manipulated variable and state the new responding variable.

	Science Process Skills	Level 1	Level 2	Level 3	Level 4
11	Making a hipotesis	Not assessed	• Make a general statement that can be tested, on the relationship between the variables in an investigation.	• Form a relationship between the manipulated variable and responding variable, to form a hypothesis that can be tested.	• Describe expected results of the scientific investigation designed.
12	Experimenting	Not assessed	• Conduct an experiment, collect data, interpret the data and summarise to prove the hypothesis and make a report.	• Make a hypothesis, select appropriate apparatus, design the method, conduct an experiment, collect data, carry out analysis on the data, make a conclusion and prepare a report.	• Identify new problems and design an experiment to test the hypothesis of these problems.

SCIENTIFIC ATTITUDES AND NOBLE VALUES

Experiences from learning science can foster positive attitudes and positive values in pupils. Positive attitudes and values fostered are as the following:

1. Interest and curiosity towards the environment
   - Inquiring from teachers, friends and others
   - Self reading
   - Collects materials or specimens for research.
   - Do their own research

2. Honest and accurate in recording and validating data.
   - Describe and record what have been observed.
   - Data that recorded is not affected by emotion or imagination.
   - Explain observations rationally.
   - Make documentation of information resources used.

3. Flexible and open-minded
   - Accept others opinion.
   - Manage to change one stand based on convinced proof.
   - Not prejudice.

4. Diligent and persevere when carrying out a task.
   - Do not give up.
   - Ready to repeat the experiment
   - Determine during carry out a task
   - Ready to accept critics and challenges.
   - Try to overcome problems and challenges.

5. Systematic, confident and ethic
   - Carry out activity in a systematic and orderly and abide to suitable time.
   - Arrange apparatus and materials in order.
   - Confident with the task given.
   - Dare to try.
   - Dare to defend what is being done.

6. Cooperative
   - Assist teachers and friends.
   - Work together in carrying out activities and experiments.
   - Selfless.
   - Fair and just.

7. Being responsible about the safety of oneself, others and the environment.
   - Personal safety and partners.
   - Preserve and conserve the environment .
8. Virtuous
   - Love all life.
   - Poise and respect.

9. Appreciating the contribution of science and technology.
   - Use science and technology invention with good manners.
   - Use public facilities invented through science and technology responsibly.

10. Appreciate God's gifts .
   - Content with what is given by God.
   - Use God's gifts wisely.
   - Thankful to God.

11. Appreciate and practise clean and healthy living.
   - Care for self hygiene and health.
   - Be sensitive to personal hygiene and environment.

12.Realising that science is a means to understand nature.
   - Stating how science is use to solve problems.
   - Stating the implications of using science to solve a problem or issue.
   - Communicate through correct scientific language.

The assimilation of scientific attitudes and noble values generally take place according to the following stages:

- Realise and understand the important and need for scientific attitudes and noble values.
- Give attention to attitudes and noble values.
- Appreciate and practise the scientific attitudes and noble values.

Proper planning is required to optimise the assimilation of scientific attitudes and noble values during science teaching and learning. Teachers should examine all the learning outcomes in a field related learning including learning standards on the application of scientific attitudes and values before starting a lesson.

21st CENTURY SKILLS

One of the KSSM's intentions is to produce pupils who have 21st century skills, focusing on thinking skills as well as life skills and inculcating noble values in their careers. 21st century skills aim to produce pupils who have the characteristics specified in the pupil profile as shown in Table 7 that enable them to compete globally. Acquiring the CS and LS in the Science curriculum contributes to the acquisition of 21st century skills among pupils.

Table 7: Pupils' Profile

PUPIL PROFILE	DESCRIPTION
Resilient	Able to face and overcome difficulties and challenges with wisdom, confidence, tolerance and empathy.
Communicator	Able to voice out and express their thoughts, ideas and information confidently and creatively in verbal and written, using a variety of media and technology.
Thinker	Able to think critically, creatively and innovatively; solve complex problems and make ethical decisions. Think about learning and about being learners themselves. Generate questions and are receptive towards perspective, values and individual traditions and society. Confident and creative in handling new learning areas.
Teamwork	Cooperate effectively and harmoniously with others. Share collective responsibility while respecting and appreciating the contributions of each member in the team. Acquire interpersonal skills through collaborative activities, which in turn mould them into better leaders and team members.
Curious	Develop natural curiosity to explore strategies and new ideas. Learn skills that are needed to carry out inquiry and research, as well as display independent traits learning. Enjoy continuous life-long learning experiences.

PUPIL PROFILE	DESCRIPTION
Principled	Honest and have integrity, equality, fair and respect the dignity of individuals, group and community. Responsible for their actions, consequences and decisions.
Informative	Knowledgeable and form wide understanding which is balanced across various disciplines. Explore knowledge on local and global issues effectively and efficiently. Understand ethical issues/laws related to the information gained.
Caring/ Concern	Show empathy, compassion and respect towards needs and feelings of others. Committed to serve the society and ensure sustainability of nature.
Patriotic	Portray love, support and respect towards the country.

HIGHER ORDER THINKING SKILLS

Higher Order Thinking Skills (HOTS) is explicitly stated in the curriculum to encourage teachers to incorporate them in teaching and learning, hence stimulating structured and focused thinking among pupils. Description of HOTS is focused on four levels as shown in Table 8.

Table 8: Thinking levels in HOTS

Thinking Level	Description
Applying	Using knowledge, skills and values to take actions in different situations.
Analysing	Breaking down information into smaller parts to enhance understanding and make relationship between the parts.
Evaluating	Using knowledge, experience skills and values to consider, make decisions and give justifications.
Creating	Producing ideas, products or methods and innovatively.

HOTS are the ability to apply knowledge, skills and values for reasoning and reflecting in solving problems, making decisions, innovating and creating. HOTS includes critical thinking, creative thinking, reasoning and thinking strategy.

Critical thinking skill is the ability to evaluate an idea in a logical and rational manner to make a fair consideration by using reason and reliable evidence.

Creative thinking skill is the ability to produce or create something new and valuable by using genuine imaginative skill and unconventional thinking.

Reasoning skill is the ability of an individual to consider and evaluate logically and rationally.

Thinking strategy is a way of thinking that is structured and focused to solve problems.

HOTS can be applied in classrooms through activities in the form of reasoning, inquiry learning, problem solving and projects. Teachers and pupils need to use the thinking tools such as thinking maps and mind maps, including high level questioning to encourage pupils to think.

TEACHING AND LEARNING STRATEGIES

Teaching and learning strategies in the science curriculum emphasise on thoughtful learning. Thoughtful learning is a process that helps pupils acquire knowledge and master skills that will help them develop their minds to the optimum level. Thoughtful learning can take place through various learning approaches such as inquiry, constructivism, science, technology and society, contextual learning and mastery learning. Learning activities should therefore be geared towards activating pupils' critical and creative thinking skills and not be confined to routine method. Pupils should be made aware of the thinking skills and thinking strategies that are being used in their learning.

They should be challenged with higher order questions and problems and be required to solve problems creatively and critically. Pupils should be actively involved in the teaching and learning that integrate the acquisition of knowledge, mastery of skills and inculcation of scientific attitudes and noble values.

Inquiry Approach

Inquiry-discovery approach emphasises learning through experiences. Inquiry generally means to find information, to question and to investigate a phenomenon. Discovery is the main characteristic of inquiry. Learning through discovery occurs when the main concepts and principles of science are investigated and discovered by pupils themselves. Through activities such as experiments, pupils investigate a phenomenon and draw conclusions by themselves. Teachers then lead pupils 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-discovery 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 or through guided inquiry-discovery to pupils.

Constructivism

Constructivism is an ideology that suggests pupils learn by building their own understanding that is meaningful to them. The important attributes of constructivism are:

- Teachers considered pupils' prior knowledge.
- Learning is the result from pupil's own effort.
- Learning occurs when pupils restructure their existing ideas by relating new ideas to old ones.
- Pupils have the opportunities to cooperate, share ideas and experiences and reflect on their learning.

Science, Technology and Society

Meaningful learning occurs if pupils can relate what they have learnt with their daily life. Meaningful learning happens to various approaches such as contextual learning and the science, technology and society (STS) approach.

The theme and objective of learning that is based on STS is reflected in this standard curriculum. The STS approach recommends that the learning of science is done through investigation and discussions based on science, technology and society issues. Science and technology knowledge can be learnt together with the application of science and technology and their implications on the society.

Contextual Learning

Contextual learning is an approach that associates learning with pupil's everyday life. This approach involves investigative learning as in the inquiry-discovery approach. In contextual learning, the relationship between knowledge taught and everyday life is explicitly demonstrated. In this context, pupils not only learn in theory but learn to appreciate the relevance of science in their lives.

Mastery Learning

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

Inculcation of Patriotism Elements

The science curriculum strengthens and fosters patriotism among pupils. For example, in the learning of colonization and displacement processes in ecosystems, pupils will learn about the rich biodiversity of the country, they will appreciate the diversity and uniqueness of natural resources, hence deepen their love for the country.

Emphasizing Science for Teaching and Learning Strategies

Various teaching and learning methods can increase pupils' interest in science. Science lessons that are uninteresting does not motivate pupils to learn and thus affecting their performance. The teaching and learning method determined should be based on the contents of the curriculum standard, pupils' abilities and pupils' repertoire of intelligences and the availability of resources and infrastructure.

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

Experiment

An experiment is a method commonly used in science lessons. Pupils test hypotheses through investigations to discover specific science concepts and principles. Scientific methods are used when conducting an experiment involving thinking skills, science process skills, and manipulative skills.

In general, procedures to follow when conducting an experiment as in Figure 4:

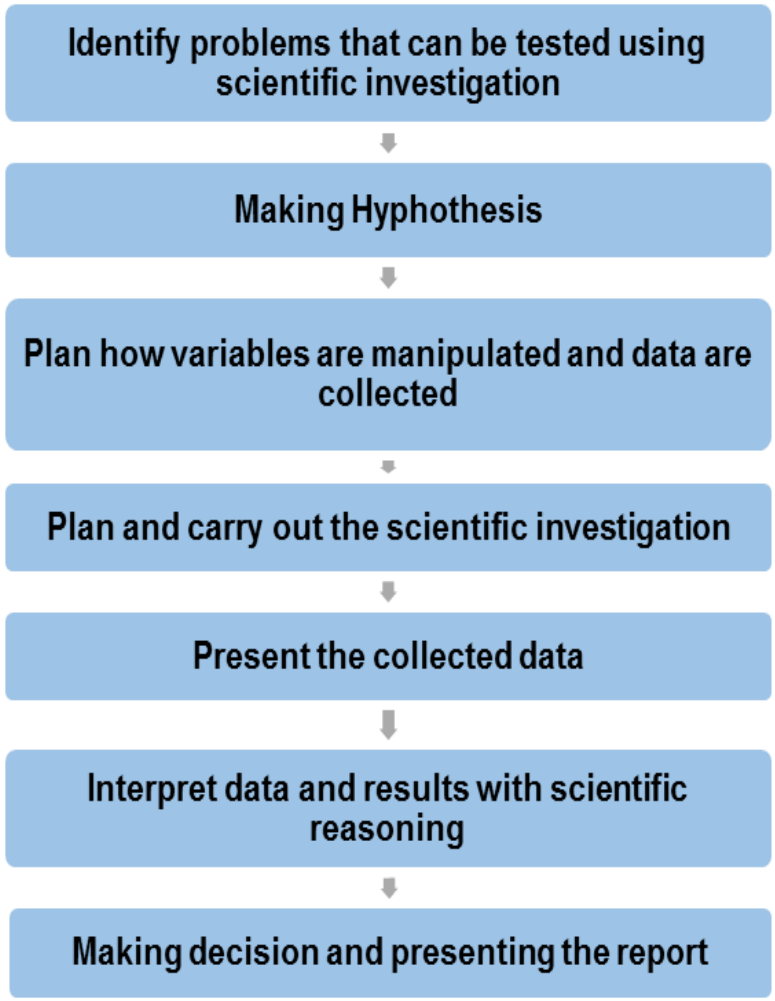

Figure 4: Steps to carry out an experiment

In this standard curriculum, it is suggested that, besides guiding pupils to carry out experiments, pupils are given the opportunity to design experiments, which involves drafting their own experimental method, the data that can be measured, how to analyse data and how to present the results of their experiments.

Simulation

Simulation is an activity that resembles the actual situation**.** Simulations can be carried out through role-play, games or use of model. In role-play, pupils act out a particular role spontaneously based on a certain pre-determined conditions. Games require procedures that need to be followed. Pupils play games in order to learn a particular principle or to understand the process of decision-making. Models are used to represent objects or real situations. Pupils will be able to visualise the real situation, thus understanding the concepts and principles learned.

Project (Collaborative Learning)

A project is an activity carried out individually or in groups to achieve a certain goal that takes a long time and exceeds formal teaching hours. Pupils are required to identify methods to solve the problem given and thus plan the entire project. The outcome of the project either in the form of a report, an artefact or in other forms needs to be presented. Projects encourage the development of problem solving skills, time management skills and self learning.

Visits and Use of External Resources

Learning science through visits to zoos, museums, science centres, research institutes, mangroves swamps and factories can make learning more effective, enjoyable and meaningful. Learning through visits can be optimised by careful planning whereby pupils have to carry out or perform tasks during the visit. Discussion after the visit should be held to conclude the activities carried out.

The Use of Technology

Technology is an effective tool for enhancing the learning of science. Through the use of technology such as the television, radio, video, computer, internet, computer software, courseware and computer interfaces make the teaching and learning of science more interesting and effective. Animation and computer simulation is an effective tool for learning of difficult and abstract science concepts and can be presented in the form of courseware or website. Software applications such as word processors, graphic presentation software and electronic spreadsheets are valuable tools for the analysis and presentation of data.

The use of other technologies such as data loggers and computerized user interface in experiments and projects can assist effective in science teaching and learning.

ELEMENTS ACROSS THE CURRICULUM

Elements Across the Curriculum (EMK) is a value-added element applied in the teaching and learning process other than those specified in the standard content. The application of these elements is aimed at strengthening the human capital skills and competency as well as intended to prepare pupils for the challenges of the present and the future. The elements are explained below:

Language

- The accuracy of the language in instruction should be a priority in all subjects.
- During the teaching and learning of each subject, emphasis is given on the aspects of pronunciation, sentence structure, grammar and the terminology of the language in order to assist pupils organise ideas as well as communicate effectively.

Environmental Sustainability Awareness

- Developing awareness towards the love of the environment in the pupils' lives needs to be nurtured through the teaching and learning process in all subjects.
- Knowledge and awareness on the importance of the environment would help to shape pupils' ethics in appreciating nature.

Values

- Values need to be emphasised in all subjects to ensure that pupils will be aware of the importance of these good principles and therefore will practise these elements in their lives.
- Values encompass the aspects of spirituality, humanity and citizenship will be the centre core of the pupils' daily life.

Science and Technology

- The increase of interest in the science and technology will help to improve scientific and technological literacy amongst pupils.
- The use of technology in teaching can help and contribute to efficient and effective learning.
- The integration of science and technology in the teaching and learning process covers four areas, namely:
    1. The knowledge of science and technology (facts, principles, concepts related to science and technology);
    2. Scientific skills (process of thought and specific manipulative skills);
    3. Scientific attitudes (such as accuracy, honesty, security); and the use of technology in classrooms.
    4. The use of technology in teaching and learning activities.

Patriotism

- Patriotism can be nurtured through all subjects, extra-curricular activities and community services
- Patriotism develops the spirit of love for the country as well as encourages the feelings of 'truly proud to be Malaysians' amongst pupils.

Creativity and Innovation

- Creativity is the ability to use imagination in gathering, extracting and generating ideas or creating new or original ideas or through combination of ideas.
- Innovation is the application of creativity through the modification and practice of ideas.
- Creativity and innovation are always inter-connected. Therefore, there is a need to ensure that human capital development is able to meet the challenges of the 21st Century.
- Elements of creativity and innovation should be integrated in the teaching and learning in the classroom.

Entrepreneurship

- The incorporation of entrepreneurship elements aims at developing specific attributes and entrepreneurial mind-set that will become a culture amongst pupils.
- Entrepreneurial attributes can be ingrained during lessons through fostering attitude such as diligence, honesty, trustworthiness and responsibility as well as developing creative and innovative mind-set to drive ideas into the market economy.

Information and Communication Technology Skills (ICT)

- Information and communication technology elements are incorporated in the lessons to ensure pupils are able to apply and strengthen their basic knowledge and skills in ICT.
- The application of ICT in the lesson does not only motivate pupils to be creative but stimulates interesting and fun teaching and learning as well as improve the quality of learning.
- ICT should be integrated in the lessons based on appropriate topics to be taught to further enhance pupils' understanding of the content subject.

ASSESSMENT

Assessment or evaluation is the process of gathering information through variety of methods such as homework, presentations, projects, tests and others. Assessment is a yardstick to assess pupils' achievement in obtaining knowledge, skills and ethics besides assessing the activities carried out during teaching and learning. Assessment supports pupils' learning and provides valuable feedback to stakeholders such as administrators, teachers, pupils and parents/guardians about pupils' progress and achievement.

The main purpose of formative assessment is to monitor the pupil's learning. Therefore, it is important for teachers to design a valid, reliable and authentic assessment instruments.

Information gathered through formative assessment should assist teachers to determine pupil's strengths and weaknesses in achieving the content standard for any subject.

The information gathered should assist teachers in adapting teaching and learning based on the needs and weaknesses of their pupils. Summative assessment is to evaluate pupil's learning with the content standards for a particular subject.

Assessment in KSSM consists of four components:

- School Assessment;
- Central Assessment;
- Physical, Sports and Co-Curricular Activity Assessment; and
- Psychometric Assessment.

A detailed assessment should be well planned and carried out continuously as part of the activities in classrooms. Teachers' efforts in implementing a holistic assessment assists to correct weaknesses in pupils, forming a conducive and balanced learning ecosystem.

Efforts to ensure the assessments assist pupils to increase their potentials and performances, teachers should use assessment strategies that have these following characteristics:

- various techniques;
- fair to all pupils;
- consider various cognitive levels;
- enable pupils to exhibit a variety of learning abilities; and
- consider the knowledge and skills acquired by pupils and assess the level of their understanding.

Science assessments in schools rely on three main domains, which are **knowledge, skills and values.**

Knowledge assessment in certain themes includes the integration of science process skills, aimed in determining the level of pupils' understanding in specific content standard holistically.

All experiments described in the notes **MUST** be carried out using the inquiry approach, however the assessment of scientific skills and values and practices will be assessed only **twice a year** for any theme. Experiments proposed in the notes may be replaced by other experiments, that can deliver the same domain knowledge as specified in the standard of learning.

List of experiments for each theme are shown in Table 9.

Table 9: List of experiments

Theme	Experiments
Scientific Methodology	1.6 Experiments for use step in scientific investigation
Maintenance and Continuity of Life	2.2 Experiments showed the need photosynthesis.
	3.1 Experiment to show how the biological action in response to changes to stabilize the body. 4.7 Experiments to determine the conditions germination of seeds.
Exploration of Elements in Nature	1.2.3 Experiments to determine the rate of diffusion. 5.2.5 Experiments to investigate the boiling point during the physical changes of water.
Energy and Sustainability of Life	8.3 Experiments to prove Law Reflection. 8.4 Experiments to study the relationship angle of incidence, i and the angle of refraction, r when light through a different medium density.

The General Statement to Interpret the Achievement of Knowledge Level for Science Subject is shown in Table 10.

Table 10: Rubric for Knowledge

PERFOMANCE LEVEL	DESCRIPTOR
1	**Recall** the basic knowledge and science skills.
2	**Understand** the science knowledge and skills as well as to explain their understanding.
3	**Apply** knowledge and skills to perform simple science tasks.
4	**Analyzing** science knowledge and skills in the context of problem solving on an event or natural phenomena.
5	**Evaluating** the science knowledge and skills in the context of problem solving and making decision to perform a task
6	**Inventing** by using science knowledge and skills in the context of problem solving and making decision or in performing the tasks in a new situation creatively and innovatively

The General Statement for Scientific Investigation for Science Subject is shown in Table 11.

Table 11: Rubric for Scientific Investigation

PERFORMANCE LEVEL	DESCRIPTOR
1	• Plan the strategy and procedure that is not accurate in the scientific investigation. • Use materials and apparatus that is not suitable in the scientific investigation. • No data collected and recorded. • No explaination or the explaination is not clear.
2	• Plan the correct strategy and procedure in the scientific investigation with guidance. • Use the suitable material and apparatus. • Collect and record incomplete data or not relevant. • Made.interpretation and conclusion not based on the collected data.
3	• Plan and execute the correct strategy and procedure in the scientific investigation with guidance. • Use the correct material and apparatus. • Collect and record relevant data. • Organise data in numerical form or visual with some error. • Interpret data and make conclusion based on the collected data. • Write an incomplete scientific investigation report. .

PERFORMANCE LEVEL	DESCRIPTOR
4	• Plan and execute the correct strategy and procedure in the scientific investigation. • Handle and use the correct material and apparatus to get an accurate result. • Collect relevant data and record in a suitable format. • Organise the data in the numerical form or visual with no error. • Interpret the data dan make an accurate conclusion based on the aim of the scientific investigation. • Write a complete report on the scientific investigation.
5	• Carry out the scientific investigation and write a complete report. • Collect, organise and present the data in the form of numerical or visual accurately and done well. • Interpret the data and make conclusion accurately with scientific reasoning. • Identify the trend, pola and making connection with the data.

PERFORMANCE LEVEL	DESCRIPTOR
6	• Justify the outcome of the scientific investigation relating to theory, principle and law of science in the reporting. • Evaluate and suggest way to improve to the scientific investigation methods and further inquiry investigation if needed. • Discuss on the validity of the data and suggest way to improve the method of collecting data.

The General Statement for Scientific Investigation for Scientific Attitude and Noble Values is shown in Table 12.

Table 12: Rubric for Scientific Attitude and Noble Values

PERFORMANCE LEVEL	DESCRIPTOR
1	Pupil is **not able** to: • state how science is used to solve problems. • state the implication of using science to solve problem or certain issues. • use science language to communicate • document the source of information used.
2	Pupil is **less able** to: • state how science is used to solve problems. • state the implication of using science to solve problem or certain issues. • use science language to communicate • document the source of information used.
3	Pupil **is able** to: • state how science is used to solve problems. • state the implication of using science to solve problem or certain issues. • use limited science language to communicate • document a few sources of information used.
4	Pupil **is able** to: • determine how science is used to solve problems or certain issues. • determine the implication of using science to solve problem or certain issues. • always use sufficient science language to communicate. • document most of the sources of information used.

PERFORMANCE LEVEL	DESCRIPTOR
5	Pupil **is able** to: • conclude how science is used to solve problems or certain issues. • conclude the implication of using science to solve problem or certain issues. • always use good science language to communicate. • document all the sources of information used.
6	Pupil **is able** to: • conclude how science is used to solve problems or certain issues. • discuss and analyse the implication of using science to solve problem or certain issues. • always use the correct science language to communicate clearly and accurately. • document all the sources of information. • become a role model to other pupil.

ORGANISATION OF SCIENCE CURRICULUM STANDARD

The content for the Science Curriculum Standard Form 1 to Form 5 is built based on the four discipline of science that is Biology, Chemistry, Physics and Earth Science. All four discipline are arranged into five themes that are Scientific Methodology, Maintenance and Continuity of Life, Exploration of Elements in Nature, Energy and Sustainabilty of Life and Exploration of Earth and Outer Space. However, in every learning year it need not consist of all five themes.

Every theme is divided into a few learning areas.

Learning area in every theme is detailed out in the Content Standard dan Learning Standard. The Content Standard may have one or more learning standards that had been conceptualized based on the learning area.

The Content Standard is written according to the hierachy in the cognitive and afective domains. The Content Standard statement is the general statement consisting of elements of knowledge, scientific skills, thinking skills, scientific attitude and noble value in line with the intended learning standard.

The learning standard is the learning objective written in the form of measurable behaviour. The learnng standard comprised of learning

scope and scientifc skills as well as the thinking skills that demands the pupils' need to do science for them to acquire the intended scientific concept. Generally, the learning standard is arranged accordingly through the hierachy from simple to complex, however the sequence of the Learning Standardcould be modified to cater to the need of learning. The Content Standard for the afective domain is normally written at the end of the cognitive domain of that particular Content Standard, however not all Content Standard cognitive domain will end with the afective domain.

The pupil's development is prescribed with one or more qualifier using a word or a phrase that signify a standard in the form of learning outcome. The teaching and learning (t&l) should be planned holistically and integrated to enable a few learning standards be achieved depending on the suitability and needs of learning. Teachers should scrutinise all learning standards and performance standard in the content standard before planning the teaching and learning activites.

The content standard for the afective domain is indirectly integrated when the content standard for the cognitive domain is being carried out. Activities can be varied to achieve one content standard to fulfil the need of learning to suit the pupils's capability and style of learning.

Teachers are encouraged to plan activites that will involve the active participation of pupils to generate thinking analitically, critically, innovatively and creatively besides using technology as a platform to achieve the content standard effectively. The implementation of teaching and learnng that requires activities, investigations and experiments that can assist in achieving the learning standards should be carried out to strengthen the pupil's understanding.

CONTENT ORGANIZATION

The Science Curriculum Standard for Secondary Schools focuses on the achievement of knowledge, skills and values that correspond to the pupil's abilities based on Content Standards, Learning Standards and Performance Standards that are arranged in three columns as shown in Table 13.

Table 13: Organisation of the DSKP

Content Standard	Learning Standard	Performance Standard
Specific statements about what pupils should know and can do during the schooling period encompassing the knowledge, skills and values.	A predetermined criteria or indicator of the quality in learning and achievement that can be measured for each content standard.	A set of general criteria which reflects the levels of pupils' achievement that they should display as a sign that certain topic has been mastered by pupils (indicator of success).

Figure 5 represents the performance standard placed at the end of every theme in the DSKP.

PERFORMANCE STANDARD

SCIENTIFIC METHODOLOGY	
Performance Level	**Descriptor**
1	**Recall** the definition of science, science laboratory, physical quantities and units, the use of measuring instruments, density and steps in scientific investigation.
2	**Understand** the definition of science, science laboratory, physical quantities and units, the use of measuring instruments, density and steps in scientific investigation.
3	**Apply** the definition of science, science laboratory, physical quantities and units, the use of measuring instruments, density and steps in scientific investigation.
4	**Analyse** the findings of the investigation and concluded that in accordance with the purpose of scientific investigation, on the definition of science, science laboratory, physical quantities and units, the use of measuring instruments, density and steps in scientific investigation.
5	**Evaluate** the entire scientific investigation process conducted to determine the steps that can be improved, on the definition of science, science laboratory, physical quantities and units, the use of measuring instruments, density and steps in scientific investigation.
6	**Create** improvements on the scientific investigation process being carried out, on the definition of science, science laboratory, physical quantities and units, the use of measuring instruments, density and steps in the scientific investigation ; in the context of **problem solving and decision making; with regards to the social values/ economy / culture of the community.**

Figure 5: Performance Standard for Scientific Methodology

There is also a Notes column that details out among others:

- the limitation and the scope for the content standard and learning standard,
- suggested teaching and learning activities.

In preparing the right and relevant activities and the learning environment to suit the pupils' abilities and interest, teachers need to use their creativity and profesional judgement.

The list of suggested activities is not compulsory and teachers are encouraged to use variety of sources like books and internet in preparing the teaching and learning activities to fulfil the pupils abilities and interest.

Theme 1: **Scientific Methodology**

This theme introduces student activities in daily life which define science as a discipline involving systematic observation and experiments on natural phenomena.

Students will gain understanding about the field of science, careers in science and the relevant subjects that need to be studied. In addition, this theme also introduces the science lab, physical quantities, density, and the use of measuring instruments and the International System of units (S.I). Students are also introduced to methods of acquiring knowledge of science through scientific investigation and problem solving.

Learning area:

1. Introduction to scientific investigation
   - 1.1 Science is part of daily life
   - 1.2 Your science laboratory
   - 1.3 Physical quantities and their units
   - 1.4 The use of measuring instruments, accuracy, consistency, sensitivity and errors
   - 1.5 Density
   - 1.6 Steps in scientific investigation
   - 1.7 Scientific attitude and values in scientific investigation

Content Standard	Learning Standard	Notes
1.1 Science is part of daily life	A student is able to:	
	1.1.1 relate daily activities to Science.	Discuss daily life activities that lead to the definition of Science.
	1.1.2 generalise the meaning of Science.	Science as a discipline that involves systematic observation and experiments on natural phenomena.
	1.1.3 summarise the importance of science in everyday life. 1.1.4 describe the fields of Science. 1.1.5 communicate about careers in Science. 1.1.6 relate subjects to be studied with science careers of interest.	Brainstorm ideas using concept maps such as i-Think concerning: • the importance of science in understanding ourselves and the environment to admire God's creations. • fields of science and examples of field of science such as zoology, astronomy, microbiology, geology, physiology, botany, engineering, pharmacology, oceanography, forensics etc. • careers in the field of science • subjects to be learnt for a chosen career.
	1.1.7 describe innovation in technology.	Group discussions and multimedia presentations on examples of innovatiuon in technology to solve problems in daily life.

Content Standard	Learning Standard	Notes
1.2 Your science laboratory	1.2.1 identify and state functions of the apparatus. 1.2.2 identify symbols and examples of hazardous materials in the laboratory. 1.2.3 draw and label apparatus commonly used in the laboratory and classify based on how it is used 1.2.4 justify the regulations and safety measures in the laboratory.	Carry out activities based on the following: • apparatus commonly used in laboratories. • symbols and examples of hazardous materials in the laboratory. • classification based on self-selected criteria and then present the results in a group discussion. Group discussion and presentation of the following : • labarotary rules • security measures • measures to prevent fires • action to be taken in the event of an accident in the laboratory such as exposed / ingested chemicals, cuts and inhaling toxic gas. Discuss and suggest the use of suitable apparatus in carrying out an experiment, to save time and material. The importance of practising caution and care to ensure one's safety and the safety of others should be emphasised.

Content Standard	Learning Standard	Notes
1.3 Physical quantities and their units	1.3.1 identify and use the correct units for different physical quantities.	Measure physical quantities of length, mass, time, electric current and temperature. Take note of values and units used in the specification and labels of products.
	1.3.2 identify the symbols and values of prefixes use in measurement.	Collect and interpret data about symbols and values of symbols for prefixes of nano-, micro-, mili_, centi_, kilo_, mega_, giga _.
	1.3.3 convert base quantity units for mass, length and time such as grams to kilograms, centimeters to meters, seconds to hours and vice versa.	Solve problems of conversion of base quantity units.
	1.3.4 justify the importance of the use of S.I. units in daily life.	Appreciate the effort of experts in creating S.I. units (Système International d'Unités) to facilitate international understanding. Carry out a multimedia presentation to show the implications of using inconsistent units in daily life.

Content Standard	Learning Standard	Notes
1.4 The use of measuring instruments, accuracy, consistency, sensitivity and errors	1.4.1 use the right measuring instrument and use it in the right way, to measure accurately and consistently the quantities of length, mass, time, temperature and electric current.	Carry out station activities using measuring instruments such as rulers, measuring tapes, thermometers, stopwatches, triple beam balances, ammeters, voltmeters and measuring cylinders. Emphasise the following: • taking readings several times to get an accurate reading. • relate the smallest scale value on the measuring device to the accuracy of the readings.
	1.4.2 use measuring instruments with higher accuracies and compare the measurements in terms of accuracy, consistency and sensitivity.	Carry out activities using instruments such as a vernier calipers, micrometer screw gauges, electronic balances, digital micrometer screw gauges, digital vernier calipers, digital thermometer, clinical thermometer, digital rangefinder.
	1.4.3 explain how to overcome systematic errors and random errors.	Carry out activities to reduce systematic error (eg: zero error) and random error (eg: parallax error).
	1.4.4 estimate the length, area, mass or volume of an object before taking actual measurements.	Carry out problem solving activities that involve the skill of making estimations and then compare with actual measurements.
	1.4.5 explain with examples innovations of various types of measuring instruments through a multimedia presentation.	Gather information and carry out multimedia presentations on innovations in measuring instruments.

Content Standard	Learning Standard	Notes
1.5 Density	1.5.1 arrange sequentially materials based on density.	Conduct a scientific investigation of the relationship between mass and density for a variety of solids which have the same volume, for example by using density cubes.
	1.5.2 predict whether the materials will float and sink according to density.	
	1.5.3 define operational definition of density.	
	1.5.4 calculate density using formula (density = mass / volume) and water displacement method.	Solve problems by using formula of density. Carry out an activity to determine the density of irregular solids using water displacement method.
	1.5.5 explain the phenomena related to the density difference in everyday life.	Discuss the phenomena in everyday life that involve differences in density and presents the results of discussions using multimedia.
	1.5.6 innovate objects, food or beverage using the concept of density.	Entrepreneurial element can be applied and practiced in this activity.

Content Standard	Learning Standard	Notes
1.6 Steps in a scientific investigation	1.6.1 differentiate each science process skills. 1.6.2 make a sequence on the steps of carrying out a scientific investigation in the correct order. 1.6.3 conduct a scientific investigation to solve a simple problem.	Teachers are recommended to use station method of the twelve science process skills. Design and conduct an experiment for each group to explain the steps and the scientific method, namely: 1. Identify a problem that could be tested by a scientific investigation 2. Construct hypothesis 3. Outline how variable are manipulated and the method of collecting data 4. Design and conduct scientific investigations 5. Present the data collected 6. Interpreting data and results with scientific reasoning 7. Make a conclusion and present a report.

Content Standard	Learning Standard	Notes
1.7 Scientific attitudes and values in carrying out scientific investigation	1.7.1 support scientific attitudes and values practiced by scientists. 1.7.2 justify the need to practice scientific attitudes and values when carrying out an investigation. 1.7.3 practice scientific attitudes and values while carrying out a scientific investigation.	Discussion on the importance of: • scientific attitudes and values • practising scientific attitudes

PERFORMANCE STANDARD

SCIENTIFIC METHODOLOGY	
Performance Level	**Descriptor**
1	**Recall** the knowledge and science skills on the definition of science, science laboratory, physical quantities and units, the use of measuring instruments, density and steps in scientific investigation.
2	**Understand** the definition of science, science laboratory, physical quantities and units, the use of measuring instruments, density and steps in scientific investigation and able to explain their understanding..
3	**Apply** the definition of science, science laboratory, physical quantities and units, the use of measuring instruments, density and steps in scientific investigation to accomplish simple task.
4	**Analyse** the entire scientific investigation process conducted to determine the steps that can be improved, on the definition of science, science laboratory, physical quantities and units, the use of measuring instruments, density and steps in scientific investigation **in context of problem solving about events or natural phenomena.**
5	**Evaluate** the entire scientific investigation process conducted to determine the steps that can be improved, on the definition of science, science laboratory, physical quantities and units, the use of measuring instruments, density and steps in scientific investigation in the context of **problem solving and decision making** to carry out a task.
6	**Design** a presentation using multi media / visual / folio / poster / role play / drama; with creative and innovative use of science knowledge and skills of the definition of science, science laboratory, physical quantities and units, the use of measuring instruments, density and steps in scientific investigation in the context of **problem solving and decision making; with regards to the social values/ economy / culture of the community.**

Theme 2: **Maintenance and Continuity of Life**

This theme provides an understanding of the cell as the basic unit of life, the function of cell structure of animals and plants, unicellular and multicellular organisms as well as the organization of cells. Focus is given to the biological processes of living things such as cellular respiration, photosynthesis and homeostasis. This theme also provides an understanding of the reproduction of animals and plants as well as an introduction to research in human reproduction, infertility and the prevention of pregnancy.

Learning area:

2. Cell as the basic unit of life
   - 2.1 Cell – structure, function and organization
   - 2.2 Cell respiration and photosynthesis

3. Coordination and responses
   - 3.1 Homeostasis in living things

4. Reproduction
   - 4.1 Sexual and asexual reproduction
   - 4.2 Human reproductive system
   - 4.3 The menstrual cycle
   - 4.4 Fertilisation and pregnancy
   - 4.5 Factors affecting the development of the feotus and newborns
   - 4.6 Infertility and pregnancy prevention
   - 4.7 Plant reproduction

Content Standard	Learning Standard	Notes
2.1 Cell – structure, function and organization	2.1.1 explain that living things are made up of cells that carry out life's functions and undergo cell division.	Show cell division using various forms of multimedia presentation (Need not introduce mitosis or meiosis). The formation of cancerous cells is discussed.
	2.1.2 demonstrate the preparation of slides of animal cells and plant cells using the correct procedures.	Carry out a scientific investigation on animal cells and plant cells using a microscope. Draw and label animal cells and plant cells observed under the microscope.
	2.1.3 communicate about each structures in cells with their functions as well as compare and contrast animal cells with plant cells.	The structure of animal cells consists of the cell membrane, cytoplasm, nucleus and mitochondria whereas plant cell comprise of nucleus, cell wall, cell membrane, mitochondria, chloroplasts and vacuole. [nucleus contains chromosomes made up of deoxyribonucleic acid (DNA) which carries genetic information].
	2.1.4 explain with examples the characteristics of unicellular and multicellular organisms for animal cells and plant cells.	Presentation using thinking maps on the characteristic of unicellular and multicellular organisms.
	2.1.5 differentiate the types and functions of animal cells and plant cells.	The various types of human cells - nerve cells, epithelium cells, muscle cells, reproductive cells , blood cells. The various types of plant cells - cells palisade leaves, guard cells, epidermal cells, capillary root's cells.

Content Standard	Learning Standard	Notes
	2.1.6 conceptualise the formation of a plant and an animal with reference to the sequence of cell organization: cell→ tissue →organ→ system → organism.	The systems in human includes the nervous system, digestive system, skeletal system, excretory system, respiratory system, reproductive system, lymphatic system, circulatory system, muscular system, endocrine system and the integumentary system.
	2.1.7 appreciate and be amazed by the existence of various organisms.	Multimedia presentation to appreciate how organisms are formed from basic unit of cells.
2.2 Cell respiration and photosynthesis	2.2.1 communicate about the process of cellular respiration.	The process of cellular respiration needs oxygen and glucose to produce energy, carbon dioxide and water.
	2.2.2 communicate about the process of photosynthesis.	Carry out experiments to show photosynthesis needs light energy, carbon dioxide, water and chlorophyll to produce glucose and oxygen.
	2.2.3 differentiate the process of cellular respiration and photosynthesis.	
	2.2.4 explain how the process of cellular respiration and the process of photosynthesis complement each other.	Relate how cellular respiration and photosynthesis complement each other for the benefits of life using multimedia presentations.

Content Standard	Learning Standard	Notes
3.1 Homeostasis in living things	3.1.1 communicate about homeostasis.	Gather informations and carry out multimedia presentations on how homeostasis regulates body temperature and water in the human body.
	3.1.2 explain with examples the systems involved with homeostasis in humans and animals	Carry out activities to show how the biological actions respond to changes to stabilise the condition of the body such as: • sweating in the heat and shivering when cold. • the heart rate increases when executing heavy tasks.
	3.1.3 explain with examples the systems involved in plant homeostasis.	Gather informations and make observations on how transpiration regulates water in plants.
	3.1.4 appreciate the importance of homeostasis in humans and living things.	Carry out brainstorming session to discuss the importance of homeostasis using various multimedia presentations.

Content Standard	Learning Standard	Notes
4.1 Sexual and asexual reproduction	4.1.1 compare and contrast sexual and asexual reproduction in animals and plants.	Gather and interpret data or information about sexual and asexual reproduction: • methods of sexual reproduction - internal fertilisation and external fertilisation. • various types of asexual reproduction - binary fission, budding, spore formation, vegetative, regeneration and tissue culture.
	4.1.2 reason the importance of reproduction.	Do a multimedia presentation to explain the importance of reproduction and problems that will arise if reproduction decreases for all living things.
	4.1.3 be grateful for the ability to reproduce and the continuation of life as a gift from God.	
4.2 Human reproductive system	4.2.1 identify the structures and function of the male and female reproductive systems.	Carry out multimedia presentations to observe and discuss the structures and function of the male and female reproductive systems.
	4.2.2 communicate about the physical changes that occur during puberty.	Discuss the physical changes and experiences during puberty.
	4.2.3 compare and contrast the male gamete with the female gamete in the reproductive system.	Use thinking maps to compare and contrast the male gamete (sperm) and female gamete (ovum) in terms of the structures and function.

Content Standard	Learning Standard	Notes
4.3 Menstrual cycle	4.3.1 communicate about the menstrual cycle and the sequence of changes in the uterus lining during menstruation. 4.3.2 relate the fertile phase of the menstrual cycle to the process of fertilisation. 4.3.3 justify the importance of personal hygiene during menstruation.	Integrate multimedia presentation and thinking maps to explain: • menstruation and menstrual cycle. • relate the fertile phase with fertilisation. • the importance of practicing good personal hygiene during menstruation.
4.4 Fertilisation and pregnancy	4.4.1 communicate about the process of fertilisation and the implantation of embryo. 4.4.2 justify the importance and functions of placenta and umbilical cord. 4.4.3 describe the development of a zygote into an embryo and subsequently into a foetus during pregnancy until birth.	Gather and share information about: • fertilisation process. • the implantation process of embryo. • the development of a zygote into an embryo and subsequently into a foetus until birth.

Content Standard	Learning Standard	Notes
4.5 Factors affecting the development of a foetus and baby	4.5.1 relate the importance of taking nutritious food during pregnancy to the health of both mother and foetus. 4.5.2 justify the importance of avoiding the intake of harmful substances to the foetus. 4.5.3 justify the benefits of breastfeeding compared to formula milk on the infant's development. 4.5.4 realise that every living creature has a right to live even if its in the womb.	Share information from a nutritionist and to relate the cause and effect of taking healthy nutritious food during pregnancy. Solve problems of miscarriage or abnormality in newborn babies that is commonly associated with unhealthy lifestyle of pregnant mothers such as smoking, drugs abuse and alcohol. Gather, interprete information and carry out a multimedia presentation on the impact of breastfeeding compared to baby formula milk in relation to the infant's development. Make decision whether to breastfeed or use formula milk.
4.6 Infertility and contraception	4.6.1 communicate the meaning of infertility and how to overcome them. 4.6.2 differrentiate methods of contraception. 4.6.3 realise the importance of practicing frequent health screening and to get immediate treatment for problems related to reproductive system.	• Methods to overcome infertility - hormone treatment , surgery and in-vitro. • Methods of contraception for married couples - contraceptive pills, implants, condoms and contraceptive devices in the uterus (Intrauterine Contraceptive Device, IUCD).

Content Standard	Learning Standard	Notes
	4.6.4 criticise the abuse of knowledge on contraception methods and its effect to society.	Debate on the abuse of knowledge regarding birth control methods and their effect to society.
4.7 Plant reproduction	4.7.1 communicate about the structure and function of each part of a flower.	Dissect different type of flowers to identify the structure with its function which include: • petal and sepal. • male part of the flower - stamen which consist of filament, anther and pollen. • the female part of the flower - pistil which consists of stigma, style and ovary.
	4.7.2 justify the pollination process.	Gather, interpret data and share relevant information on the following: • pollination process . • self -pollination and cross-pollination . • the advantages of cross- pollination . • the application of cross- pollination in agriculture.
	4.7.3 describe the process of fertilisation and explain the formation of seeds and fruits in plants.	Discuss and carry out multimedia presentation on the process of fertilisation in plants and the formation of fruits and seeds.

Content Standard	Learning Standard	Notes
	4.7.4 describe the germination process of a seed.	Conduct an experiment to determine the required conditions for the germination of seeds .
	4.7.5 solve problems if germination does not occur	Collect and interpret data on the following: • functions of the different parts of a seed. • physical changes to the seed during germination in terms of the growth of the radicle, the plumule and the cotyledon.

PERFORMANCE STANDARD

MAINTENANCE AND CONTINUITY OF LIFE	
Performance Level	**Descriptor**
1	**Recall** the knowledge and science skills on cell as the basic unit of life / coordination / response / reproduction
2	**Understand** cell as the basic unit of life / coordination / response / reproduction and able to explain their understanding.
3	**Apply** knowledge of cell as the basic unit of life / coordination / response / reproduction to accomplish simple task.
4	**Analyse** knowledge of cell as the basic unit of life / coordination / response / reproduction **in context of problem solving about events or natural phenomena.**
5	**Evaluate** knowledge of cell as the basic unit of life / coordination / response / reproduction in the context of **problem solving and decision making** to carry out a task.
6	**Design** a presentation using multi media / visual / folio / poster / role play / drama; with creative and innovative use of science knowledge and skills of the cell as the basic unit of life / coordination / response / reproduction; in the context of **problem solving and decision making; with regards to the social values/ economy / culture of the community.**

Theme 3 **Exploration Of Elements In Nature**

This theme aims to provide understanding of the variety of resources on Earth based on the structure and characteristics of various materials. Earth's natural resources exists in the form of elements, compounds and mixtures, and are studied focusing on the comparison of their properties and uses in daily life.

Learning area

5. Matter
   - 5.1 Matter in nature
   - 5.2 Three states of matter

6. Periodic Table
   - 6.1 Classification of elements
   - 6.2 Mixtures
   - 6.3 Compounds

7. Air
   - 7.1 Composition of air
   - 7.2 Combustion
   - 7.3 Air Pollution

Content Standard	Learning Standard	Notes
5.1 Matter in nature	A student is able to:	
	5.1.1 state that almost everything that exists in nature is matter.	Carry out activities and create a multimedia presentation to show that living things and non-living things have mass and occupy space.
	5.1.2 prove that living things and non-living things have mass and occupy space.	
	5.1.3 differentiate the physical properties and chemical properties of matter.	Carry out activities to differentiate: • physical properties of matter such as boiling point and melting point, solubility, heat conductivity. • chemical properties of matter such as rusting and flammability.
	5.1.4 classify materials by the different characteristics.	Carry out activities to classify materials by density, melting point, boiling point and solubility.
5.2 Three states of matter	5.2.1 generalise that matter consists of particles.	Carry out simulations to conceptualise that matter is made up of small and discrete particles.
	5.2.2 compare and contrast three states of matter based on the kinetic theory in terms of the arrangement and movement of particles.	Carry out visual presentations about the three states of matter in terms of the arrangement and movement of particles and relation to the physical properties of solids, liquids and gas (volume, shape, density and compressibility).

Content Standard	Learning Standard	Notes
	5.2.3 use space-time relationships to compare rate of diffusion in three states of matter.	Carry out experiments to determine the rate of diffusion, example copper(ll) sulphate in two states of matter (solid and liquid).
	5.2.4 describe the change in state of matter, in terms of movement of particles caused by the absorption and the release of heat, based on kinetic theory.	Use a diagram or a concept map to illustrate boiling, evaporation, condensation, freezing, melting, and sublimation.
	5.2.5 conclude that temperature remains constant during freezing, melting and boiling.	Carry out an experiment to investigate that temperature of water remains constant during melting and boiling. Plot and interpret graphs to show that:
	5.2.6 conclude that the mass remains constant during physical changes.	• Temperature remains constant during the melting and the boiling of water. • Mass remains unchanged during; physical transformation, ie changes in state of matter; dissolving solid in a liquid; and expansion by heat
	5.2.7 explain with examples the changes of the state of matter in daily life	Create a multimedia presentation about the change of state of matter in daily life

Content Standard	Learning Standard	Notes
6.1 Classification of element	6.1.1 conclude that all matter consists of atoms. 6.1.2 differentiate between atoms and molecules as well as elements and compounds. 6.1.3 identify the position of metal, non-metal and inert gases in the periodic table. 6.1.4 differentiate the characteristics of metals and non-metals. 6.1.5 appreciate the order of elements that exist in nature that has allowed people to organize them in the form of a table.	Discuss by using multimedia to explain: • all matter consists of atoms • atomic structure • sub-atomic particles (electron, proton and neutron) • the difference between atoms and molecules • the difference between elements and compounds By referring to the periodic table, discuss the position of metals, non-metals and inert gases. Carry out activities to differentiate the characteristics of metal and non-metal: • shiny surfaces • ductility • malleable • electrical and heat conductivity • boiling point and melting point Encourage creative writing and presentation in various media.

Content Standard	Learning Standard	Notes
6.2 Mixture	6.2.1 communicate about examples of mixtures in daily life	
	6.2.2 solve problem of separating mixtures through activities based on the different characteristics of material and physical methods	Conduct activities to separate a mixture using various methods such as filtration, distillation, separation by using magnets, sedimentation, flotation and chromatography.
6.3 Compound	6.3.1 communicate about compounds in daily life.	Use various forms of multimedia to illustrate the used of compounds in daily life.
	6.3.2 demonstrate the formation of compounds between metal and non-metal.	Carry out activities of hetaing metal and non-metal to produce a compound.
	6.3.3 conclude that mass is conserved during chemical change. 6.3.4 separate compounds through chemical methods. 6.3.5 differentiate between chemical change and physical change.	Conclude and record that: • mass is conserved during chemical change. • compound can be separated through chemical method. • differences in physical changes and chemical changes during the formation of compounds.
	6.3.6 differentiate between mixtures and compounds.	Create and carry out a multimedia presentation on the similarities and differences between mixtures and compounds.

Content Standard	Learning Standard	Notes
7.1 Composition of Air	7.1.1 plan ways to determine and record the composition of air. 7.1.2 synthesise the composition of air from a pie chart. 7.1.3 justify the importance of oxygen, nitrogen carbon dioxide and inert gases in daily life. 7.1.4 appreciate the carbon cycle and the oxygen cycle in maintaining the composition of gases in the air. 7.1.5 solve problems when there is/are interferences to the oxygen and the carbon cycle.	Carry out activities to determine the percentage of oxygen in air. Interpret a pie chart on the composition of the air to realise that air is a mixture. Interpret and share information on daily life regarding: • the importance of oxygen, nitrogen carbon dioxide gases and inert gases. • the oxygen cycle and the carbon cycle. • how the carbon cycle and the oxygen cycle maintains the percentage of gases in the atmosphere. The effects of the increase of carbon dioxide emission to life and the environment.
7.2 Combustion	7.2.1 conclude about the conditions needed for combustion. 7.2.2 relate the conditions of combustion with the principles used in the manufacture of fire extinguishers. 7.2.3 practice safety measures to prevent the occurrence of fire which can lead to the destruction of life and property.	Carry out activities to prove that oxygen, heat and fuel are needed for combustion List materials used as fire extinguishers for different sources of fire. Provide materials such as posters to create awareness among the school community about the causes of fire and prevention measures.

Content Standard	Learning Standard	Notes
7.3 Air Pollution	7.3.1 define air pollution and air pollutants. 7.3.2 communicate about air pollutants and the causes. 7.3.3 justify steps to prevent and control air pollution. 7.3.4 solve problems on the adverse effects of air pollution.	Discuss and share ideas of air pollution such as haze that frequently hit our country and the sources that cause these pollutions. Collect, interpret and share information about: • steps taken by authorities in controlling air pollution. • adverse effects of air pollution on living things and the environment.

PERFORMANCE STANDARD

EXPLORATION OF ELEMENTS IN NATURE	
Performance Level	**Descriptor**
1	R**ecall** the knowledge and science skills on matter / the periodic table / air.
2	**Understand** of matter / the periodic table / air and able to explain their understanding.
3	**Apply knowledge** of matter / the periodic table / air to explain natural phenomena to accomplish simple task.
4	**Analyse** knowledge of matter / the periodic table / air **in context of problem solving about events or natural phenomena.**
5	**Evaluate** matter / the periodic table / air in the context of **problem solving and decision making** to carry out a task.
6	**Design** a presentation using multi media / visual / folio / poster / role play / drama; with creative and innovative use of science knowledge and skills of matter / the periodic table / air in the context of **problem solving and decision making; with regards to the social values/ economy / culture of the community.**

Theme 4 **Energy and sustainability of life**

The objective of this theme is to give an understanding about the existence of various forms of energy, how energy can be saved, energy efficiancy, and also the importance of energy in daily life. In addition, this theme is also focused on how to give abetter understanding about the usage of mirrors, lights, and colours to enhance our sensory perception and its role in the development of optical technology.

Learning area 8. Lights and optic.

8.1 Usage of mirrors
8.2 Chacteristic of light
8.3 Reflection of light
8.4 Refraction of light
8.5 Dipersion of light
8.6 Scattering of light
8.7 Addition and of light substraction of light

Content Standard	Learning Standard	Notes
8.1 The use of mirrors	A student is able to:	
	8.1.1 differentiate between a real image and a virtual image.	Use the screen and plane mirror to show the difference between real images and virtual images.
	8.1.2 Communicate about the characteristics of image formed by a plane mirror, concave mirror and convex mirror.	Carry out an activity to determine: • characteristics of the image formed when the light incident on the plane mirror. concave mirror (enlarge image) and convex mirror (shrink image). • the object distance and image distance in a plane mirror with a sketch diagram
	8.1.3 state that the object distance is equal to the image distance in a plane mirror	
	8.1.4 use the plane mirror to apply the concept of reflection of light.	Discuss by using a multimedia presentation about these application: • plane mirror • concave mirror • convex mirrors
	8.1.5 justify the application of concave mirror and convex mirror in daily life.	
	8.1.6 construct an optical instruments to appreciate the use these of optical instruments to enhance the ability of the human senses.	Carry out an activity to designan optical instruments eg. periscope or kaleidoscope.
	8.1.7 solve problems in daily life involving the application of plane mirror, concave mirror and convex mirror.	The use of mirrors such as: • the side mirror and rear view mirror in the car. • the plane mirror use by dentist during treatment. • the convex mirror placed at the dangerous roads.

Content Standard	Learning Standard	Notes
8.2 Properties of light	8.2.1 communicate about the properties of light.	Properties such as the speed of light and natural phenomena (the formation of shadows, lightning appearing before thunder, rainbows).
8.3 Reflection of light	8.3.1 state the characteristics of image formed by a plane mirrors 8.3.2 communicate aboiut the Law of Reflection. 8.3.3 draw ray diagrams to show the reflection of light 8.3.4 solve problems in daily life.with the application of reflection of light.	Identify the characteristics of image formed by a plane mirror and sketch the image observed (vertical, lateral inversion, same size, same object distance with the image distance) Carry outan experiment to measure the angle of incidence, *i* and angle of reflection, *r*, using the plane mirror and determine the relationship between angle of incidence, i and angle of reflection, r. Introducing The Law Of Reflection. Example on the use of the concept of reflection of light: • Road sign board with reflectors so that it can be seen at night. • Safety jackets with reflector strips for construction site workers. • Triangle shaped emergency reflector for cars that breakdown on the road.

Content Standard	Learning Standard	Notes
8.4 Refraction of light	8.4.1 generalisethat refraction occurs when light moves through médium of different densities.	Collect and interpret these information about the following • Refraction of light • Natural phenomena such as the apparent dept and real dept, straw seem bent in water-filled glasses.
	8.4.2 draw ray diagrams to show refraction of light when light propagate from one medium to another medium of different densities.	Carry out activities to show that light refract away from the normal when light travels from a dense medium to a less dense and bent toward the normal when light travels from a medium of low density to a médium of high density
	8.4.3 generalise the relationship between the angle of incidence, *i* and angle of refraction, *r*, when light travels from a medium of low density to a medium of high density.	Carry out an experiment to study the relationship between the angle of incidence, *i* and angle of refraction, *r*, when light travels from a medium of low density (air) to a medium of high density (glass block)
	8.4.4 justify the applications of refraction of light in daily life.	Conduct a library research and make the presentation of the phenomenon of refraction, for example, twinkling stars, spoon appear to bend in the water, bottom of a swimming pool looks more shallow.

Content Standard	Learning Standard	Notes
8.5 Dispersion of light	8.5.1 communicate about the dispersion of light. 8.5.2 explain with an example the dispersion of light in daily life.	Collect and interpret information about the dispersion of light and phenomena related to the dispersion of light. Carry out activities to study the following: • dispersion of light by using prism • formation of rainbow
8.6 Scattering of light	8.6.1 communicate about scattering of light 8.6.2 explain with an example scattering of light in daily life	Using various forms of multimedia for interpreting information about scattering of light. Carry out activities to study the effect of scatteringof light. Collect and interpret information about the following • scattering of light • natural phenomena such as blue sky and reddish sunset.
8.7 Addition and subtraction of light	8.7.1 identify primary colours 8.7.2 identify the addition of primary colours to produce secondary colours. 8.7.3 communicate about subtraction of light.	Carry out activities to study: • the addition of light using the primary color filter to produce secondary color (cyan, magenta and yellow) • subtraction of light that occurs when light is absorbed or subtracted by colour filters. • the difference between the addition and subtraction of light.

Content Standard	Learning Standard	Notes
	8.7.4 record the colours formed on the screen when light apsses through colour filters. 8.7.5 differentiate the addition and subtraction of light. 8.7.6 explain with examples addition and substraction of light in daily life.	Gather information and do a multimedia presentation

PERFORMANCE STANDARD

ENERGY AND SUSTAINABILITY OF LIFE	
Performance Level	**Descriptor**
1	**Recall** the knowledge and science skills on mirrors / characteristic of light / reflection of light / refraction of light / dipersion of light / scattering of light / addition and substraction of light.
2	**Understand** mirrors / characteristic of light / reflection of light / refraction of light / dipersion of light / scattering of light / addition and substraction of light and able to explain their understanding.
3	**Apply** mirrors / characteristic of light / reflection of light / refraction of light / dipersion of light / scattering of light / addition and substraction of light through a simple task.
4	**Analyse** knowledge of mirrors / characteristic of light / reflection of light / refraction of light / dipersion of light / scattering of light / addition and substraction of light **in context of problem solving about events or natural phenomena.**
5	**Evaluate** mirrors / characteristic of light / reflection of light / refraction of light / dipersion of light / scattering of light / addition and substraction of light in the context of **problem solving and decision making** to carry out a task.
6	**Design** a presentation using multi media / visual / folio / poster / role play / drama; with creative and innovative use of science knowledge and skills of mirrors / characteristic of light / reflection of light / refraction of light / dipersion of light / scattering of light / addition and substraction of light in the context of **problem solving and decision making; with regards to the social values/ economy / culture of the community.**

Theme 5 **Exploration of Earth and Space**

The objective of this theme is to present an understanding about the structure of the Earth and how geohazards happen. The impact of geohazards can be reduced on human and environment through the development of science and technology. This theme also gives a better understanding on the formation of fossil fuel, alternative energy resources and its uses.

Learning area: 9. Earth

- 9.1 System and structure of the Earth
- 9.2 Substance of the Earth
- 9.3 Main processes of the Earth
- 9.4 Geohazard phenomena
- 9.5 Age of the Earth
- 9.6 Earth resources and applied geology

Content Standard	Learning Standard	Notes
9.1 The system and structure of the earth	A student is able to	
	9.1.1 communicate about the system of the Earth	Create a multimedia presentation about the Earth structure that consist of four main spheres that is hydrosphere, atmosphere, biosphere and geosphere. • Atmospheric stratification and its role, including the depletion of the ozone layer. Introduce that temperature and pressure changes with altitude in the atmosphere. • Ocean stratification from the surface to the dark zone including the distribution of life forms in them. Distribution of other water bodies on Earth such as seas, rivers, glasiers, clouds and ground water is also introduced.
	9.1.2 explain differences in Earth layers based on its composition and physical characteristics. .	Create a visual presentation to show the differences between crust, mantle and core of the Earth including the lithosphere, asthenosphere and mesosphere.
	9.1.3 realise that Earth is the only place that can sustain life based on its physical characteristic	Discuss that the Earth is the only home for every living organism.
9.2 Composition of the Earth	9.2.1 explain type and characterictic of rocks. 9.2.2 communicate on how to differentiate the process of rock formation.	Carry out an activity and present a multimedia presentation on the three types of rocks e.g. igneous rocks, sedimentary rocks and metamorphic rocks based on its formation.

Content Standard	Learning Standard	Notes
9.3 Main processes of the Earth	9.3.1 explain the different Earth processes that effect the changes on Earth.	Gather information about exogenic and endogenic processes and present it using a multimedia presentation.
	9.3.2 communicate about exogenic and endogenic processes.	Exogenic process – weathering, erosion, mass depletion, land depletion, transport and sedimentation. Endogenic process – mantle convection process, magma activity, Earth crust movement (tectonic layer)
9.4 Geohazard phenomena	9.4.1 communicate about geohazard.	Collect, interpret data through a multimedia presentation on geohazards e.g. earthquake, volcanism, land slide, tsunami, global warming, acid rain, quicksand and sinkholes.
	9.4.2 generate ideas on how science and technology are used to prepare for geohazards.	Discuss and share ideas on how science and technology can be use to prepare for the possibilities of geohazards.
	9.4.3 realise that enviromental disasters effect human livelihood.	Using various media to explain impact of enviromental disasters e.g. loss of life, loss of property, diseases, and starvation. Highlight the need to symphatise with victims of enviromental disaster.

Content Standard	Learning Standard	Notes
9.5 Age of the earth	9.5.1 communicate about geological time scale of the Earth. 9.5.2 explain the method to determine the age of the Earth. 9.5.3 communicate about fossils. 9.5.4 reason about the importance of fossils in the advancement of contemporary science.	Gather and share informations about the geological time scale of the Earth and method to determine the age of the Earth. Using visual graphic presentation to present about fossils and relate it to earth history. Discuss how knowledge on fossils can help modern science.
9.6 Earth resources and applied geology	9.6.1 explain surface water and its risks. 9.6.2 explain the importance of underground water and its risks. 9.6.3 communicate about economic minerals. 9.6.4 explain the formation of petroleum and coal. 9.6.5 communicate about the hydrothermal process.	Search for information and carry out a multimedia presentation on surface water and aquifers. Economic minerals consist of metallic minerals, non-metallic minerals and rare earth minerals. Carry out a multimedia presentation on the formation of petroleum and coal. Discuss the economic prospects of hydrothermal processes.

Content Standard	Learning Standard	Notes
	9.6.6 solve problems about the negative effects of unplanned human activities on all living things on Earth.	Debate how exploitation of Earth's resources without proper planning may cause adverse effects on living things on Earth.

PERFORMANCE STANDARD

EXPLORATION OF EARTH AND SPACE	
Performance Level	**Descriptor**
1	**Recall** the knowledge and science skills on about the Earth's structure/geo-disasters/Earth's resources.
2	**Understand** the Earth's structure/geo-disasters/Earth's resources and able to explain their understanding.
3	**Apply** knowledge on the Earth's structure/geo-disasters/Earth's resources to accomplish simple task.
4	**Analyse** knowledge of knowledge on the Earth's structure/geo-disasters/Earth's resources **in context of problem solving about events or natural phenomena.**
5	**Evaluate** about the Earth's structure/geo-disasters/Earth's resources in the context of **problem solving and decision making** to carry out a task.
6	**Design** a presentation using multi media / visual / folio / poster / role play / drama; with creative and innovative use of science knowledge and skills of the Earth's structure/geo-disasters/Earth's resources in the context of **problem solving and decision making; with regards to the social values/ economy / culture of the community.**

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