MINISTRY
OF
EDUCATION, YOUTH & INFORMATION
Every Child Can Learn, Every Child Must Learn

NATIONAL STANDARDS CURRICULUM

SCIENCE

GRADES 7-8 APSEII

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ACKNOWLEDGEMENT

Our connection with each other is unquestionable and so at the end of this arduous yet rewarding journey, the Ministry of Education, Youth and Information gratefully acknowledges the contributions of the following individuals and institutions who generously gave of their time and resources in the planning and development of the National Standards Curriculum (NSC):

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- The curriculum formatter, Ms Janielle Flowers
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- All others whose names do not appear, but who contributed to the production of the NSC

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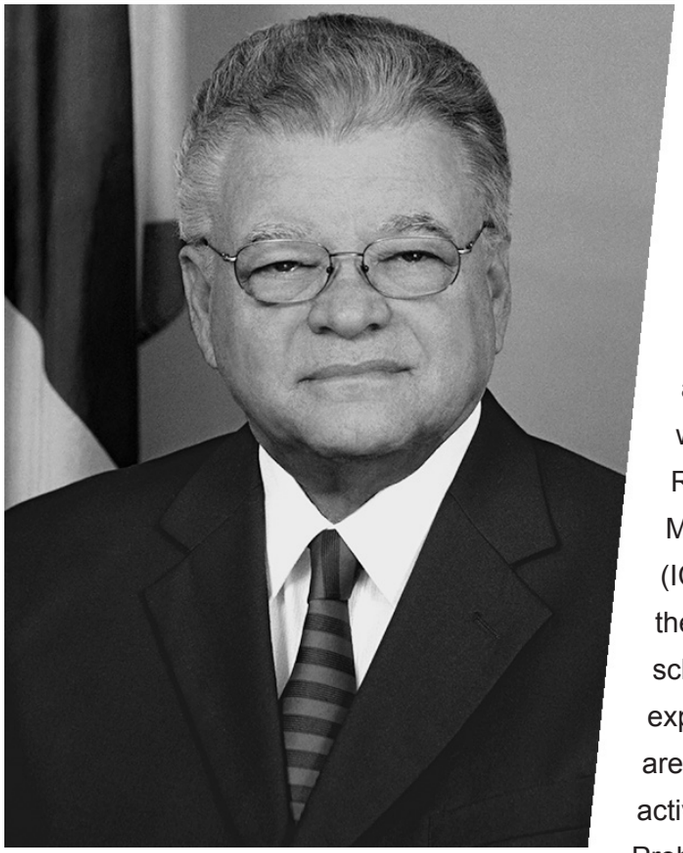


The curriculum of any country informs all aspects of operations and helps to shape the intellectual, social, psychological and spiritual dimensions of our society. By its design, the National Standards Curriculum (NSC) clearly conveys the knowledge, skills and attitudes deemed by our society as critical to addressing Jamaica's current realities. It is expected that as teachers and students interact efficiently with the curriculum that a culture of communication, collaboration, creativity and thinking critically will be honed.

Through the implementation of the NSC, education in Jamaica is being reframed and re-positioned as customized, diverse, relevant, equitable, outcomes-based, and inclusive. Significantly, this approach will signal the introduction of the Alternative Pathways to Secondary Education (APSE), Spanish and Resource and Technology at the Primary level, the integration of the Science Technology Engineering and Mathematics (STEM) methodology and a greater utility of Information and Communication Technology (ICT) tools to facilitate improved outcomes. Since there is no one subject that can be relied on to meet all the needs of our children as each child differs in learning style preferences, abilities, background and so on, schools are expected to use the curriculum to schedule learning episodes that allow all children to creatively express themselves through the Creative Art Forms; think critically in the context of the Exploratory Core areas; practice behaviours that lead to spiritual, physical, emotional and social well-being through Enrichment activities and demonstrate productive capabilities by working collaboratively on projects in settings with a Problem Solving/Work-Based focus, using the standards and principles of Resource and Technology.

The Ministry of Education, Youth and Information will continue to support our schools in the implementation process through the provision of continued training opportunities for school leaders and teachers, improved physical infrastructure and the provision of the necessary teaching/ learning resources to support pedagogy. We look forward to the support of all our stakeholders- members of the community, members of school boards, principals and teachers in ensuring a successful implementation of the NSC.

The Honourable, Karl Samuda, CD, MP

Minister without Portfolio with responsibility for Education, Youth and Information

M E S S A G E

I fully endorse the National Standards Curriculum (NSC) as being pivotal to advancing the education of our Jamaican children. The broad focus on critical thinking, collaboration, creativity and communication is indeed very critical in equipping young Jamaicans with the requisite twenty- first century skills as we seek to advance the achievement of Jamaica's Sustainable Development Goals by 2030. There is no denying that quality education is one of the most powerful and proven tools for the sustainable development of any country, and that through the re- alignment and re-scoping of the national curriculum, Jamaica is well on its way to ensuring that our goals are not just symbolic but are a reality lived by all Jamaicans, particularly our youth.

The NSC is on the cutting edge of curriculum design and represents the shift from a content- based focus to a competency- based one where skills and attitudes are placed at the forefront. This approach should ensure that our youth are fully equipped with a combination of the essential knowledge, skills and attitudes to be successful in every aspect of their lives. Users of the curriculum will be pleased to find the utilization of a Pathway Approach to Education with an emphasis on the integration of the Science, Technology, Engineering and Mathematics (STEM) Methodology, Information and Communication Technology (ICT), the Creative Arts and the Technical and Vocational areas. The provision of alternative pathways for our learners, supported by learning coaches/ special needs educators is a significant achievement for the MoEYI and our ongoing support for this area concretizes our belief that every child can indeed learn.

The production of this curriculum document is not an indication that our journey has ended; rather it is a signal that we have advanced the very dynamic and obligatory process of the transformation of our education system. I anticipate the support of all our stakeholders in ensuring the curriculum implementation process is without major challenges.

The Honourable, Alando Terrelonge, MA, MP

State Minister in the Ministry of Education, Youth & Information

It was the mandate of the Curriculum Units of the Ministry of Education, Youth and Information to spearhead the crafting of a new curriculum for the nation, in keeping with international standards, global trends in the educational landscape and societal goals and aspirations. The mandate had several facets: to establish clear standards for each grade, thereby establishing a smooth line of progression between Grades from 1 to 9; to reduce the width, complexity and amount of content; to build in generic competencies such as critical thinking across the subjects; to ensure that the curriculum is rooted in Jamaica's heritage and culture; to make the primary curriculum more relevant and more focused on skills development, and to ensure articulation between primary and secondary curricula, especially between Grades 6 and 7. To achieve this, the MoEYI embarked on an extensive process of panel evaluations of the existing curricula, consultation with stakeholders, (re)writing where necessary and external reviews of the end products.

Today, we are indeed proud that, the curriculum development teams have succeeded in crafting a curriculum which has met these expectations. Under the National Standards Curriculum (NSC) focus will be given to project-based and problem-solving learning, with an integration of Science, Technology, Engineering and Mathematics/Science, Technology, Engineering, Arts and Mathematics (STEM/STEAM) methodologies across the system. Learners will benefit from more hands-on experiences which should enhance the overall learning experience and cater to the different kinds of learners in our classroom. In addition, they will be exposed to work-based learning opportunities that will help them become productive citizens of Jamaica and the world at large.

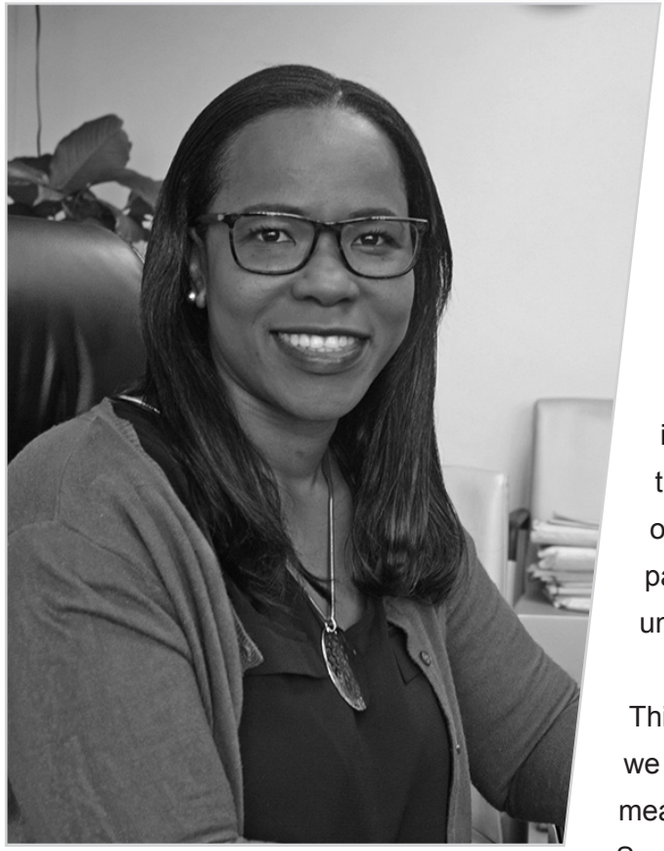
It is anticipated that as school administrators and teachers system-wide implement the National Standards Curriculum that improvements will be evident in the general academic performance, attitude and behaviour of our students.

We anticipate the participation of all our stakeholders in this process as we work together to improve the quality of life and prospects for all the children of Jamaica and to realize our mantra that *every child can, and must, learn.*

Dr. Grace McLean

Permanent Secretary , Ministry of Education, Youth & Information (Acting)

MESSAGE



Education is the means by which the society can re-create itself in future generations. Cognizant of this fact, the Ministry of Education, Youth and Information (MoEYI) has positioned the National Standards Curriculum (NSC) as an important avenue through which the identity of future generations can be positively impacted. Given its very vibrant and broad-based nature the NSC targets the holistic development of learners with a view to develop successful lifelong learners and confident and productive individuals who are deeply rooted in their culture, identity and citizenship.

In preparing the education system for the implementation of the NSC the MoEYI continues to offer ongoing training/coaching support for all the relevant stakeholders involved in the implementation, including school administrators, teachers, parents and students. We are also committed to provisioning the system with the resources needed to ensure a successful implementation, particularly in the context of the inclusive and differentiated approaches endorsed by the NSC. We will continue to work with our partners in ensuring the resources available to schools are fully aligned to the content and philosophical underpinnings of the NSC.

This is an exciting time for education in Jamaica. As we advance the curriculum implementation process, we aim to provide all our learners with access to the best education possible. However, we recognize that meaningful and sustainable progress can only be realized from the collaborative effort of all our stakeholders. So as we forge ahead with implementation we invite all our stakeholders to keep focused on our shared vision: “Every Child Can Learn; Every Child Must Learn”.

Capt. Kasan Troupe, Ed. D, JP

Chief Education Officer (Acting), Ministry of Education, Youth & Information

MESSAGE

Fundamental to the Ministry of Education, Youth and Information's (MoEYI) core value is the belief that all learners deserve the opportunity to achieve their full potential in all facets of their lives (spiritual, moral, cultural, intellectual and physical). With its dynamic, inclusive approaches, the National Standards Curriculum (NSC) provides a clear and robust blueprint to provide our young Jamaicans with the opportunities, responsibilities and experiences to make this a reality.

The accomplishment of this curriculum cannot be attributed to the effort of one or two individuals. The MoEYI brought together a wide cross section of our stakeholders who contributed their diverse skills in creating curriculum documents that will facilitate high standards of learning and enhance the quality of instructional delivery. Our main mandates concerning the revision of the Curriculum included better alignment of the curriculum in the lower grades secondary grades with the Caribbean Secondary Examination Certificate (CSEC) examinations syllabus used in the upper secondary grades; developing progressive standards for all subject areas; prioritizing the 21st century skills of collaboration, critical thinking, communication and creativity; integrating STEM, the Creative Arts, the Enrichment Areas and ICT in the curriculum documents. It also promotes the use of learner-centred approaches across the various disciplines and creates a more inclusive learning environment by catering to diversity in our learners.

Additionally, Civics will return to be a discrete discipline, while Technical and Vocational Education and Training (TVET), and Spanish will be formally introduced at the Primary level. The Health and Family Life (HFLE) Curriculum has been reviewed and re-scoped to ensure alignment to the philosophy of the NSC and inclusion of all the relevant life skills needed by the 21st century learner.

It is with a deep sense of gratitude that I pay tribute to all the educators who have contributed to the timely development of this National Standards Curriculum which will invariably help all learners to maximize their potential.

Mrs Winnie Berry

Deputy Chief Education Officer,

Curriculum and Support Services, Ministry of Education, Youth & Information

M E S S A G E

The National Standards Curriculum (NSC) rests on the belief that all learners are endowed with the capabilities, gifts and talents to fulfil their divine purpose. These attributes are to be further enhanced or improved in a nurturing, inspiring and inclusive environment; one that caters to the whole person (soul, spirit and body - spiritual, emotional, social, physical and mental). As learners assume their roles and responsibilities individually and as communities of learning in such an environment, they become critical-reflexive thinkers, creative problem solvers, effective communicators and natural collaborators.

A curriculum design of this nature, calls for transformative change at the societal level (Elkind, 2004)[1] and not just at the school and classroom levels. This is a call for all stakeholders, as users of the curriculum, to adopt a critical -reflective and reflexive stance and join learners in the quest for meaning, purpose and stability as they help to shape the world. By integrating principles from various disciplines and their related methodologies, learners who interact with the curriculum are provided with enriching experiences, opportunities for creative expressions and authentic exploration of problems from a classical standpoint as well as in the context of workplace learning. This is due to the fact that the NSC recognizes the importance of each discipline in the problem solving process and in development.

Assessment as an element of the curriculum becomes primarily a learning process for charting progress through self-corrective measures that are informed by feedback from peers and teacher-facilitator. By providing assessment criteria statements in the curriculum, teachers are encouraged to facilitate learners functioning as self and peer assessors. This approach should see the learner developing self-direction with the support of mentors and coaches and forming an intrinsic desire to succeed. These attributes prepare them to face high stakes assessment as problems to be confronted with courage, a sense of readiness, insight and creative prowess.

These features of the NSC have the potential to influence learners' profile as Jamaicans who are gratified by an identity of cultural excellence that embodies moral obligations, intellectual rigour, innovativeness, environmental stewardship and productivity. The curriculum echoes the sentiments of our National Anthem, National Song and Pledge and serves as rich and credible source of the values and virtues that are woven together to convey the Jamaican identity. I wish for our school administrators, teachers, students and other stakeholders much success as they work with the document.

Dr Clover Hamilton Flowers

Assistant Chief Education Officer, Core Curriculum Unit, Ministry of Education, Youth & Information

[1] Elkind, D. (2004). The problem with constructivism. The Educational Forum, 68(4), 306–12.

TERMS	DEFINITIONS/MEANINGS
Range of Content	Provides an overview of the concepts, knowledge, skills and attitudes that will be developed in a unit of study.
About the Unit	Gives a brief overview of the content, skills that are covered in the unit and the methodologies that are used. As well as the attitudes to be developed.
Standards	Statements that explain what all students are expected to know and be able to do in different content areas by the end of a course of study e.g. by the end of period spanning grades 4 – 9
Attainment Targets	An attainment target is a desired or expected level of performance at the end of a course of work, within a given/specified teaching-learning period. Attainment targets identify the knowledge, skills and understanding which students of different abilities and maturities are expected to have by the end of each Grade. It is the standard that we expect the majority of children to achieve by the end of the grade.
Benchmarks	Behaviours students are expected to exhibit at different stages of development and age/grade levels.
Theme/Strands	Unifying idea that recurs throughout a course of study and around which content, concepts and skills are developed.
Prior Learning	It is what students are expected to already know through learning and experience about a topic or a kind of text
Specific Objectives	Specific objectives state what the student is expected to know or understand as a result of the learning experience. The specific objective is usually framed in the areas of the knowledge, skills and attitudes that the students are expected to achieve. Specific objectives tell us what the children will learn or will be taught.
Suggested Teaching/Learning Activities	A teaching/learning activity is an organised doing of things towards achieving the stated objectives. They are suggested activities that are crafted in a way to be an efficient vehicle which can move the student between what is to be learnt (objective) and what the student is to become (outcome).
Key Skills	Indicate the important skills that students should develop during the course of a unit. Key skills are aligned to the suggested teaching and learning activities in the unit which are intended to develop the skill to which it is aligned. Included in the key skills are the 21st century skills such as critical thinking and problem solving, collaboration, communication and ICT.

TERMS	DEFINITIONS/MEANINGS
Assessment	An assessment is a determination of whether intended results have been achieved. This section of the curriculum speaks to both the product that will be judged as well as the criteria against which it will be judged. It must be noted that this section does not introduce new activities. Instead, it speaks to the judging of the suggested teaching and learning activities Formal assessment may be conducted with the aid of instrument (e.g. via written test, portfolio) or by requiring students to complete assigned tasks (e.g. performance), and is usually recorded against a predetermined scale of grading. Informal assessment (e.g. via observation or spontaneous student expression) may also reveal important evidence of learning.
Points to Note	This section provides technical information that must be considered in delivering the unit. It may also include information that provides additional explanation of key concepts that may be unfamiliar to the teacher as well as suggestions for infusion within the unit.
Extended Learning	These are opportunities for students to utilise the knowledge and skills they would have acquired in the unit in authentic situations/experiences.
Learning Outcomes	A learning outcome is a demonstration/ behavioural evidence that an intended result has been achieved at the end of a course of study. The learning outcome tells us if pupils have understood and grasped what they have been learning.
Links to other Subjects	Suggests opportunities for integration and transfer of learning across and within different subject areas.
Key Vocabulary	This section consists of a number of words/phrases that addresses the skills, topics and content that must be covered in the unit.
Professional Portfolio	A professional portfolio is a structured and thoughtfully organized collection of artefacts which illustrates your skills and abilities, substantiated by samples of student work and realized through reflective writing, deliberation, and conversation with peers, teachers and faculty (Shulman, 1998).

AIMS

The study of Science should enable students to become:

- Willing to embrace the rapidly changing worlds of knowledge and technology and be capable of managing information with understanding and confidence to meet the personal, social and vocational needs and challenges.
- Adept in participating in decision making processes and be competent in their role of contributing to social and economic development, while being mindful of sensitive moral and ethical concerns that impact ecologically-sustainable environment.
- Proud citizen of Jamaica by embracing values that impact increased productivity and economic prosperity, and promote equity and social justice for all.

THE PHILOSOPHY BEHIND THE NEW SCIENCE CURRICULUM

Science is a way of knowing about the structure and behaviour of the physical and natural world through observation and investigation.

Today's global societies have become significantly more scientific and technological, requiring an understanding of science in making many personal decisions and addressing various socio-economic, environmental and health issues. A course of study in science therefore offers students the ability to develop crucial skills and knowledge that equip them to understand the world around them, make informed decisions, and build positive life-long learning habits, behaviours and attitudes.

The Grades 1-9 Science Curriculum is predicated upon the constructivist approach to learning in that it creates, through a variety of learner-centred instructional methodologies, 'hands-on,' 'minds-on,' and 'real world' experiential opportunities for exploring, catering to multiple intelligences and, in the early years (Grades 1-3), makes the most of the pedagogy of play. The curriculum has been redesigned to have a greater emphasis on the integration and application of scientific concepts, principles and innovation. Fundamental to this new curriculum is the acquisition of the science process skills that will enable students to engage in scientific enquiry which forms a foundation for scientific programmes at advanced levels. The curriculum has also taken into consideration the national strategic objectives in education as well as the twenty first century desired outcomes which include the ability to communicate ideas, to collaborate on issues thereby building interpersonal skills, to create meaningful solutions to problems with real world applications and to exercise critical thinking skills which has implications for personal growth and development. As a result, students will become flexible and adaptable, information and technology literate, aware of health and wellness issues and globally competent.

The assessment of the science curriculum is also predicated on constructivism, and incorporates real life and performance based experiences that are student-centred and formative in nature. Learner-centred assessment relies heavily on formative assessment and requires the use of varied, multiple non-traditional assessment strategies and tools to measure students' achievement and progress throughout the school year. These assessment strategies actively engage students and promote the involvement of students through performance tasks and student self and peer assessments.

Based on the National Standards Curriculum (NSC) Framework, the curriculum emphasizes the need for balance between the acquisition of scientific knowledge, as against the learning process and attitudes. In addition, where applicable, the technological applications, social implications and the value aspects of science are also considered. The curriculum exposes students to methodical approaches to investigation and problem solving, as the basis for evidence-based conclusions. Students will encounter the need for fair test and veracity in data derived through experimentation. They will build personal integrity and develop personal qualities such as perseverance, ingenuity, respect for the opinions of others and tolerance for diversity of opinions even when they contradict their personal beliefs. Acquisition of these qualities, along with the understanding of scientific principles and applications, when transferred to life beyond school, will not only produce astute scientists but will also impact the social, economic and political lives of graduates. Science in the curriculum also adequately equips students to choose relevant careers by making them knowledgeable about the diverse branches of science and technology and a growing number of other science-related professions; many of which have not yet been created.

In the NSC, science is linked with other subject areas such as Social Studies, Geography, Mathematics, Resource and Technology and the Arts within the context of integration through STEM. This interdisciplinary approach helps students recognize the relevance of each subject and that everything in our world is interconnected.

RANGE OF ACTIVITIES

Students should be inducted into the processes of science, engage in practical inquiry and plan and conduct investigations both in groups and individually. They should develop an appreciation for the range of flora and fauna in their locality and beyond and understand how they maintain the delicate balance in the environment. Students should learn the scientific basis of the structures and functions of their bodies. They should explore the range of materials and understand their physical and chemical properties. They should also explore the different forms of energy and forces and how these impact on everyday life.

The New Standards Curriculum (NSC) is predicated on the science process skills and science practices. It is designed so that students develop these skills while learning the prescribed content. The process skills and science practices are addressed each year, with a particular focus at each grade level. Students use the process skills and practices of science to develop an understanding of the scientific concepts (see figure 1). The scientific attitudes and practices enable students to work like scientists.

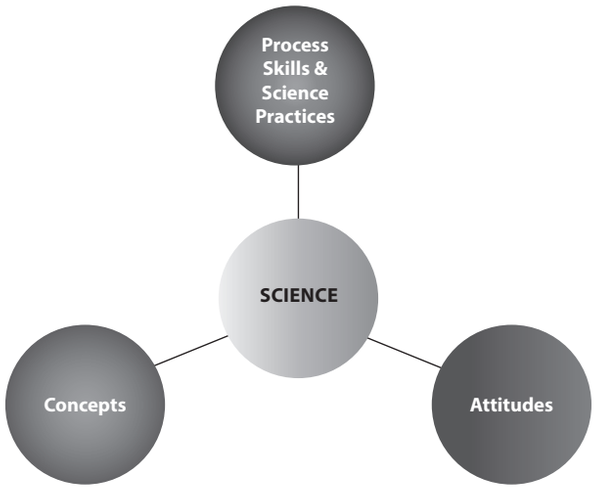


Figure 1: Elements of Science

The NSC design is based on education of the whole child and provides a well-rounded and enriching experience. Since science is about asking questions and finding answers to questions, the Process skills are actually the same skills that we all use in our daily lives as we try to figure out everyday questions.

These skills include:

- Observing
- Communicating
- Measuring
- Classifying
- Predicting
- Inferring
- Identifying and controlling variables
- Define operationally
- Formulating hypotheses
- Interpreting data
- Experimenting
- Creating models

When we teach students to use these skills in science, we are also teaching them skills that they will use in the future in every area of their lives.

Content is easy to forget but the process skills remain forever/for longer periods.

Scientific competences do not develop incidentally - they must be deliberately and systematically included in students' educational experiences. Laboratory/practical activities positively influence the development of process skills.

The NSC emphasizes the teaching of science using process/inquiry skills in order that students:

- acquire content
- develop the ability to recognise problems
- think critically about how to solve problems
- follow logical, sequential and analytical steps in arriving at solutions

These are achieved in the NSC through the use of student-centred approaches such as inquiry-based, project-based, and problem-based learning, which are utilised in the integrative STEM/STEAM approach. From these, the science and engineering practices are fostered.

The science and engineering practices, as identified by the Next Generation Science Standards (NGSS), are:

- Asking Questions or Defining Problems
- Developing and Using Models
- Planning and Carrying Out Investigations
- Analysing and Interpreting Data
- Using Mathematics and Computational Thinking
- Constructing Explanations or Designing Solutions
- Engaging in Argument From Evidence
- Obtaining, Evaluating, and Communicating Information

Activities in the NSC are investigative in nature and encourage the exploration of the natural environment. Emphases on real-world applications foster the development of the key 21st century skills commonly called the 4Cs (critical thinking, creativity, collaboration and communication) as well as scientific attitudes such as curiosity, objectivity, critical mindedness, open mindedness, inventiveness, intellectual honesty, humility and perseverance.

ASSESSMENT IN THE SCIENCE CURRICULUM

In the science learner-centred classroom, assessment is done by the teachers and students. The key aim of science at this stage, in addition to garnering knowledge and understanding about certain science phenomena considered crucial for students at this level, is to enable children to develop twenty-first century competencies through active and real life experiences which train them to 'work scientifically' and solve problems through inquiry and the engineering design process. Such an aim cannot be effectively achieved by the administration of external written tests.

Explicit links between what is intended to be learned and what is assessed have been created in the science teaching and learning units. Each science unit within a grade level outlines the assessment criteria to be used in determining the skills, knowledge and understanding students are expected to achieve, after their learning encounters within that unit. However, the teacher has the liberty to select the learner-centred assessment strategies and tools that will be most effective in measuring the targeted learning outcomes. Scientific vocabulary and factual knowledge can be assessed by using well-structured short open-ended and multiple choice tests or quizzes given at appropriate times.

Assessment of students' achievements gathered within the school is used for two main purposes.

1. Formative assessment (assessment for learning - to assist learning). These assessment activities are:
    - aligned with the learning objectives of the science curriculum;
    - realistic and manageable for pupils and teachers, with cited time demands;
    - for ascertaining and reporting the achievement of individual pupils, information is gathered by use of a variety of learner-centred strategies and tools; and promote the active engagement of pupils in their learning and its assessment.

2. Summative assessment (assessment of learning - to summarize and report on what has been learned, at the end of each unit or at the end of each term).

Assessment should not be an after-thought, but is an integral part of the delivery of instruction.

TERM 1

Working Like a Scientist 1.1

Defining science

Examples of dimensions of science

Works of selected Jamaican and

international scientists Scientific Process skills – observing, measuring, classifying, comparing, predicting

Safety practices in the home, school & work environment Significance of safety signs and symbols

Working Like a Scientist 1.2

The Scientific Method

Application of the Scientific Method

Use of templates to write Laboratory

Reports Methods of presenting Data – Tables, drawing/ diagrams

Investigating Water

Identifying fair tests – simple examples

Importance of water to life

Investigating presence of water in plants and animals

Formation of dew

Investigating flocculation in water purification Chemical test for water - cobalt chloride paper

Investigating Air

Properties of air - occupies space, exerts pressure Structure and function of human respiratory system - breathing

Application of air pressure - life processes (breathing) and technology

TERM 2

Cells as the Basic Units of Life

Identification of life processes

Defining the cell

Examining cells under a microscope Making models of animal cells

Relating cell structures to their functions Cell specialization

Hierarchical relationship between cells, tissues, organs and organ-systems

Defining ‘systems’

Identification and functions of organ systems

Identifying selected organs in each system

Diffusion

Investigating diffusion

Defining diffusion

Importance of diffusion as a life process Evidence of diffusion in life situations

Osmosis

Investigating Osmosis

Defining osmosis

Importance of osmosis as a life process Evidence of osmosis in life situations

TERM 3

Forms of Energy

Defining energy

Identifying energy forms and sources

Investigating energy conversions

Investigating chemical energy in food

Identifying renewable and non-renewable energy sources

Advantages and disadvantages of renewable and non- renewable sources

Phases of Matter

Classification of materials as solids, liquids and gases Investigations showing particles in solids, liquids and gases

Characteristics of the three states in terms of particle movement and arrangement

Investigating changes of state by heating and cooling Processes involved in changes of state

Definition of Matter

Definitions and examples of melting, freezing, evaporation and condensation

Elements, Mixtures and Compounds

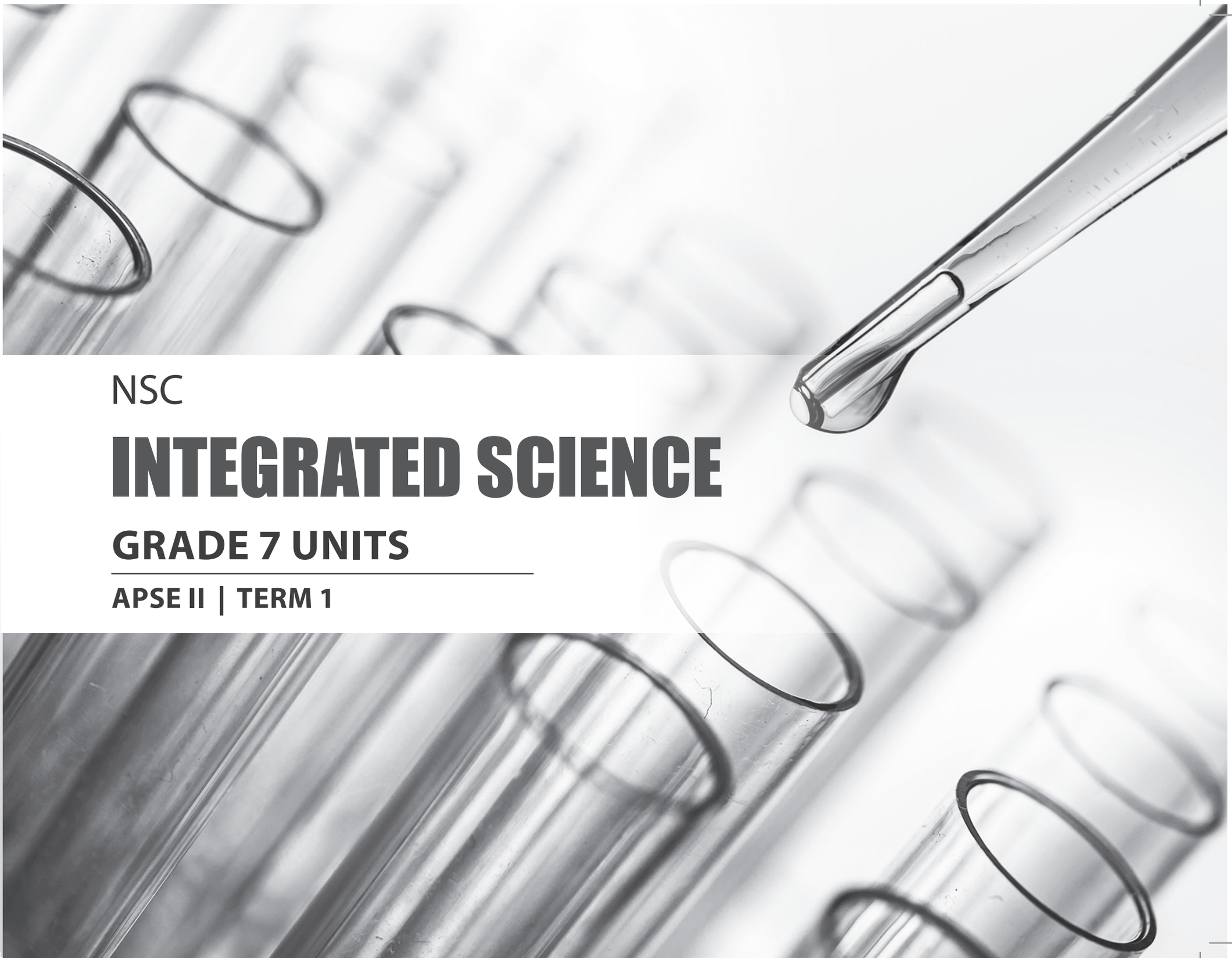
Listing common elements of the Periodic

Table and their symbols

Defining mixtures and compounds

Classifying mixtures

Investigating methods of separating mixtures Definition of and characteristics of an element Classifying substances as elements, mixtures and compounds



NSC

INTEGRATED SCIENCE

GRADE 7 UNITS

APSE II | TERM 1

ABOUT THE UNIT

In this unit, students will explore the work of a scientist in order to discover the science process skills and scientific attitudes and tools which are used for the production of scientific knowledge. Students will construct an understanding of science as a process of inquiry and synthesise a definition for science. They will be guided to illustrate this concept of science through concept maps and explore the safety measures involved in the use of laboratory tools and the need and strategies for safety in the laboratory or classroom.

RANGE OF CONTENT

The key concepts and knowledge students will learn in this unit are:

- Science as a process of inquiry as depicted in the work of a scientist
- Tools used in scientific inquiry, their purpose and directions for their safe use and the observance of safety in the laboratory
- Identification and definition of selected problems linked to the natural environment
- Methods of scientific investigations and their suitability for solving identified problems

GUIDANCE FOR THE TEACHER

Science is more than just a body of knowledge. It is a process of inquiry and therefore constitutes a set of process and cognitive skills and attitudes which are all used in the construction of scientific knowledge and understandings of the natural world. It allows for appreciation of the environment and the use of it in sustainable ways. An inter-disciplinary approach is intended to allow students to make links between Science, Mathematics, Technology, Engineering and English language. A variety of teaching strategies is required to allow students to get involved in learning experiences which are in keeping with their preferred learning styles, as they learn how to learn and acquire the intended outcomes of learning.

Prior Learning

Check that students:

- Know who is a scientist and what he or she does.

WORKING LIKE A SCIENTIST 1.1

ATTAINMENT TARGET(S):

Demonstrate an understanding of the scientific process, and the impact of air and water on the environment, and on our everyday life.

Demonstrate positive interpersonal skills in order to foster good working relationships.

Theme: Exploring Science and the Environment

Topic: Science as a process of enquiry
Duration: 5 hours/2 weeks

OBJECTIVES

Students will:

- Arrive at a definition of science as a process of enquiry.
- Analyse the work of a scientist to show the three dimensions of science as a process of inquiry.
- Illustrate the concept of science as a process of enquiry.
- Identify specific situations in the home, classroom or science laboratory which may be potentially dangerous.
- Describe ways in which potentially dangerous situations may be corrected.
- Recognize and use common safety signs and symbols.
- Formulate safety rules for working in the laboratory.
- Work collaboratively with others in small groups.

ICT ATTAINMENT TARGETS:

COMMUNICATION AND COLLABORATION - Use technology to communicate ideas and information, and work collaboratively to support individual needs and contribution to the learning of others.

RESEARCH, CRITICAL THINKING, PROBLEM-SOLVING AND DECISION MAKING - use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems, and make informed decisions.

DESIGNING AND PRODUCING - use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DIGITAL CITIZENSHIP - Recognise the human, ethical, social, cultural and legal issues and implications surrounding the use of technology and practice online safety and ethical behaviour.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Write a definition for science. Discuss their definition in small groups and arrive at a consensus on what is science. Share the group's definition for science with the whole class. Compare definitions and explain how they are similar and different. Examine and discuss the teacher's definition of science as a process of inquiry and use this as the standard to evaluate their definitions and make modifications of these where necessary. Design and create a personal portfolio. Place a picture that illustrates what science is in portfolio.	Define, communicate, collaborate, think critically - compare, evaluate, draw conclusions	Accurate definition of science as a process of inquiry Portfolio satisfies given criteria
In small groups, construct a concept map to illustrate the concept of science as a process of inquiry. Present and discuss their map with the class. Use information from their map and their definition of science, to logically explain how their concept map illustrates their definition of science as a process of inquiry. Analyse and discuss a concept map of science, presented by the teacher. Compare their concept map with that of the teacher's. Explain three dimensions of science as portrayed by these maps. Place a copy of their concept map in portfolio.	Collaborate, explain, communicate, think critically - compare, illustrate, justify	Concept map depicts science as a process of inquiry and indicates the essentials of science and the interrelationships among these

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
The scientists, Redi and Pasteur found evidence to show that the maggots which appears in decaying meat do not come from the meat itself. Read the teacher- made story of how Redi and Pasteur solved this problem and answer the question, "How does Redi and Pasteur's work reflect science as a process of inquiry?" Identify the three dimensions of science from their work and discuss how these were used to produce new scientific knowledge. Answer the question, "What tools did Redi and Pasteur use in their work"? Use the internet to find pictures of laboratory tools and construct a table to show the list of tools, what each is used for and safety precautions associated with their use. Research the work of a scientist and place in portfolio.	Collaborate, communicate, think critically - analyse, interpret	Accurate analysis and interpretation of the work of the scientists
Brainstorm safety signs and symbols that they come across in their daily lives. Discuss the importance of these signs and symbols. Create posters with safety signs and symbols that relate to the school environment. Hang posters around the class or school. Place one safety symbol found in a science laboratory in their portfolio and explain how such a symbol is of importance or of benefit to them.	Communicate, think critically - analyse, justify, create, reflect	Creative posters contain accurate information Justifiable reasons given for importance of safety signs/ symbols Symbol correctly represents one found in a laboratory and explanation gives evidence of self-reflection
In groups, examine pictures and/or online/offline video tutorials of work areas in the home, school, classroom/laboratory, on the streets and workplace to identify and record at least five possible dangers and five safe practices. Discuss and record possible outcomes of the potentially dangerous situations identified, and the benefits of carrying out the safe practices in the pictures/videos. Share and discuss the information with the class.	Collaborate, communicate, observe, record, think critically - infer, analyse, research	At least five logical dangers and five valid safety practices identified Possible outcomes/benefits relate to potentially dangerous situations or safe practices
In groups, use pictures of work areas in the classroom/laboratory to develop rules that would help to reduce potentially dangerous situations in those areas. Place the rules under the title, "Safety in the Laboratory." Evaluate, through a classroom discussion and/or peer-assessment, the rules they developed for the home and classroom to determine their appropriateness.	Collaborate, communicate, think critically - evaluate, create	Rules developed reflect accurate content Plausible reasons given to support developed rules

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Accurately define science as a process of enquiry
- ✔ Describe the dimensions of science
- ✔ Recognize common safety signs and symbols
- ✔ Demonstrate understanding of appropriates afety precautions in various environments
- ✔ Use graphic organizers and multimedia software to communicate informationon safety in laboratory/classrooms

Points to Note

- The charts made by students should be prominently displayed in the class/laboratory for constant reference.
- Encourage creativity in the sharing/presentation of scientific information.
- Encourage the development of scientific literacy.
- Demonstrate the construction of a concept map before requiring studentsto develop one.
- Collaborate and communicate information using a variety of ICT tools.
- Develop students' vocabulary by requiring them to write, spell, define and use related science words in simple sentences after each activity.
- Where students are unable to write a laboratory report, allow them to use a prepared template until they can do so on their own.
- Differentiate activities as much as possible where necessary.
- Emphasize the development of the key skills, especially critical thinking skills, as students carry out the cited activities.
- It is not necessary to assign a grade to every piece of assessment. Ensure however, that assessment data, including qualitative data is organised and recorded appropriately.

Extended Learning

Use the computer to find information about persons who implement rules, for example, police officers, traffic wardens, food inspectors and explain how they contribute to their safety in various life situations.

RESOURCES

Story on the work of the scientist e.g. Redi and Pasteur or the work of any relevant Jamaican scientist, pictures or videos depicting safe or unsafe scenes computers, internet, speaker, multimedia projector, CDs/ DVDs, graphic organizer and multimedia software

KEY VOCABULARY

Science, science process skills, scientific attitudes, scientific inquiry, precaution, safety, safety symbols, signs

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LINKS TO OTHER SUBJECTS

Social Studies, language Arts, Information Technology

Prior Learning

Check that students:

- Know that scientists carry out their work in a systematic way.

WORKING LIKE A SCIENTIST 1.2

ATTAINMENT TARGET(S):

Demonstrate an understanding of the scientific process, and the impact of air and water on the environment, and on our everyday life.

Demonstrate positive interpersonal skills in order to foster good working relationships.

Theme: Exploring Science and the Environment

Topic: The Scientific Method
Duration: 7.5 hours/3 weeks

OBJECTIVES

Students will:

- Outline the stages in the scientific method.
- Apply the scientific method to solve everyday problems.
- Write a report of a laboratory investigation using a template.
- List a variety of science-related careers.
- Show respect for another person's idea.

ICT ATTAINMENT TARGETS:

COMMUNICATION AND COLLABORATION - Use technology to communicate ideas and information, and work collaboratively to support individual needs and contribution to the learning of others.

RESEARCH, CRITICAL THINKING, PROBLEM-SOLVING AND DECISION MAKING - use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems, and make informed decisions.

DESIGNING AND PRODUCING - use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DIGITAL CITIZENSHIP - Recognise the human, ethical, social, cultural and legal issues and implications surrounding the use of technology and practice online safety and ethical behaviour.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Use research skills to identify at least 10 careers related to Science. Research the nature of these careers by interviewing (create interview questions with guidance of teacher) persons in these areas or use online/offline methods. Present information creatively using displays, scrap books or projects.	Communicate, gather data, record, think critically - formulate questions, create, research	Creative presentations Accurate information presented
Write down, step by step, what they think they would do to solve a simple everyday problem. For example, if they woke up one morning and could not find a pair of shoes they needed that day. Share and discuss their answers to the question posed. As a class, discuss the application of problem-solving procedures in everyday situations. Discuss the fact that scientists apply particular methods in the solution of problems. Discuss the Scientific Method as one such method. In groups, research the steps involved in the Scientific Method. Create models/charts/drawings, (electronic/ non-electronic) depicting the steps involved in the scientific method. Present the models and charts to the class for discussion and display in the classroom. Place a diagram of the Scientific Method in their portfolio.	Collaborate, communicate, think critically – research, create, solve problems	Displays contain the basic steps in the scientific method and steps correctly sequenced

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Complete prepared worksheets on the Scientific Method (e.g. worksheets that require students to: match given sentences with a step in the Scientific Method process; spell and define words associated with the Scientific Method process; identify the various science processes a scientist followed in carrying out a given experiment). Discuss the difference between a wild guess and an intelligent guess.	Communicate, think critically – apply information, solve problems	Templates correctly completed
In groups, discover how much sugar will completely dissolve in a 1⁄4 cup of cold water. Place one tablespoon of sugar into a quarter cup of cold water and stir until all the sugar dissolves. Record observations and the amount of sugar added. Repeat, adding one tablespoon of sugar each time until no more sugar will dissolve in the water (Do not taste). Record individual observations and share with class. Investigate whether more or less sugar will dissolve in the same amount of hot water. Write a problem statement for the investigation and make a prediction as to what the result will be. Draw a conclusion, using evidence from the investigation, about how sugar dissolves in cold and in hot water. Share findings with class.	Communicate, collaborate, observe, record, think critically – apply, predict, hypothesise, investigate, solve problems, draw conclusions	Steps of the Scientific Method are followed correctly Logical prediction Accurate observations made and recorded Logical conclusion based on evidence and provides answer to problem
As homework assignment, use the Scientific Method to solve a variety of real-world problems identified by the teacher/class (ensure that students can carry out the selected investigations on their own safely). Write a report on the investigations, using a teacher prepared template. Share results with class.	Communicate, collaborate, think critically - investigate, solve problems, research	Steps of the Scientific Method evident in investigations Report correctly reflects the Scientific Method
Examine several scenarios/investigations to identify which ones are fair tests. Justify their choices using simple scientific language. (Teacher should introduce students to variables and emphasize the importance of identifying and controlling variables to ensure a fair test.)	Communicate, think critically - analyse, apply, justify	Appropriate reasons given (using appropriate scientific language) for fair tests identified

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Identify characteristics of a fair test in an investigation by solving the problem, 'Which type of vinegar will react most vigorously with baking soda?' In groups, label three large transparent jars or plastic cups with the names of three different types of vinegar (white vinegar/cane vinegar, apple cider vinegar, Balsamic vinegar or red wine vinegar). Place one level teaspoon of baking soda into each jar or cup. Add 2 tablespoon/30 ml of the white vinegar to the jar labelled white vinegar. Immediately mark on the jar, the height of the foam formed. Measure the height of the foam. Record observations and height of foam. Repeat the test using the Balsamic and red wine vinegar. Repeat the entire investigation two more times and record observations. Tabulate the results for the three trials appropriately (a prepared table may be provided for students where needed) and draw an evidence- based conclusion about the problem, 'Which type of vinegar will react most vigorously with baking soda?' Answer the questions: • What factors made the investigation a fair test? • Which variable/s were controlled? • Which variable/s were changed? • Why was the investigation repeated two times? Write a laboratory report of the investigation using a prepared template.	Communicate, collaborate, observe, measure, record, tabulate, think critically - analyse, apply, justify, draw conclusion	Table accurately captures the relevant data Observations accurate and complete Correct answers supplied for each question Evidenced-based conclusion drawn Template accurately completed
Design a fair test to solve a simple everyday problem (e.g. 'Which hand towel/paper is most absorbent?'). Share design with class. Write the answer to the following question in their portfolio. • Why is it important for scientists to follow the Scientific Method when carrying out experiments?	Communicate, think critically – design, reflect	Fair tests contain all the required elements

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Use the scientific method to solve problems
- ✔ Prepare simple scientific reports
- ✔ Communicate information using productivity tools (e.g. presentation software, graphic organizer, word processing)
- ✔ Conduct electronic search for various kinds of information e.g. text images, audio and video

Points to Note

- Special emphasis should be placed on the development of skills and attitudes throughout the unit.
- Basic steps in the scientific method: Question --> research --> hypothesis --> experiment --> analyse results --> communicate findings)
- Use digital graphic organisers to structure, analyse and evaluate information and aid problem solving and decision-making processes.
- Develop students' vocabulary by requiring them to write, spell, define and use related science words in simple sentences after each activity.
- Where students are unable to write a laboratory report, allow them to continue using a template until they can do so on their own.
- Differentiate activities as much as possible where necessary.
- Emphasize the development of the key skills, especially the critical thinking skills, as students carry out the cited activities.
- It is not necessary to assign a grade to every piece of assessment.
- Ensure however, that assessment data, including qualitative data is recorded appropriately.

Extended Learning

Select a problem in their school/community and use the Scientific Method to solve it.

RESOURCES

Information sheets containing scenarios in which science skills are used, teacher prepared scientific method templates, three types of vinegar, baking soda, marker

KEY VOCABULARY

Hypotheses, problem specification, observe, manipulate, classify, communicate, measure, infer, predict

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LINKS TO OTHER SUBJECTS

Language Arts, ICT

ABOUT THE UNIT

In this unit, students will employ the process of scientific inquiry to discover the presence of water in the environment and its importance to the survival of organisms. They will apply their knowledge of how scientists work to conduct investigations, including 'fair tests', designed to strengthen the development of science process skills and science related attitudes. Through these explorations, students gather reliable evidence which is used to support or refute their predictions and, construct explanations about the role of water in the environment.

RANGE OF CONTENT

The key concepts, skills and knowledge students will learn in this unit are embedded in:

- The use of scientific inquiry to explore issues related to water in the environment
- The conducting of a fair test to provide evidence to explain the importance of water for the survival of plants
- The synthesis of evidence-based explanations of the presence of water in the earth's atmosphere
- Methods of scientific investigations and their suitability for solving identified problems

GUIDANCE FOR THE TEACHER

Science is more than just a body of knowledge. It is a process of inquiry and therefore constitutes a set of process and cognitive skills and attitudes which are all used in the construction of scientific knowledge and understandings of the natural world. It allows for appreciation of the environment and the use of it in sustainable ways. An inter-disciplinary approach is intended to allow students to make links between Science, Mathematics, Technology, Engineering and English language. A variety of teaching strategies is required to allow students to get involved in learning experiences which are in keeping with their preferred learning styles, as they learn how to learn and acquire the intended outcomes of learning.

Prior Learning

Check that students can:

- Explain the scientific method and describe a fair test.
- Explain water pollution.

INVESTIGATING WATER

ATTAINMENT TARGET(S):
Demonstrate an understanding of the scientific process, and the impact of air and water on the environment, and on our everyday life.

Demonstrate positive interpersonal skills in order to foster good working relationships.

Theme: Exploring science and the environment

Topic: Water and its importance to life
Duration: 7.5 hours/3 weeks

OBJECTIVES

Students will:

- Gather evidence through practical activity to show that plants need water for survival.
- Investigate the presence of water in the tissues of animals and Plants.
- Use a model to explain the formation of dew as evidence of water in the earth's atmosphere.
- Use practical activity to explain 'Flocculation' as one step in large scale purification of water.
- Carry out a given activity in a safe, clean, tidy and systematic way.
- Write a report of a laboratory investigation using a template.
- Show respect for another person's idea.

ICT ATTAINMENT TARGETS:

COMMUNICATION AND COLLABORATION - Use technology to communicate ideas and information, and work collaboratively to support individual needs and contribution to the learning of others.

RESEARCH, CRITICAL THINKING, PROBLEM-SOLVING AND DECISION MAKING - use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems, and make informed decisions.

DESIGNING AND PRODUCING - use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DIGITAL CITIZENSHIP - Recognise the human, ethical, social, cultural and legal issues and implications surrounding the use of technology and practice online safety and ethical behaviour.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: In small groups, find out and list the conditions which are required for healthy growth of seedlings. Write the answer to the question, 'What do you think will happen to seedlings if they are not watered?' Test their answer by planning and carrying out a fair test. (Use two identical seedlings, e.g. bean seedlings which were grown for this purpose). State what is a fair test and why two identical seedlings are needed for this fair test, identify the control and explain why a control is needed in a fair test, explain which condition will be kept constant and why. Set up the experiment and control under the guidance of the teacher. Record the steps followed in setting up the experiment and control. Observe the seedlings for three weeks, giving water to one seedling and none to the other. Carefully record observations and note any important changes that are of relevance to the stated question. Use the recorded observations to draw an evidenced-based conclusion about the need for water by plants. Share and discuss findings with the class. Use a teacher prepared template to write up a science report (template should include hypothesis, materials, method, observations, interpretation of observations and conclusion).	Communicate, collaborate, observe, record, think critically - investigate, analyse, control variables, interpret, plan and design, research, draw conclusion, reflect	Correct identification of conditions for healthy growth of seedlings to include water Clearly stated hypothesis Accurate understanding of fair test and its application Appropriate control identified Accurate record of steps and observations Conclusion drawn is based on analysis and interpretation of observations and findings Report template accurately completed to include all appropriate headings

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Explain what happens to plants during a drought. Research to find out and explain how desert plants are able to survive with very little water. Present findings to class using creative ways. Place an interesting bit of information/picture about desert plants in their portfolio.		Presentation contains accurate information and satisfies other given criteria
In groups, provide evidence of the presence of water in plants by wrapping a plastic bag around the shoot of a potted plant and tying it at the stem. Leave plant in the sun for about two hours and record observations. (Droplets of liquid should appear on the inside of the plastic bag). Test the liquid for water using blue cobalt chloride paper. Write an explanation of their observations and draw an evidence- based conclusion. Answer the questions: • How do plants obtain water and for what purposes do they use water? • How do plants contribute to the water cycle?	Collaborate, observe, explain, think critically - investigate, infer, draw conclusions	Relevant and adequate evidence to establish the presence of water in plants supplied in explanation Conclusion based on evidence Correct answers to questions supplied
In groups, provide evidence of the presence of water in animals by exhaling on the smooth surface of a small mirror. Record and explain their observations. Use observations to formulate a conclusion. Share and discuss their findings with the class. Research to find out what percentage of the human body constitute water.	Collaborate, observe, explain, think critically - investigate, infer, draw conclusions	Relevant and adequate evidence to establish the presence of water in plants supplied in explanation Conclusion based on evidence
Brainstorm the answers to the questions: • How can the presence of water on the grass early in the morning, when there was no rain, be explained? • From where does the water on the grass come? • What is this water called? • Besides the grass, where else can dew be seen and when can it be observed?	Communicate, explain, collaborate, think critically – apply, infer	

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: In groups, collect two drinking glasses. Place ice cubes in one glass and tap water into the other. Record and explain observations. Share explanations with class. Use their findings to write an explanation of the formation of dew.	Communicate, explain, observe, collaborate, think critically – apply, infer	Correct application of a model to explain condensation and to account for the presence of dew on the grass early in the morning correct explanation of dew formation
In groups, investigate the causes of water pollution in the community. Present findings to class using a variety of mediums (posters, digital story, booklet etc.). Compare a beaker of pure bottled water with turbid water and record observations. Share observations with class. Watch the video: **https://www.youtube.com/results?search_query=Flocculation** and answer the questions: • Why could turbid water be unsafe for drinking? • How can turbid water be made clear? In groups, place a teaspoon of alum in some water and stir. Leave for a while and observe. Record and explain observations. (This process is called "flocculation.") Construct a logical explanation for flocculation, using information from the practical activity and the video. Find out and explain how this process is used in large scale purification of water at water treatment plants.	Collaborate, communicate, explain, observe, record, define, think critically - compare, research, create, investigate	Causes of water pollution correctly identified and findings presented in a suitable format Presentations satisfy other given criteria Evidence of group collaboration Logical explanation of flocculation

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Provide evidence for the presence of water in the tissues of plants and animals
- ✔ Explain the importance of water for survival of organisms
- ✔ Explain the formation of dew
- ✔ Use model accurately to explain the process of flocculation
- ✔ Work systematically and safely keeping work area clean and uncluttered

Points to Note

- Use digital graphic organisers to structure, analyse and evaluate information and aid problem solving as far as possible
- Help students develop research skills by consulting encyclopaedias, using the internet etc.
- Recognise some of the dangers associated with internet use and demonstrate safe online behaviours
- Develop students' vocabulary by requiring them to write, spell, define and use related science words in simple sentences after each activity.
- Where students are unable to write a laboratory report, allow them to continue using a template until they can do so on their own.
- Differentiate activities as much as possible where necessary.
- Emphasize the development of the key skills, especially the critical thinking skills, as students carry out the cited activities and record students' progress as they work to develop these skills.
- It is not necessary to assign a grade to every piece of assessment.
- Ensure however, that assessment data is recorded appropriately.

Extended Learning

Find out how desert animals survive in arid environments and present findings in creative ways.

RESOURCES

Seedlings, teacher prepared scientific method template, plastic bag, potted plant, string, mirror, drinking glasses, teaspoon, alum, ice cubes, turbid water, cobalt chloride paper, computers, internet

KEY VOCABULARY

Fair test, experiment, control, independent and dependent variables, hypothesis, dew, turbidity, flocculation

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LINKS TO OTHER SUBJECTS

Information Technology, Social studies

ABOUT THE UNIT

In this unit students will employ the process of scientific inquiry to explain some properties of air and how these properties contribute to its usefulness in different aspects of life. Students explore the relationship between air pressure and the functioning of the human lungs in breathing and, its application in the design of simple technology that improve our lives. They will use research skills in discovering information about air and use this information to provide answers to questions designed to clarify their understanding of the properties of air.

RANGE OF CONTENT

- The key concepts and knowledge students will learn in this unit are:
- The use of scientific inquiry to explore issues related to the properties and use of air in the environment
- The use of practical activities to explain that air is real, occupies space and exerts pressure which is vital for the mechanism of breathing and ultimately life
- The synthesis of evidence-based explanations of how air pressure is used in everyday life, for example, drinking from a straw
- Methods of scientific investigations and their suitability for identified problems

GUIDANCE FOR THE TEACHER

Science is more than just a body of knowledge. It is a process of inquiry and therefore constitute a set of process and cognitive skills and attitudes which are all used in the construction of scientific knowledge and understandings of the natural world and how it works. It allows for an appreciation of the environment and how to use it in sustainable ways. An inter-disciplinary approach is intended to allow for students to make links between science and Mathematics, Technology, Engineering and English language. A variety of teaching strategies is required to allow for students to get involved in learning experiences which are in keeping with their preferred learning styles, as they learn how to learn and acquire the intended outcomes of learning.

Prior Learning

Check that students can:

- Explain how a scientist works.
- List the components of air.

INVESTIGATING AIR

ATTAINMENT TARGET(S):
Demonstrate an understanding of the scientific process, and the impact of air and water on the environment, and on our everyday life.

Demonstrate positive interpersonal skills in order to foster good working relationships.

Theme: Exploring science and the environment

Topic: Properties of Air and its importance of to life
Duration: 7.5 hours/3 weeks

OBJECTIVES

Students will:

- Demonstrate the concept, "air occupies space".
- Demonstrate that air exerts pressure.
- Use a model of the thoracic cavity and lungs to demonstrate the use of air pressure in breathing.
- Explain how we use air pressure to drink from a straw.
- Show safety consciousness for self and others when doing practical activities.

ICT ATTAINMENT TARGETS:

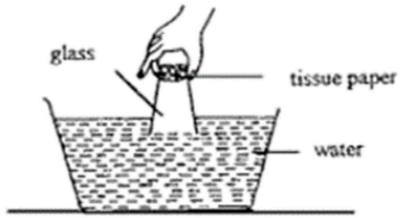
COMMUNICATION AND COLLABORATION - Use technology to communicate ideas and information, and work collaboratively to support individual needs and contribution to the learning of others.

RESEARCH, CRITICAL THINKING, PROBLEM-SOLVING AND DECISION MAKING - use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems, and make informed decisions.

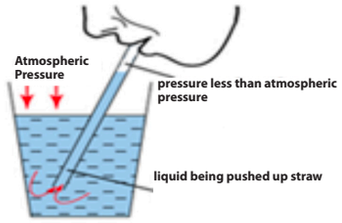
DESIGNING AND PRODUCING - use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DIGITAL CITIZENSHIP - Recognise the human, ethical, social, cultural and legal issues and implications surrounding the use of technology and practice online safety and ethical behaviour.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Push a piece of tissue right down to the bottom of a glass. Insert the glass vertically to the bottom of a container filled with enough water to completely cover it when submerged. Predict what will happen to the tissue. Remove the glass from the container by pulling it straight up without tilting it. Examine the tissue. Record their observation and write an explanation of it. Draw a logical, evidenced-based conclusion. Re-examine their prediction and modify if necessary. Answer the questions: • What do the findings reveal about where air can be found? • What is a vacuum, where can it be found and in what ways are they useful?	Manipulate, observe, record, communicate, collaborate, report, think critically - predict, investigate, infer, analyse, interpret, draw conclusions	Plausible predictions Accurate record of observation Logical explanation of observation Conclusion based on evidence



Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Examine a plastic bottle that has a balloon filled with water in it. Brainstorm ideas to explain how the balloon with water got into the bottle. Test at least one of the ideas to determine if it works (e.g. try pushing a balloon filled with water into an empty plastic bottle). Insert a deflated balloon into a plastic bottle and secure the mouth of the balloon over the opening of the bottle. Predict what would happen air is blown into the balloon. Blow air into the balloon. Record and explain observations. Punch a small hole about 4 cm above the base of another plastic bottle. Insert the same balloon used previously inside bottle and secure over opening of bottle. Blow air into the balloon. Record and explain observations. Place finger over the hole at the base of the bottle and blow into the balloon again, then remove finger from the hole. Record and explain observations. Place lips over hole at the base of bottle and take in several small breaths (inhale). Record and explain observations. Participate in a teacher led discussion of their observations and explanation of these observations. Demonstrate how they would get water into the balloon in the plastic bottle with the hole. Watch the video: **https://www.youtube.com/watch?v=Grziaq-caVE** which illustrates that air occupies space to clarify their understanding of the concept, air occupies space.	Manipulate, observe, record, explain, communicate, collaborate, report, think critically - predict, investigate, infer, analyse, interpret, draw conclusions	Successfully follows instructions Plausible predictions Accurate record of observation Logical explanation of observations Successfully applies knowledge to get water into balloon in bottle
Fill a glass to the rim with water. Place a square of cardboard over the top of the glass. Hold the cardboard against the glass and turn the glass upside down. Record and explain observations. Answer the questions: • How does this investigation show that air exerts pressure? • Where is the pressure being exerting? • What is atmospheric pressure?  Watch the video: **https://www.youtube.com/watch?v=axbFowsp4g** which explains air pressure.	Communicate, collaborate, manipulate, observe, record, report, think critically - investigate, infer, analyse	Effective manipulation of apparatus to demonstrate air pressure Accurate observation and interpretation of observation

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: In groups, carry out the investigation using the Scientific Method. Use a prepared template to write a laboratory report about the investigation.	Observe, record, report, think critically - investigate, analyse	Effectively carries out the steps of the Scientific Method to complete investigation Template correctly completed
Fill a clear glass with water. Place a drinking straw into the glass of water, cover opening of straw with mouth and suck on it. Join five or six straws with tape and repeat investigation (Attach straws by splicing and securing with tape). Make a prediction about what is likely to happen. Record observations. Explain observations without using the term 'suck'. Explain how atmospheric pressure enables us to drink from a straw. Identify and explain everyday life situations where air pressure is used. Include one such situation in their portfolio.  	Communicate, manipulate, observe, record, explain, think critically - predict, investigate, draw conclusion	Accurate observation, interpretation and explanation of observations Accurate explanation of the use of air pressure in practical, familiar situations
Watch the videos which describes aspects of the mechanism of breathing. **https://www.youtube.com/watch?v=5JrON_sm5gc&index=3&list=PL1lVFP-k_im8UXhAPQnYx-Q5591TLMYQdE** **https://www.youtube.com/watch?v=Y_5tkl_askY&list=PL1lVFP-k_im8UXhAPQnYxQ5591TLMYQdE&index=2** Obtain from the internet or other source, a picture of the ribcage showing the location of the lungs, diaphragm and windpipe. Breathe in, placing your hand on your chest and feel the ribcage move upward and outward. Breathe out and observe what happens to the rib-case. Explain what happens to the ribcage when you breathe in and out. Answer the question: What happens to the diaphragm when you breathe in and out?	Observe, explain	Responsible and efficient use of the internet to collect picture. Correct explanation of breathing

Suggested Teaching and Learning Activities

Students will:
Watch the video:
https://www.youtube.com/watch?v=I_auLy036U8 to answer the question: What role does air pressure play in the mechanism of breathing?

In small groups, suitable materials (e.g. plastic bottle with cover, straws, balloons, tape) to build a model of human respiratory system (trachea, bronchioles, lungs, diaphragm, ribcage). Use the model to explain the breathing mechanism to the class. Pull the diaphragm downwards and observe what happens. Let go of the diaphragm and observe what happens. Record and explain your observations. Use the model to explain what happens to the air pressure in your lungs when you breathe in and out? Compare the model with the thoracic cavity and create a concept map to explain the mechanism of breathing in humans and the role of air pressure in the process. Take pictures of model and insert in portfolio.

Key Skills

Collaborate, communicate, explain, observe, record, demonstrate, think critically – create, compare, analyse, synthesize

Assessment Criteria

Model accurately represents named structures of respiratory system

Accurate use of model and concept map to explain the mechanism of breathing and the role of air pressure in this process

Work methodically and safely

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Explain how the properties of air contribute to its usefulness
- ✔ Use a model to explain air pressure
- ✔ Use the internet to collect and edit images

Points to Note

- When doing practical activities, constantly ensure that students show regard for the safety of themselves and for others.
- Do not attempt to delve into elaborate explanations or demonstrations of air pressure. Only a simple treatment is required.
- Only a simple explanation of the role air pressure plays in helping us drink from a straw is necessary.
- Ensure that drinking straws are not shared by students. Each student should use a separate, clean straw during activity.
- Develop students' vocabulary by requiring them to write, spell, define and use related science words in simple sentences after each activity.

Extended Learning

Research to find out a variety of ways by which air pressure is used (e.g., in wheels of vehicles and the pressure cooker).
Research to find out the instrument used for measuring air pressure and plan, design and construct a model of the instrument.
Explain the history of the invention of this instrument and state which scientist uses it and for what purpose.

Points to Note

- Differentiate activities as much as possible where necessary.
- Emphasize the development of the key skills, especially the critical thinking skills, as students carry out the cited activities and record students' progress as they work to develop these skills.
- Review students' portfolio regularly and offer feedback. Selected entries in the portfolio may be assessed to determine attitudes, development of certain skills, conceptual understanding or views about various learning tasks.
- Air pressure videos:

https://www.youtube.com watch?v=TKMKKOV7xhM
https://www.youtube.com/watch?v=o9lwghOHL5E

Extended Learning

Find out how desert animals survive in arid environments and present findings in creative ways.

RESOURCES

Materials for making a model of the lung – 2 bell jars (or firm plastic or glass bottles), plastic tubing, balloons;
large contain (basin), water, plastic cups, tissue, straws, cardboard computers, Internet

KEY VOCABULARY

Air pressure, vacuum, breathing, lung, diaphragm, trachea, ribcage, vacuum

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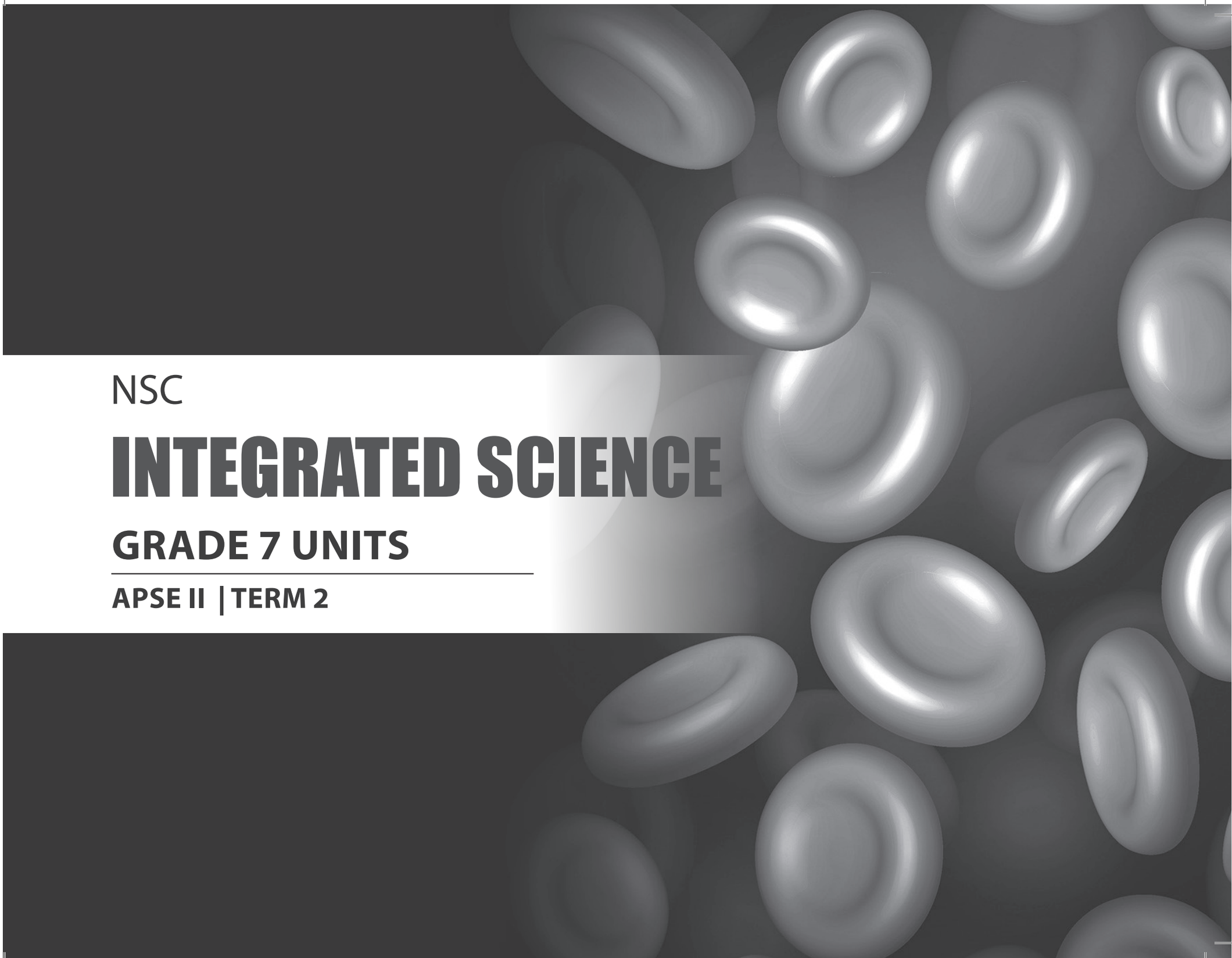
LINKS TO OTHER SUBJECTS

Mathematics, Information Technology



NSC

INTEGRATED SCIENCE

GRADE 7 UNITS

APSE II | TERM 2

ABOUT THE UNIT

In this unit, students will learn that the cell is the unit of structure of all living organisms and is responsible for the life sustaining processes. For cells to carry out their life sustaining functions in humans, they are organized hierarchically as cells, tissues, organs and organ systems. Students, through research and exploratory activities will take a close look at actual cells, create representative drawings and models of them and demonstrate an understanding of how they are organised into groups to form the more complex structures that work together to keep us alive. They will examine diagrams and study a range of specialised animal cells and relate the changes in their structure to their specific functions.

RANGE OF CONTENT

The key concepts, skills and knowledge students will learn in this unit are:

- The cell is the unit of structure and function of living organisms
- Cells are organized as tissues, organs and organ systems in organisms
- Cells are specialised to carry out unique functions

GUIDANCE FOR THE TEACHER

1. Cell structures to include only: cell wall, cell membrane, nucleus, vacuole, cytoplasm and chloroplasts and mitochondria.
2. Mitochondria, though not usually visible under the light microscope, should be discussed.
3. Discuss guidelines for making appropriate scientific drawings.
4. Models of cells can be exhibited as a mini expo in which all Grade 7 classes showcase their work.
5. Micro projector/multimedia projector may be used to support teaching of cells/cell structure (particularly for students with poor/ limited manipulative skills or in cases where classes are too large for the number of available microscopes).

Prior Learning

Check that students can:

- Recall the characteristics of living things
- Identify organs and organ systems of plants and animals

THE CELL AS THE BASIC UNIT OF LIFE

ATTAINMENT TARGET(S):
Understand the importance of the life processes and body systems, health and well-being.

Theme: Living Things and Life Processes

Topic: Cell structure, function and organization
Duration: 7.5 hours/3 weeks

OBJECTIVES

Students will:

- List and explain the life processes.
- Define the cell as the basic unit of structure and function of living organisms.
- Examine plant and animal cells using the light microscope.
- Construct a model of a typical animal cell to show its structure.
- Relate selected cell structures to their function.
- Outline the hierarchical relationship between cells, tissues, organs, organ-systems and organisms.
- Identify examples of simple specialized cells and explain how they are structurally adapted to perform their function.
- Draw and label diagrams of the blood and sperm cells.
- Work collaboratively in groups.

ICT ATTAINMENT TARGETS:

COMMUNICATION AND COLLABORATION - Use technology to communicate ideas and information, and work collaboratively to support individual needs and contribution to the learning of others.

RESEARCH, CRITICAL THINKING, PROBLEM-SOLVING AND DECISION MAKING - use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems, and make informed decisions.

DESIGNING AND PRODUCING - use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DIGITAL CITIZENSHIP - Recognise the human, ethical, social, cultural and legal issues and implications surrounding the use of technology and practice online safety and ethical behaviour.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Watch the video: **https//www.youtube.com/watch?v=1JMT8VAWtEs.** In small groups, use the information from the video to list seven life processes and create posters, charts or PowerPoint presentations to communicate the meanings of each life process. Explain the differences between respiration and breathing; excretion and egestion.	Observe, define, think critically - compare, analyse, create	Accurate list of the seven life processes Posters and charts are attractive and convey correct information Accurate comparison of the pairs of life processes

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Watch the video: **https://www.youtube.com/watch?v=MfopLillOeA**. List the various parts of a typical animal cell and link each part to the life process which it carries out. Use suitable materials to construct a model of a typical animal cell. Take a picture of model, insert in portfolio and label. Display the models in classroom. Write a simple explanation of the meaning of the concept "The cell is the basic structure of an organism." View picture of a Rhoeo plant (Purple water grass) cell as seen under the light microscope or a digital graphic display and identify the different parts of the cell. Visit different work stations in the classroom, each set up with a specimen of the Rhoeo plant and a magnifying instrument (e.g. binoculars, spectacles, hand lens, microscope). View the specimens and select the best instrument for observing the cells in the specimens. Use examples to show the hierarchical relationships from cell to organism. Create posters to demonstrate the hierarchical relationship from cells to organism. Make an entry in portfolio under the heading, 'Am I Understanding This Topic".	Observe, think critically - create, evaluate, analyse, synthesize, reflect	Correct list of the various parts of an animal cell Model accurately represents the cell Explanation indicate understanding of the concept Appropriate instrument selected Correct sequencing to show hierarchical relationship Posters reflect accurate information
Make a simple microscope using a thin piece of wire and petroleum jelly. Twist the ends of the wire to form a loop then wipe petroleum jelly around loop. Dip loop in water so that a drop is formed (this is a water drop lens). Use the water drop lens to read writing on a page. Explain the importance/usefulness of microscopes in the study of cells.	Manipulate, communicate, observe, think critically - create	Instructions accurately carried out Water drop lens works
Research and list the systems in the human body. Find out by navigating digital content on websites and storage devices, the organs which compose the systems in the human body (digestive, circulatory, respiratory, excretory, reproductive, skeletal, nervous systems). Tabulate the findings. Make drawings to show examples of specialized cells (e.g. sperm cell and blood cell). Illustrate how these cells are similar to and different from the typical animal cell. Explain how their structures are adapted for the functions they perform.	Observe, record, draw, communicate, think critically - analyse, research, apply	Table constructed accurately and according to given criteria Accurate record of content Drawings accurately represent information and satisfy given criteria

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Define the cell as the basic unit of structure and function of organisms
- ✔ Make labelled drawings of specialised animal cells
- ✔ Explain how selected specialised cells are similar to and different from a generalised animal cell
- ✔ Describe the hierarchy of cellular organisation in an organism
- ✔ Collect, edit, organize and represent information from the internet
- ✔ Organize data in tables
- ✔ Create multi-media presentations to communicate information

Points to Note

- Examples of tissues, organs and organ systems that should be considered include:
  Animal tissue - blood
- Animal organs- sense organs, stomach, heart, lungs, kidney, ovaries, testes
- Use word processing software to create table
- Examples of selected specialised cells - red blood cells, sperm, ovum, guard cells
- Drawings should be done in pencil only; label lines - no arrow heads and do not cross each other; title below diagram in capitals and underlined; Labels - written in script entirely in lower case
- Develop students' vocabulary by requiring them to write, spell, define and use related science words in simple sentences after each activity.
- Where students are unable to write a laboratory report, allow them to continue using a template until they can do so on their own.
- Differentiate activities as much as possible where necessary.
- Emphasize the development of the key skills, especially critical thinking skills, as students carry out the cited activities.

Extended Learning

Survey the history of the microscope. Research tissue culture as it relates to agriculture. Critique the use of tissue/organ transplants in the health services. Research to find out about 'Cancer as a disease resulting from cell malfunction'.

RESOURCES

Computer, multimedia projector, graphic organizer software, CDs/DVDs, videos, Rhoeo leaves, petroleum jelly, wire to make loop for water drop lens, microscope/hand lens

KEY VOCABULARY

Cell wall, cytoplasm, cell membrane Organelles - chloroplast, nucleus, vacuole, mitochondria hierarchy, tissue, organ, organ-system, organism, microscope, specialisation, multicellular organisms, life processes, lens

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LINKS TO OTHER SUBJECTS

Information Technology

ABOUT THE UNIT

Students will explore the concept of diffusion as the net movement of particles from a region where they are in large amounts to a region where they are in smaller amounts. They will watch a video of the process and observe its real-life occurrence through practical activities on diffusion between liquids (syrup and water); a solid and a liquid (potassium permanganate and water) and between gases (perfume vapour and air) and garner evidence for the construction of a definition for diffusion. Students will apply their understanding of diffusion to explain the exchange of materials between the alveoli and the blood capillaries and infer the importance of diffusion to the life of organisms.

RANGE OF CONTENT

The key concepts, skills and knowledge students will learn in this unit are:

- Substances move into and out of cells by diffusion
- Diffusion occurs between a solute and a solvent
- Diffusion can also occur between gases and liquids
- It is the process by which materials are exchanged between a cell and its environment

GUIDANCE FOR THE TEACHER

It is expected that ample opportunities will be provided for encounter with the concept in ways that allow students to discover the critical attributes to be used for the construction of accurate/scientific definition. Further encounter with the concept can be facilitated through use of the following video, if necessary:

http://highered.mheducation.com/sites/0072495855/student_view0/chapter2/animation__how_diffusion_works.html

Prior Learning

Check that students can:

- Recall the life processes.
- Recall the basic function of the cell membrane, cytoplasm and vacuole.

DIFFUSION

ATTAINMENT TARGET(S):
Demonstrate understanding of the importance of the life processes and body systems, health and well-being.

Theme: Living Things and Life Processes

Topic: Diffusion
Duration: 7.5 hours/3 weeks

OBJECTIVES

Students will:

- Investigate the process of diffusion
- Construct a definition of diffusion
- Explain the importance of the process of diffusion to the survival of the cell
- Explain the importance of diffusion to the survival of organisms
- Identify and explain examples from everyday life situations, diffusion between liquids, gases and dissolved solutes

ICT ATTAINMENT TARGETS:

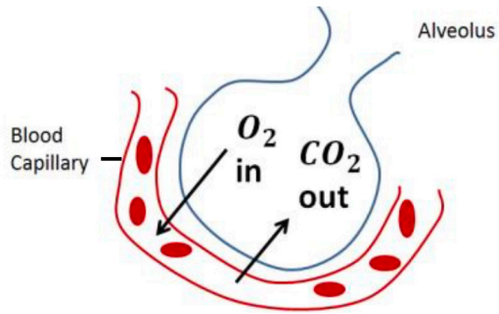
COMMUNICATION AND COLLABORATION - Use technology to communicate ideas and information, and work collaboratively to support individual needs and contribution to the learning of others.

RESEARCH, CRITICAL THINKING, PROBLEM-SOLVING AND DECISION MAKING - use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems, and make informed decisions.

DESIGNING AND PRODUCING - use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DIGITAL CITIZENSHIP - Recognise the human, ethical, social, cultural and legal issues and implications surrounding the use of technology and practice online safety and ethical behaviour.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Watch the video: **https://www.youtube.com/watch?v=55CPfc9ij48** which demonstrates diffusion. Observe the direction of movement of the colour and describe it. Discuss, in small groups, answers to the question: What does the movement of the colour indicate? Use information from the video to explain the concept of diffusion.	Observe, communicate, explain	Accurate definition of diffusion as the movement of a substances from an area of high concentration to an area of low concentration
In groups, half fill a beaker with water. Predict and record what will happen when a crystal of potassium permanganate/drop of ink or food colouring is added to the water and left for some time. Drop a crystal of potassium permanganate (one drop of ink or food colouring or other suitable substance) to one side of the beaker of water. Make sketches of observations at the beginning and at 15-minute intervals to the end of the class. Describe what happened to the potassium permanganate crystal (food colouring or drop of ink). How does this compare with what was observed in the video?	Observe, record, draw, think critically - predict, investigate, compare, draw conclusions	Acceptable explanation of the process of diffusion in relation to activity Accurate drawings Acceptable explanations of what happened to the particles of the substance (potassium permanganate/ink, etc.)

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: In groups, plan and carry out an investigation to show diffusion between liquids (e.g. syrup and water; allow students to choose the liquids they would like to investigate). Make predictions and use a template to write a simple report of the investigation. Take pictures of the different stages of their investigation, place in portfolio and annotate. Present findings to the class.	Observe, collaborate, communicate, record, report, annotate think critically – predict, plan and design, investigate	Investigation plan includes all steps in the scientific method and identifies a fair test where necessary Logical predictions Presentation clearly outlines procedures followed and includes an explanation of diffusion in liquids
Indicate the point at which they were able to detect the smell of perfume/air freshener sprayed at the back of the classroom by a fellow student. Describe the scent of the substance, including its strength, and explain why they were able to smell the perfume from the front of the room (e.g. Where is the scent strongest? Why?) Describe their understanding of the process of diffusion in relation to the activity. Write a simple explanation using specific and appropriate scientific terms and report to class.	Observe, explain, record, communicate	Accurate explanation of diffusion between gases
Watch the video: **https://www.youtube.com/watch?v=2AXC2iU4biQ** about diffusion in cells. Participate in a discussion on this video and explain why it is important for substances to move in and out of cells. Give examples of some of the substances which move by diffusion.	Observe, explain	
In groups, use this diagram of the alveolus and blood capillary to explain how diffusion allows for the exchange of gases in the alveoli of the lungs and the blood.  	Collaborate, communicate, observe, explain, think critically - analyse, apply, create, reflect	Correct application of knowledge to explain how gases are exchanged between blood capillary and alveolus

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Discuss the importance of this process to human life. Use the internet to find relevant information on at least two other situations where diffusion occurs in the human body. Use posters/charts or computer software to present findings to the class. In presentation, help others to understand the importance of diffusion to human life. Watch the first part of the video as reinforcement of understanding of the concept of diffusion: **https://www.youtube.com/watch?v=QXdL2H11up4** Reflect on the questions: What is the purpose of learning about diffusion? What can I do to help me remember what diffusion is? Place the answers to these questions in their portfolio.		Accurate explanation of the importance of diffusion to the life of a cell Posters/charts etc. present findings accurately and clearly

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Explain the importance of substances moving in and out of cells and provide examples of such substances
- ✔ Define and explain the processes of diffusion
- ✔ Demonstrate the process of diffusion using simple materials
- ✔ Describe examples of diffusion in living organisms and briefly explain the importance to the organism's survival
- ✔ Plan and conduct research, using a wide variety of electronic sources e.g. online media, CDs/DVDs

Points to Note

- Before spraying perfume/air freshener, check whether students are allergic to these substances
- Conduct electronic search for different kinds of information e.g. text images, audio and video by using successful search strategies
- Follow guidelines to promote healthy use of ICT tools
- Develop students' vocabulary by requiring them to write, spell, define and use related science words in simple sentences after each activity.
- Where students are unable to write a laboratory report, allow them to continue using a template until they can do so on their own.
- Differentiate activities as much as possible where necessary.
- Emphasize the development of the key skills, especially the critical thinking skills, as students carry out the cited activities.
- It is not necessary to assign a grade to every piece of assessment.
- Ensure however, that assessment data, including qualitative data is recorded appropriately.

Extended Learning

Research to find out the meaning of concentration gradient and explain how this factor affect the rate of diffusion.

Find out which two other factors affect the rate of diffusion and explain this and present your findings using posters, charts or other creative ways to attract attention and effectively communicate accurate information for others to understand.

RESOURCES

Potassium permanganate/food colouring, beakers or other suitable transparent plastic/glass containers, computer, internet, multimedia projector, CDs/DVDs

KEY VOCABULARY

Diffusion, particles, concentration, dilute, selectively permeable

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LINKS TO OTHER SUBJECTS

Physics, Chemistry

ABOUT THE UNIT

Students will explore the concept of osmosis as the net movement of water particles from a region where they are in large amounts to a region where they are in smaller amounts. They will watch a video of the process and observe its real-life occurrence through practical activities to garner evidence for the construction of a definition for osmosis. Students will apply their understanding of osmosis to explain how water enters and leaves the cells of the tissues and its importance for vital chemical reactions of the cells.

RANGE OF CONTENT

The key concepts, skills and knowledge students will learn in this unit are:

- Water moves into and out of cells by osmosis
- Osmosis is a special type of diffusion
- Osmosis allows for the presence of water in cells to facilitate many chemical reactions (e.g. digestion of food) which sustain life
- The process occurs across a selectively-permeable membrane

GUIDANCE FOR THE TEACHER

It is expected that ample opportunities will be provided for encounter with the concept in ways that allow students to discover the critical attributes to be used for the construction of accurate/scientific definition. Further encounter with the concept can be facilitated through use of the following video, if necessary.

http://highered.mheducation.com/sites/0072495855/student_view0/chapter2/animation__how_osmosis_works.html.

Prior Learning

Check that students can:

- Recall the life processes.
- Recall the basic function of the cell membrane, cytoplasm and vacuole.

OSMOSIS

ATTAINMENT TARGET(S):
Understand the importance of the life processes and body systems, health and well-being.

Theme: Living Things and Life Processes

Topic: Osmosis
Duration: 8 hours/3 weeks

OBJECTIVES

Students will:

- Investigate the process of osmosis
- Construct a definition of osmosis
- Explain the importance of the process of osmosis to the survival of the cell
- Explain the importance of osmosis to the survival of organisms
- Identify and explain examples of osmosis in everyday life situations
- Compare diffusion with osmosis

ICT ATTAINMENT TARGETS:

COMMUNICATION AND COLLABORATION - Use technology to communicate ideas and information, and work collaboratively to support individual needs and contribution to the learning of others.

RESEARCH, CRITICAL THINKING, PROBLEM-SOLVING AND DECISION MAKING - use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems, and make informed decisions.

DESIGNING AND PRODUCING - use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DIGITAL CITIZENSHIP - Recognise the human, ethical, social, cultural and legal issues and implications surrounding the use of technology and practice online safety and ethical behaviour.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Watch the video which describes diffusion and osmosis: **https://www.youtube.com/watch?v=QXdL2H11up4** Write a simple definition for osmosis. Use information from the video to answer the questions: • Which substance is involved in osmosis? • What is a selectively-permeable membrane? • Why is the cell membrane considered to be selectively permeable? • What is meant by solute, solvent, low concentration and high concentration of water? • In what direction does water travel during osmosis? • What is meant by net-movement of water molecules?	Observe, communicate, explain, think critically - analyse, research	Correct answers provided to the questions

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Share answers with class. Watch the video: **https://www.youtube.com/watch?v=laZ8MtF3C6M** which explains the importance of osmosis to cells and organisms. Identify and explain some examples of osmosis in everyday life situations (e.g. placing raisins or wilted callaloo in water overnight, keeping the hands in water for an extended period, kidney dialysis etc.)	Think critically - analyse, apply, research	Correct examples identified Accurate explanation of concept of osmosis as it relates to examples identified
In groups, investigate the effects of pure water and strong sugar solution on de- shelled chicken eggs. Make predictions about expected changes that will take place in the appearance of the eggs when submerged in pure water and in a strong sugar solution and left for some time. Take measurements of each egg - mass and circumference (use a string and ruler), then submerge one into the beaker of pure water and the other into the beaker of strong sugar solution. Cover the containers and set aside for 12-24 hours. Construct a suitable table to record the measurements. After 12-24 hours, remove the eggs and rinse in tap water. Measure the circumference and mass of the eggs and record the results in the table. Compare the eggs before and after placing them in the liquids. Explain the changes observed in the eggs in terms of osmosis. Use a template to write a simple laboratory report. Participate in a class discussion about the observations and results.	Think critically - analyse, apply, research Measure, observe, record, explain, communicate think critically - Investigate, predict, compare, apply	Application of the concept of osmosis in explaining observations and results Logical predictions Accurate measurements recorded appropriately Evidence of collaboration
In groups, plan and carry out an investigation to determine the effect of different concentration of sugar solution on potato strips (Include a fair test). Make predictions and write a simple report of the investigation. Present findings to the class.	Observe, collaborate, communicate, record, report, think critically - predict, plan and design, investigate, draw conclusion	Investigation plan includes all steps in the scientific method and identifies a fair test where necessary Logical predictions Presentation clearly outlines procedures followed and includes an explanation of osmosis Logical conclusion based on evidence

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Create a poster, chart, PowerPoint presentation or digital story about the similarities and differences between osmosis and diffusion and, the importance of osmosis to the survival of cells and the organism. Formally share creations with class in timed sessions. Display work in classroom. Reflect on the questions: What is the purpose of learning about osmosis? What can I do to help me remember what osmosis is? Place the answers to these questions in their portfolio.	Communicate, collaborate, think critically - research, create, reflect	Accurate information presented in Poster/chart/ digital story or PowerPoint presentation and satisfy given criteria Oral presentations satisfy given criteria (e.g. those criteria outlined on a presentation rubric)

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Explain the concept of osmosis as involving the net movement of water molecules from a region of high concentration of these molecules to a region where the molecules are lower in concentration
- ✔ Demonstrate osmosis using simple materials
- ✔ Explain the importance of osmosis to the survival of the cell and to the life of the organism
- ✔ Distinguish between osmosis and diffusion

Points to Note

- To prepare de-shelled eggs - place them in 300-500 cm3 dilute hydrochloric acid (HCl) or vinegar (acetic acid) in a beaker/suitable container overnight or until the shell of the eggs are fully dissolved. Ensure the eggs are fully submerged in the HCl (rest a small beaker of water over the eggs to prevent floatation). Carefully, using tongs/ spoon, remove the eggs and rinse them properly in tap water. Dispose of the HCl. The eggs are now ready for use by students. Remind them to handle the eggs gently and carefully.

Extended Learning

Research the applications of osmosis in every-day life using the following examples:

- How do fish and other forms of marine life survive in a salt-water environment?
- The use of osmosis in food preservation–e.g. salting, pickling, sugar curing.
- The effects of excessive use of chemical fertilisers on plants (woody and herbaceous).
- The effect of osmosis on red blood cells.

Points to Note

- Students should be given enough time to create their presentations (some parts may be done outside of class time).
- Incorporate opportunities for students to assess themselves and their peers.
- Dispose of acids safely.
- Ensure that students wash their hands after handling eggs and acids.
- Develop students' vocabulary by requiring them to write, spell, define and use related science words in simple sentences after each activity.
- Where students are unable to write a laboratory report, allow them to continue using a template until they can do so on their own.
- Differentiate activities as much as possible where necessary.
- Emphasize the development of the key skills, especially the critical thinking skills, as students carry out the cited activities and assess for the development of these skills.
- It is not necessary to assign a grade to every piece of assessment. •
- Ensure however, that assessment data, including qualitative data is organised and recorded appropriately.

Extended Learning

RESOURCES

Eggs, sugar solution, vinegar/hydrochloric acid, Irish potatoes, hand towels, tongs/spoons, beakers/suitable containers
Computers, Internet, speaker, multimedia projector, demonstration video, CDs/DVDs

Video: https://www.youtube.com/watch?v=zuNMVzTeCtw

KEY VOCABULARY

Solution, solute, solvent, permeable, selectively-permeable, net-movement, osmosis, diffusion, concentration

LINKS TO OTHER SUBJECTS

Mathematics, Language Arts

NSC

INTEGRATED SCIENCE

GRADE 7 UNITS

APSE II | TERM 3

ABOUT THE UNIT

In this unit, students will explore energy conversions through a variety of hands-on activities. They will classify energy forms and examine the need for alternative energy solutions in Jamaica and the Caribbean. They will be provided opportunities to demonstrate the efficient use of energy and energy conservation practical applications.

RANGE OF CONTENT

The key concepts, skills and knowledge students will learn in this unit are:

- Energy forms and conversions
- The concept of energy in foods and calories as its unit of measurement
- Renewable and non-renewable sources of energy; their importance and advantages and disadvantages in their use

GUIDANCE FOR THE TEACHER

Science is a body of knowledge, as well as skills and attitudes that helps man to understand, appreciate and make use of his environment in a sustainable way. The unit is intended to be delivered in such a way as to allow students to experience and acquire a holistic concept of science as a process of enquiry.

Prior Learning

Check that students:

- Know that energy is the ability to do work.
- Know some forms and sources of energy.

FORMS OF ENERGY

ATTAINMENT TARGET(S):
Understand the importance of energy in our everyday life, and the need for grouping things.

Theme: Energy and Matter

Topic: Forms and sources of Energy
Duration: 7.5 hours/3 weeks

OBJECTIVES

Students will:

- Define energy.
- Identify and explain each form of energy (e.g. thermal, solar, chemical, electrical, mechanical) and list their sources.
- Investigate energy transformations (potential and kinetic).
- Investigate chemical energy in food and explain the term calorie.
- Distinguish between renewable and non-renewable sources of energy.
- Identify advantages and disadvantages of renewable and non-renewable sources of energy.
- Explain what is meant by 'alternative energy sources.'

ICT ATTAINMENT TARGETS:

COMMUNICATION AND COLLABORATION - Use technology to communicate ideas and information, and work collaboratively to support individual needs and contribution to the learning of others.

RESEARCH, CRITICAL THINKING, PROBLEM-SOLVING AND DECISION MAKING - use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems, and make informed decisions.

DESIGNING AND PRODUCING - use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DIGITAL CITIZENSHIP - Recognise the human, ethical, social, cultural and legal issues and implications surrounding the use of technology and practice online safety and ethical behaviour.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Watch the video: **https://www.youtube.com/watch?v=wMOpMka6PJI** and discuss the meaning of the term''energy.'Write a definition for energy. Identify at least five forms of energy and give an example of each. Using information from the video, explain each form of energy (thermal, solar, chemical, electrical and mechanical) and give examples of each in everyday situations. Record their findings in creative ways.	Collaborate, communicate, record, define	Accurate definition given for energy and, mechanical energy Correct examples given for forms of energy identified
Be given rubber bands and asked to hold and stretch them as tightly as possible without breaking. Then let go of the rubber bands -- pointing them at the wall and not at each other. In groups or pairs, discuss the activity and state whether or not the elastic bands possessed energy when stretched and when moving. Share and discuss their thoughts with the class. (Teacher should use the opportunities provided by the class discussions to introduce the terms kinetic energy and potential energy.) As a class, formulate a simple working definition for kinetic and potential energy. (Teacher should build awareness only; no formal definitions of, or formulae for kinetic energy and potential energy should be introduced.) Classify energy forms given, as kinetic and potential.	Communicate, collaborate, define, think critically – classify, investigate, evaluate	Acceptable definitions for kinetic and potential energy Correct classification of energy forms as potential and kinetic

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Plan and carry out simple investigations to further demonstrate and explain potential and kinetic energy and their inter-conversions (e.g. pendulum investigation or the rolling of a ball down a hill). Evaluate their work and make amendments where necessary. Explain mechanical energy. Share work with class.	Communicate, explain, think critically - plan and design, investigate, analyse, evaluate	Investigations give evidence of the use of the scientific method, fair tests and successfully demonstrates potential and kinetic energy
In groups, suggest ways in which we can provide evidence to show that food contains energy. Record suggestions. Brainstorm explanations of a calorie. Use the internet to assist in creating a definition for calorie. Answer the questions - How can the number of calories in food be measured? Why is it important to know how many calories are in various types of food? Watch the video: **https://www.youtube.com/watch?v=nAOkh9dVSqE** which shows a simple way to measure calories in a particular food. Note the materials used, list the procedures and work out the findings. In groups, use this as a guide to plan and carry out an investigation to find out which of two samples of foods contains more energy/calories. Use prepared templates to record investigations.	Explain, define, observe, record, think critically - investigate, research, plan and design	Appropriate evidence to show that food contains energy Work safely; uncluttered work area Instructions carried out safely and correctly Logical, evidenced-based conclusions
In groups, brainstorm the meaning of the terms alternative, renewable and non- renewable energy and, construct definitions for these terms. Tabulate the differences and examples of renewable and non-renewable energy. Create a checklist of actions that can be taken to conserve energy usage at home or school. Evaluate checklist using information from the following video: **https://www.youtube.com/watch?v=wMOpMka6PJI** Use word processing software, PowerPoint, digital stories, charts or posters to present their work on renewable and non-renewable sources of energy, advantages and disadvantages in their use and the need to conserve energy. Record, in a suitable format, their thoughts on the need for conservation of energy and ways in which they resolve to conserve energy at home and at school.	Collaborate, tabulate, define, think critically - evaluate, create, compare, reflect	Accurate meanings of alternative energy sources Correct examples of renewable and non-renewable sources of energy and differences between both Checklist satisfies given criteria Advantages and disadvantages correctly identified

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Explain concept of energy
- ✔ Identify the forms of energy as thermal, solar, chemical electrical, mechanical; list their sources and describe their inter-conversions
- ✔ Define and give examples of non-renewable sources of energy and renewable sources of energy
- ✔ Use a simple activity to demonstrate potential and kinetic energy

Points to Note

- Follow guidelines to promote healthy use of ICT tools.
- Develop students' vocabulary by requiring them to write, spell, define and use related science words in simple sentences after each activity.
- Where students are unable to write a laboratory report, allow them to continue using a template until they can do so on their own.
- Differentiate activities as much as possible where necessary.
- Emphasize the development of the key skills, especially the critical thinking skills, as students carry out the cited activities.
- It is not necessary to assign a grade to every piece of assessment.
- Ensure however, that assessment data, including qualitative data is recorded appropriately.

Extended Learning

Research the use of alternative energy in Jamaica and the Caribbean. Describe ways in which alternative energy is harnessed.

RESOURCES

Energy conversion devices, e.g. flashlights, buzzers, radios, computer, Internet, multimedia projector, word processing and multimedia software, videos, CDs/DVDs

KEY VOCABULARY

Renewable, non- renewable, alternative, conservation, transformation, energy, calorie

LINKS TO OTHER SUBJECTS

Technical Vocational Education

ABOUT THE UNIT

In this unit, students will learn about matter and the particulate nature of matter. They will also be exposed to information about different states of matter and investigate the effect of heat on matter.

RANGE OF CONTENT

The key concepts, skills and knowledge students will learn in this unit are:

- Matter is made up of tiny particles, has mass and occupies space.
- The three states of matter (solid, liquid and gas) differ in terms of arrangement and movement of particles.
- Matter can change state from one to another depending on the absorption or release of heat energy.
- Processes involved in changing the state of matter include melting, freezing, evaporation and condensation.

GUIDANCE FOR THE TEACHER

Science is more than just a body of knowledge but also constitutes a set of process and cognitive skills and attitudes which are all used in the construction of scientific knowledge and understandings of the natural world and how it works. An inter-disciplinary approach is intended to allow students to make links between Science, Mathematics, Technology, Engineering and English Language. A variety of teaching strategies is required to allow students to get involved in learning experiences which are in keeping with their preferred learning styles. It is important to teach starting from what students know and experience and then move into the unknown.

Prior Learning

Check that students:

- Know that matter is all around them.
- Know that matter is made of tiny particles.

PHASES OF MATTER: SOLIDS, LIQUIDS AND GASES

ATTAINMENT TARGET(S):
Demonstrate understanding of the importance of energy in our everyday life, and the need for grouping things.

Theme: Phases of Matter: Solids, Liquids and Gases

Topic: Matter and change of state
Duration: 7.5 hours/3 weeks

OBJECTIVES

Students will:

- Classify materials as solids, liquids and gases.
- Demonstrate that solids and liquids are made up of tiny particles.
- Compare the three states of matter in terms of physical properties, energy of particles and strength of attractive forces.
- Illustrate in creative ways the differences in the arrangement of particles in solids, liquids and gases.
- Investigate how matter changes state.
- Formulate a working definition of matter, freezing, melting, evaporation and condensation.
- Show respect for another person's idea.
- Work cooperatively in groups.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: In groups, be given three balloons: one filled with water, one filled with marbles/stones, and one filled with air. Each member of the group will feel the balloons, find the mass and discuss their observations. Describe the materials in each balloon and compare their observations. Record whether the material inside is a solid, liquid or gas. (Teacher should emphasize that most gases are invisible however they may be felt and their effects seen when trapped.) Tabulate the properties of solids, liquids and gases.	Collaborate, manipulate, measure, communicate, make observations	Materials correctly identified as solid, liquid and gas Properties listed for each state are correct Correct mass of objects found
Participate in a class discussion to recap the forms in which water exists. Through teacher-led class discussion, identify ice, water and steam as solid, liquid and gas respectively. View pictures, videos of different materials and group materials under the following: solid, liquid, gas.	Communicate, classify, observe	Materials correctly classified as solids, liquids and gases
In groups, carry out short activities which will help them explain why solids, liquids and gases behave differently, for example: • comparing the masses of identically-sized blocks of two or three different materials such as wood, glass and metal • trying to fit a metal bar into a gauge before and after strong heating • opening a perfume bottle at arm's length • heating one end of a metal rod that has paperclips attached by petroleum jelly • trying to depress the plungers of three sealed syringes, one containing a solid, one a liquid and one a gas Discuss what they observe and try to explain what has happened. Present, describe and explain their observations in a variety of ways to the class. Discuss and compare their own ideas with those of others. (Only a simple treatment of the concept of diffusion is required.)	Manipulate, investigate, observe, communicate, think critically - analyse, classify, compare, draw conclusions	Logical explanations given for observations. Physical properties of different states correctly identified Differences between states of matter accurately determined

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: In groups, grind a stick of chalk into dust and use a hand lens to view the powder and record observations. Observe dust particles in a beam of light. Discuss and make inferences from their observations. Write simple explanations. Share their observations and explanations with the class in a variety of ways.	Manipulate, communicate, collaborate, observe, record, think critically – analyse, infer, make conclusions	Explanations infer that solids and liquids are made up of tiny particles
Watch a video on matter. Share and discuss findings with class to arrive at a common understanding of what is matter. Record what they understand the term matter to mean. (Teacher should emphasize that matter is made of tiny particles, occupies space, and has mass. Do NOT introduce the atom/molecules at this point, unless students mention it.)	Collaborate, communicate, think critically – analyse, define, synthesize	Acceptable definition of matter
Heat a substance such as ice or wax from the solid to the gaseous state and participate in class discussion on the movement and energy of particles. Make annotated diagrams to describe the arrangement and movement of particles in solids, liquids and gases. OR Organize/position objects or class mates to represent the arrangement and movement of particles in solids, liquids and gases. Create a game where students move into positions when each state of matter is mentioned.	Observe, draw, create, communicate, think critically – analyse, infer, apply, draw conclusions	Accurate representations of the states made in diagrams and object arrangements Game accurately differentiates the three states of matter Logical conclusions drawn about movement and energy of particles in the three states
Watch the video: https://www.youtube.com/watch?v=gez2rmeCpfE and, using evidence from the video, discuss in small groups the arrangement of particles in solids, liquids and gases. Explain the differences in arrangements in terms of kinetic energy and inter-particulate forces (with teacher's guidance). Use this knowledge to explain why liquids and gases can flow but solids cannot. Share your explanations with the class. Make adjustments to the explanations where necessary.	Record, communicate, collaborate, think critically – analyse, apply, evaluate Conduct electronic search	Differences between the three states identified in terms of energy of the particles and inter-particulate forces

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Use the following illustration to discuss the precautions to be taken when heating substances in a test tube. Review the rules for working safely in the science laboratory. 	Communicate, think critically - research, create	Stated precautions are applicable to heating substances
Follow teacher's instructions to heat iodine crystals in a test tube. Carefully observe what happens when the crystals are heated and record your observations (draw or take pictures). Explain these observations and share in small groups and with the class. What change of state was demonstrated by heating iodine crystals? Arrive at a consensus and present your findings in writing. Use the following questions to discuss change of state in everyday situations: • Why does water from a ditch disappear after a while? • What is mist?	Manipulate, observe, communicate, collaborate, think critically – analyse, draw conclusions	Manipulate, observe, communicate, collaborate, think critically – analyse, draw conclusions
As recap, view videos showing how matter changes from one state to another. Use information from the video to explain melting, freezing, evaporation, condensation and sublimation. List and provide a working definition for the processes. Represent the processes on a diagram. Construct a table to show the five changes of state; whether it requires heat or gives up heat and give two examples of each from their everyday experiences.	Observe, define, communicate, create, tabulate, think critically – design, analyse, synthesize	Acceptable definition Diagram correctly represents processes Table contains correct information under appropriate headings

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Group materials as solid, liquid and gas
- ✔ Distinguish between the three states of matter in terms of arrangement of particles, energy and attractive forces
- ✔ Identify the processes condensation, sublimation, evaporation, melting and freezing occurring in everyday life situations
- ✔ Show curiosity in exploring matter in the surroundings and question what they find
- ✔ Plan and conduct research, using a wide variety of electronic sources e.g. online periodicals, CDs

Points to Note

- Demonstration to investigate sublimation should be carried out in a well ventilated laboratory/ classroom.
- Recognise some of the dangers associated with internet use and demonstrate safe online behaviours

Extended Learning

Research to find out and present findings in creative ways to explain and illustrate the use of the inter-conversions of the states of matter in the manufacturing and other industries.

RESOURCES

Computer, internet, iodine crystals, heat source, test tube, tongs, test tube holder

KEY VOCABULARY

Solids, liquids, gases, inter-particulate forces, sublimation, evaporation, condensation, melting, dissolving, freezing

LINKS TO OTHER SUBJECTS

Social Studies, Geography, Information technology

ABOUT THE UNIT

In this unit, students will group matter as pure and impure. Students will use experiments to determine the differences in properties of elements, mixtures and compounds. In addition, students will investigate ways of separating impure matter, particularly mixtures.

RANGE OF CONTENT

The key concepts, skills and knowledge students will learn in this unit are:

- Matter can be grouped into pure and impure substances.
- Pure matter contains only one kind of substance (e.g. element and compound) while impure matter contains different kinds of substances (e.g. mixtures).
- Compounds are formed when two or more atoms combine in a chemical reaction.
- Mixtures are formed when two or more elements and/or compounds join physically.
- Mixtures can be solutions, suspensions or colloids.

GUIDANCE FOR THE TEACHER

A variety of teaching and learning strategies is required to provide opportunities for the use of practical hands-on activities which will help students understand these concepts and allow them to get involved in learning experiences that are in keeping with their preferred learning styles. Everyday examples of elements, mixtures and compounds will allow students to relate better to this topic and make it real.

Prior Learning

Check that students:

- Identify a substance that is a mixture

ELEMENTS, MIXTURES AND COMPOUNDS

ATTAINMENT TARGET(S):
Demonstrate understanding of the importance of energy in our everyday life, and the need for grouping things.

Theme: Energy and Matter

Topic: Elements, Mixtures and Compounds
Duration: 7.5 hours/3 weeks

OBJECTIVES

Students will:

- Locate at least 10 elements used in everyday life on the Periodic Table.
- Match selected elements to their respective symbols.
- Demonstrate that a mixture is made up of two or more substances.
- Classify mixtures as solutions, suspensions, and colloids.
- Demonstrate the separation of selected types of mixtures using various techniques.
- Find out what characteristics apply to all elements and define an element.
- Define a compound.
- Classify substances as elements, mixtures and compounds.
- Conduct investigations with due regard to safety.
- Use appropriate scientific language.

ICT ATTAINMENT TARGETS:

COMMUNICATION AND COLLABORATION - Use technology to communicate ideas and information, and work collaboratively to support individual needs and contribution to the learning of others.

RESEARCH, CRITICAL THINKING, PROBLEM-SOLVING AND DECISION MAKING - use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems, and make informed decisions.

DESIGNING AND PRODUCING - use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DIGITAL CITIZENSHIP - Recognise the human, ethical, social, cultural and legal issues and implications surrounding the use of technology and practice online safety and ethical behaviour.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: In groups, read information/view video on Elements in the Periodic Table. Examine different elements provided by the teacher (e.g. aluminium, magnesium, sodium (under oil), sulphur, gold, silver, carbon). Place the selected elements on a Periodic Table. Describe the appearance of each element and compare them. Share descriptions with class. (Teacher should use a Periodic Table that shows pictures of elements.)	Communicate, collaborate, observe	Correct observations noted Elements correctly located Correct descriptions of the selected elements
Participate in teacher led discussion on the representation of elements using symbols. Play online/offline game of match the name with symbol (the names of the elements and their symbols are divided among students). Try to locate the person with matching name or symbol and tag them (Other versions of the game may also be used). Explain their choice.	Communicate, collaborate, explain	Symbols and names correctly matched

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Participate in teacher led demonstration of sub-division of samples of elements previously identified (such as graphite), until further break up cannot take place. Discuss findings with class.	Manipulate, communicate	Atoms identified as building blocks for elements Particles identified as building blocks for matter
Examine structures/materials (LEGO blocks) made from only one kind of brick and others made of several types of bricks. Produce an argument as to which structures represent elements and which do not.	Manipulate, communicate, think critically - evaluate	Argument supported by evidence
Watch the video: **https://www.youtube.com/watch?v=MaZ7lsc5ub8** to find out the basic unit of all elements. Discuss and list the main characteristics of elements and define elements. Share their definition and assess its accuracy.	Define, communicate, observe	Correct definitions of the term element
In groups, mix the materials given, (e.g. sugar and water, oil and water, stones and marbles, sand and rice etc.) and record their observations. Sort the items mixed as solid-solid, solid-liquid or liquid-liquid (e.g. sugar and water is a mixture of solid and liquid) and report to the class. Discuss their understanding of a mixture and how some mixtures differ from others. From their results and the discussions, write a simple definition for the term 'mixture'.	Collaborate, manipulate, observe, communicate, record, classify, define, think critically – investigate	Correct classification of materials as solids, liquids and gases Acceptable definition for mixture given
In groups, add water to each of the substances provided (salt, dirt and oil) and stir for two minutes. Describe the appearance of the resulting mixture in writing and drawing. Share their observations with the class, and in a teacher-led discussion, relate the special features of each type of mixture to the terms: solution, suspension, and colloid. Sort pictures of mixtures provided by the teacher as solution, suspension or colloid.	Collaborate, manipulate, observe, communicate, classify	Pictures correctly classified
In groups, make a mixture of iron filings and sulphur. Observe and describe the elements iron and sulphur. Identify the characteristics of the mixture. Suggest how the elements could be separated. Carry out the separation method and report findings to the class.	Manipulate, collaborate, observe, communicate, think critically – analyse, draw conclusions	Correct observations noted Logical reasons given for choice of method

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: In groups, carry out separation techniques including filtration and evaporation, paper chromatography, simple distillation, sublimation, centrifuging and separating funnel. (e.g. sand and gravel by sifting, sulphur and iron using a magnet, sand and salt by dissolving and filtering, salt solution by simple distillation, oil and water using separating funnel and the colours in black marker/purple Kool Aid using paper chromatography.) In a teacher led discussion, use their results to draw simple conclusions about how the method used to separate a mixture depends on the properties of the components of that mixture and make predictions for setting up further investigations.	Collaborate, observe, manipulate, communicate, think critically – predict, apply, analyse, draw conclusions	Mixtures successfully separated Accurate conclusions drawn Techniques correctly predicted
Analyse everyday scenarios involving mixtures and identify the best way(s) of separating them. For example: Mr Brown was unloading some deliveries at his shop when he tripped and fell. Unfortunately, he dropped some of the deliveries on the floor and they got mixed up. He swept up what he could and put it in a bucket. Can you help him separate the different materials again? The mixture contains: salt, sawdust, paperclips and gravel.	Communicate, think critically - analyse, problem solve	Appropriate separation techniques suggested
View teacher demonstration/video showing the heating of the elements iron and sulphur to form the compound iron (II) sulphide, then record and discuss their observations in groups. Share findings with class and participate in teacher-led class discussion (Teacher guide students to realise that a new substance was formed and that this new substance is an example of a compound). Write down their observations of: The differences between the two elements – iron and sulphur • The differences between the compound and the elements which compose it Alternately, burn magnesium in air to form magnesium oxide (although oxygen cannot be seen). Teacher should guide students that oxygen is used up. Formulate a definition for compounds.	Observe, communicate, collaborate, think critically – analyse, draw conclusions, interpret, define operationally	Accurate information reported on the process observed. Correct differences between the elements and compound given Correct definition of compound given

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Collect labels of ten substances found in the home. From the ingredients given on each label, identify and record the names of two compounds present. Produce a display board with the labels and information extracted. Set up display in science corner.	Observe, communicate, classify, think critically - create	Display is neat with appropriate headings/title and correct information
In groups, label two beakers A and B. Place a mixture of iron and sulphur in beaker A, and the compound Iron (II) sulphide in beaker B, make observations (particle size, colour, attraction to a magnet etc.) then mix each beaker with water, make observations and record findings. Report on findings including written explanations of results, displays or presentations and use the results to suggest improvements and predictions for setting up further tests. After class discussion, formulate a definition for mixtures and state at least two differences between mixtures and compounds.	Collaborate, observe, define communicate, report, think critically - investigate, analyse, compare, draw conclusions	Report contains accurate information on observations Correct definition for mixtures given Two correct differences between mixtures and compounds given
Be given pictures/video/list of different substances. Construct a table with appropriate headings to group the substances as elements, mixtures and compounds, suggesting reasons for the classification.	Communicate, tabulate, think critically - classify, justify	Substances correctly classified as elements, mixtures and compounds Justifiable reasons given for grouping

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Demonstrate knowledge that symbols are used to represent elements in the periodic table
- ✔ Recognize some familiar elements by their symbols
- ✔ Describe what is a mixture
- ✔ Group mixtures as solution, suspension and colloid
- ✔ Separate mixtures using appropriate methods
- ✔ Distinguish between elements, mixtures and compounds
- ✔ Give examples of elements, mixtures and compounds
- ✔ Collaborate and communicate information using digital graphics, drawing tools, discussion forum and social network

Points to Note

- Mention the proper way of writing symbols (capital letter for the first and common letter for the second)
- Simple treatment of periodic table is required
- Ensure that the room is well ventilated when sulphur is being burned
- Demonstrate safe, respectful, responsible and clear online communication

Extended Learning

Research to find out and classify the following:
• Mixtures and compounds used as medicines
• Mixtures and compounds used in the kitchen
• Collect labels of food items and display as examples of mixtures of compounds – identify their constituent elements
Report findings in creative ways to educate others on common everyday mixtures and compounds and their uses.

RESOURCES

Periodic table, LEGO blocks, bricks, Iron (II) sulphide, sulphur, iron filings, samples of different mixtures internet, multimedia projector, computers, Internet, speaker, multimedia projector, demonstration video, CDs/DVDs

KEY VOCABULARY

Elements, compounds, mixtures, filtration, evaporation, distillation, paper chromatography, sublimation, decanting, separating funnel

LINKS TO OTHER SUBJECTS

Technical Vocational Education, Information Technology

TERM 1

Rocks and Minerals
Identifying minerals

Investigating differences between minerals and rocks Investigating formation of rocks

Defining rocks and minerals

Classifying rocks

Importance of rocks and minerals

Soils
Investigating composition of soil

Process of soil formation

Investigating soil types and characteristics causes and ways of preventing soil erosion Investigating process of soil erosion

Conservation of Forests and Wildlife
Identifying earth's natural resources

Inter-dependence of forests and wildlife

Importance of forests in sustaining life - maintaining watersheds, minimizing greenhouse effect and acid rain

Identifying indigenous species of plants and animals Importance of conserving the natural environment

Term 2

Sensory and Endocrine System
Importance of responding to changes

Linking sensory cells to sense organs and stimuli

Components of the central nervous system

Main parts of the brain and their functions

Distinguishing voluntary and involuntary actions

Importance of reflex actions

Importance of the endocrine system

Identifying selected endocrine glands and associated hormones

Comparing the nervous and endocrine system

Embryo development and Birth Control
Development of fertilised ovum into foetus

Identifying key structures in a pregnant uterus and their functions

Effects of negative maternal behaviours on embryo development

Evaluating methods of birth control

Evaluating problems associated with teenage pregnancy

Human Nutrition
Relating foods to particular nutrients Identifying the basic food groups Defining a balanced diet

Defining nutrition

Structure and function of human digestive system

Role of large intestine in egestion

Investigating the nutrients through food tests

Evaluating meals to determine a balanced diet

Assessing nutritional information on food products

Term 3

Energy from Food
Identify organs of the human respiratory system

Path air travels from atmosphere to alveoli

Defining respiration as energy release

Movement of gases (oxygen, carbon dioxide) across the air sacs

Word equation for aerobic respiration

Distinguishing between respiration and breathing Investigating products of aerobic respiration Importance of energy to organisms

Energy Transfer in the Ecosystem
Investigating conditions necessary for photosynthesis Word equation for photosynthesis

External leaf adaptations for photosynthesis

Defining consumer, herbivore, carnivore, producer, Energy flow in food chains and inter-dependence among organisms

Creating food chains and webs (maximum two food chains)

Impact of human activities on food chains

Physical and Chemical Changes
Defining physical and chemical changes

Differentiating between physical and chemical changes Investigating physical and chemical changes Investigating conditions for rusting

NSC

INTEGRATED SCIENCE

GRADE 8 UNITS

APSE II | TERM 1

ABOUT THE UNIT

In this unit, students will learn about the identification, formation and use of rocks and minerals. Students will apply scientific knowledge and processes such as inductive and deductive reasoning, make observations and draw inferences in conducting investigations designed to develop conceptual understanding of rocks and minerals, their importance in the natural environment and in the life of humans.

RANGE OF CONTENT

The key concepts, skills and knowledge students will learn in this unit are:

- Methods of scientific investigations.
- Science as a process of inquiry.
- Formation and use of Rocks and minerals.
- Rocks are solid materials composed of minerals.
- The three rock types are igneous, sedimentary and rocks which are related through the rock cycle.
- Minerals are solids with a regular, crystal structure made of one or more chemical elements.

GUIDANCE FOR THE TEACHER

Science is not just a body of knowledge, but it also constitutes methods of investigating. These methods utilize the cognitive and science process skills and attitudes for the purpose of understanding concepts and solving authentic problems. In the study of this unit, opportunities will be provided for students to use science process, critical thinking and problem-solving skills through the appropriate methods of inquiry in acquiring meaningful understandings of concepts related to the topic. Students will come to understand that minerals are solids with a regular, crystal structure, formed in nature (are therefore naturally occurring) from non- living material or chemicals. They include gems and nutrients used by plants and animals (e.g. Calcium carbonate). Minerals make up rocks and ores. A rock is made up of two or more minerals. Examples of minerals are: Gold, diamond, iron ore, quartz, feldspar, talc and calcite. Students should also be able to explain the formation of the three types of rocks; provide examples of rocks and minerals and explain the uses of rocks and minerals.

Prior Learning

Check that students:

- Have some understanding of science as a process of inquiry.
- Know the difference between organic and inorganic.

ROCKS AND MINERALS

ATTAINMENT TARGET(S):
Apply scientific knowledge and processes to the solution of real-world problems.

Theme: Exploring science and the environment

Topic: Formation and Importance of Rocks and Minerals
Duration: 7.5 hours/3 weeks

OBJECTIVES

Students will:

- Identify the characteristics of minerals.
- Investigate how rocks are formed.
- Investigate how rocks and minerals differ.
- Construct definitions for the concepts of rocks and minerals.
- Identify examples of minerals and the three types of rocks.
- Differentiate among sedimentary, igneous and metamorphic rocks.
- Explain the uses of rocks and minerals.
- Communicate scientific information.
- Work collaboratively with others.

ICT ATTAINMENT TARGETS:

COMMUNICATION AND COLLABORATION - Use technology to communicate ideas and information, and work collaboratively to support individual needs and contribution to the learning of others.

RESEARCH, CRITICAL THINKING, PROBLEM-SOLVING AND DECISION MAKING - use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems, and make informed decisions.

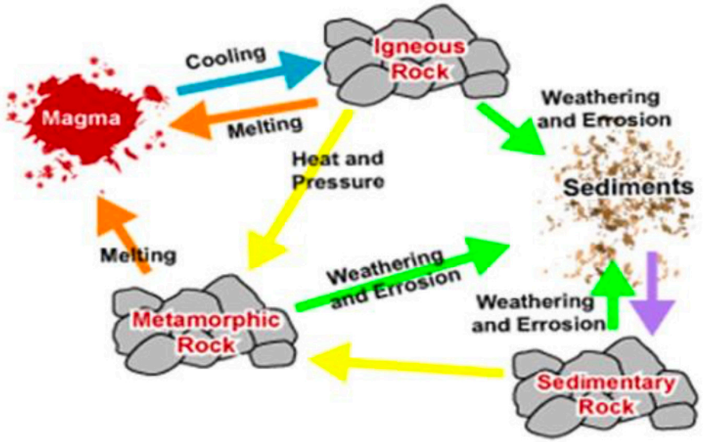
DESIGNING AND PRODUCING - use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DIGITAL CITIZENSHIP - Recognise the human, ethical, social, cultural and legal issues and implications surrounding the use of technology and practice online safety and ethical behaviour.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Watch the video: **https://www.youtube.com/watch?v=rTXSwnkieZc** about the characteristics of minerals. Construct a table of the characteristics of minerals and include examples (use picture or drawings where possible) of these characteristics. Use the table and hand lenses to identify, from a given selection of items, which ones are minerals and which ones are not (e.g. glass, water, salt, ice, gypsum, quartz, calcite etc.). Give reasons for selections and tabulate results.	Explain, tabulate, annotate, observe, communicate, think critically – analyse, create, investigate, compare	Accurate observations made Logical conclusions drawn in identifying minerals Accurate contents of the table and appropriate headings and title
Watch the video: **https://www.youtube.com/watch?v=pg_jKJFbA2A** about the three types of rocks. Discuss the differences between the three types. In groups, examine labelled samples of sedimentary, igneous and metamorphic rocks. Record the characteristics of each type of rock in a table under the headings colour, texture and lustre. Go on a field trip or nature walk around the school or home and collect samples of the three types of rocks. Use hand lenses to examine the samples of rocks and record on a worksheet, the components of each sample (fossils, pebbles, minerals/crystals), colour and texture. Perform hardness test on the rocks and compile a list to show range of hardness for the samples. Place their rock samples or pictures of these, in a scrapbook and annotate.	Observe, communicate, record, classify, think critically – compare, analyse, draw conclusions	Accurate observations noted Accurate completion of worksheet List accurately arranged in order of hardness

The rock granite commonly contains three minerals:
quartz •feldspar •biotite

In groups, demonstrate sedimentary rock formation by cutting five different coloured pieces of starburst candy into cubes. Mix the pieces and squeeze together. Compare with a sedimentary rock and record observations. Place sedimentary rock model into a clear plastic bag and use palms to press down on the model. Remove model and fold it in half, replace in plastic bag and repeat pressing motion, this time, with a book. Record observations and suggest the type of rock the model now represents. Remove the model from bag and place on a heavy-duty piece of aluminium foil paper. Place the aluminium foil on a warm hot plate until the candy melts (allow to cool). Record observations and suggest the type of rock the model now represents. Write a report of the activities and explain, through additional research, how these activities illustrate the 'Rock Cycle'.



Make a concept map to show the relationship between rocks and minerals.

Explain, tabulate, annotate, observe, communicate, collaborate, think critically – analyse, create, investigate, compare, infer

Accurate observations and types of rocks correctly identified

Report written is consistent with the steps in the scientific method and correctly indicates how activities represents the Rock Cycle
Concept map contains accurate information and shows logical relationship between rocks and minerals

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Research to find out about the kinds of rocks and minerals that are found in the earth's crust, mantle and core. On a map of Jamaica, locate places where an abundance of rock ores such as bauxite and gypsum can be found. Tabulate findings. Use the video: **https://www.youtube.com/watch?v=8a7p1NFn64s** as an aid in brainstorming ideas for definition of rocks and minerals. Create a class display to show examples of the various types of rocks and minerals and their uses.	Tabulate, collaborate, communicate, define, think critically - create, analyse, synthesis, research	Accurate information recorded in suitable table and on map Correct definitions Accurate information tabulated Display satisfies given criteria

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Use scientific investigations in deepening and broadening understanding of scientific concepts and phenomena related to rocks and minerals
- ✔ Use established characteristics to differentiate minerals and rocks and, identify common examples
- ✔ Describe how rocks are formed and classify samples of local rocks
- ✔ Explain the benefits of rocks and minerals in the life of humans

Points to Note

- Throughout this curriculum, emphasis is laid on the use of scientific investigations, the development of science process skills and cognitive skills. Deliberate attention is given to the inculcation of scientific attitudes as students go through the process of acquiring scientific knowledge.
- Ensure that safety procedures are followed when using sharp tools.
- Develop students' vocabulary by requiring them to write, spell, define and use related science words in simple sentences after each activity.

Extended Learning

Make a model to demonstrate how a volcano works. Explain how a volcano provides circumstantial evidence on the interior of the earth, for the scientist.

OR

View pictures or videos of bauxite mining, limestone quarrying and sand mining. Suggest how the mining of these minerals affect the environment and outline measures that can be taken to minimize the effects of these industries on the environment. Present findings in a variety of ways.

RESOURCES

Videos, computer internet, multi-media projectors, blank maps of Jamaica, specimen of sedimentary, metamorphic and igneous rocks, minerals, starburst candy, hot plate, aluminium foil, knife, plastic bags
Video: 17 Most Unreal Rock Formations https://www.youtube.com/watch?v=bjMEIxuaDUA (real-life enrichment)

KEY VOCABULARY

Mineral, rock, organic, inorganic, sedimentary, igneous, metamorphic, pressure, rock cycle, lustre, texture, scientific process

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LINKS TO OTHER SUBJECTS

Geography, Social Studies, Visual Arts, Language Arts

ABOUT THE UNIT

Students will explore the concept of soil by scientific inquiry which engages them through the use of science process skills and requires them to think critically, solve problems and make connections between the knowledge and understanding they develop about the formation and composition of soil, the three soil types and soil erosion and the real-world.

RANGE OF CONTENT

The key concepts, skills and knowledge students will learn in this unit are:

- Soil is defined as a combination of organic and inorganic materials found on the earth's surface and provides a medium for the growth of plants and a habitat for insects and other animals. It is formed as a result of weathering, a process which breaks down rocks into small pieces.
- These pieces of broken rock particles and organic materials together make up soil.
- The process of weathering could be mechanical, physical or chemical. In mechanical weathering rocks are physically broken down. This can happen through the expansion and contraction of water which finds its way between cracks in rocks or by plant roots growing in rock crevices.
- In chemical weathering the minerals in rocks are broken down or changed to new substances by water, oxygen or acids.
- There are three main types of soil – sand, clay and loam. The soil types vary according to amount of organic material and particle size and, in ability to support plant growth.
- Causes of erosion, its effects and methods of prevention.

GUIDANCE FOR THE TEACHER

In this study of soil, students should be provided with opportunities for first hand investigation of soil composition, weathering, formation and erosion through demonstrations and Experimentation. Experimentation should engage them in asking questions suitable for fair testing, hypothesizing, gathering and recording relevant data and analysing and interpreting such data to arrive at evidenced-based conclusions.

Prior Learning

Check that students:

- Recall the meaning of science as a process of inquiry and the use of inquiry skills.

SOILS

ATTAINMENT TARGET(S):
Apply scientific knowledge and processes to the solution of real-world problems.

Theme: Exploring Science and the Environment

Topic: Soils
Duration: 10 hours/4 weeks

OBJECTIVES

Students will:

- Investigate the composition of soil.
- Investigate soil types and characteristic features.
- Explain how soil is formed.
- Identify factors that lead to soil erosion.
- Demonstrate the process of soil erosion.
- Explain the importance of preventing soil erosion.
- Set up a simple fair test to determine which soil type is best for a particular purpose.
- Make observations and present these in a suitable format.
- Work cooperatively in groups.

ICT ATTAINMENT TARGETS:

COMMUNICATION AND COLLABORATION - Use technology to communicate ideas and information, and work collaboratively to support individual needs and contribution to the learning of others.

RESEARCH, CRITICAL THINKING, PROBLEM-SOLVING AND DECISION MAKING - use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems, and make informed decisions.

DESIGNING AND PRODUCING - use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DIGITAL CITIZENSHIP - Recognise the human, ethical, social, cultural and legal issues and implications surrounding the use of technology and practice online safety and ethical behaviour.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Observe and discuss the video: **www.youtube.com/watch?v=_Vho8o_ObrQ** on the composition of soil. Using hand lens, identify the components of soil (animals, plants, dead leaves and animals, twigs, rock particles). Label a sample of sand, loam and clay. Sieve each sample and then use hand lenses to the examine the size of the particles in each sample. Arrange each sample sequentially based on its particle size. Examine the texture of each sample by gently rubbing them between the fingers. Record observations and describe the differences in particle size and texture. Place samples of sand, loam and clay separately into each of three glass jars with water and shake thoroughly. Let the jars stand overnight. Observe and record observations. Make annotated drawings of the soil profiles and identify the differences among them. Share the information with the class.	Observe, describe, identify, record, explain, communicate, annotate, think critically - compare, investigate	Accurate observations made, and relevant details recorded Identification of soil components Drawings accurately depict soil profile and are annotated correctly

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
In groups, investigate the water retention capacity of sand, clay and loam by sealing the nozzle end of a plastic funnel with cotton wool. Place equal amounts of each soil sample separately into each funnel. Fit the funnel over a measuring cylinder and add equal volumes of water to each funnel (note this volume of water). Record the time taken for most of the water to pass through the soils and the volume of water that collected in the measuring cylinder. Compare the volume of water poured on the soil samples and the volume of water collected in each measuring cylinder. Answer the questions: • Which soil held the most water? • What does this suggest about the water-holding capacity of the soil? Suggest which soil type would be best suited for growing plants. Write a report on the findings (account for these findings based on particle size). Share findings with class.	Collaborate, manipulate, measure, observe, communicate, think critically – analyse, interpret, draw conclusions	Accurate measurement of time and volumes of water Correct calculations to find volume of water retained by soils and which soil retained the most water Logical conclusions drawn about the water retention capacity of the three types of soil Correct answers to questions
Formulate a hypothesis about which soil contains the largest percentage of organic material. Design and conduct an experiment, which includes a fair test, to test their hypothesis (identify variables which will be manipulated and those that will be controlled). Use a prepared template to record their experiment. Share findings with the class.	Observe, record, explain communicate, think critically - hypothesize, predict, design, investigate, draw conclusion, compare	Acceptable hypothesis; logical prediction Successful investigation that reveals which soil contains the most organic material Inclusion of fair test and accurate identification and control of variables
Research the meaning of 'weathering' and differentiate between mechanical and chemical weathering. List factors responsible for each type of weathering. Perform hands-on activities to demonstrate one example of each type of weathering. Use the activities to explain how weathering results in the formation of soil. Identify the factors that lead to erosion.	Demonstrate, observe, communicate, explain, think critically - research, create, evaluate	Research provides accurate information about weathering Accurate explanation of the formation of soil Factors the lead to soil erosion correctly identified
Explore the erosion of soil by water by cutting away one flat side (above mouth) of three 5 litre plastic bottles (leave bottom of bottles in tact). Place bottles on a flat surface and add three cups of loam soil from the same source into two. Place dead leaves and twigs on the surface of soil in one. Carefully remove a patch of grass with roots in tact from the same area with loam soil and place into the second plastic bottle. Leave the third bottle as is. Make three 'water buckets' by cutting three 600 ml in halves and lace a piece of string through two small holes made on either side (take care to punch the holes so that the 'buckets' will be balanced once the string is passed through them). Attach the 'buckets' to the mouth of the 5-litre bottles by the strings. Predict what is likely to happen when water is poured into each bottle.	Observe, communicate, record, explain, collaborate, think critically – predict, investigate, analyse, research	Accurate observations and explanation of observations Accurate explanation of how plants minimize soil erosion logical ways of preventing or minimizing soil erosion given

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Pour the same amount of water into each 5-litre bottle. Record and explain observations. Explain how plants can minimize or prevent erosion. Find out and other ways by which soil erosion can be prevented or reduced. Participate in class discussion of findings.		
Create a digital story or PowerPoint presentation about evidence of soil erosion in their community or on their school compound, the importance preventing soil erosion in these areas and, ways in which the erosion can be stopped.	communicate, think critically – analyse, create, research, investigate	Digital story/PowerPoint satisfies given criteria

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Analyse a problem, select and employ appropriate methods of inquiry
- ✔ Formulate a hypothesis
- ✔ Perform fair tests and identify and control variables
- ✔ Present and analyse data and arrive at logical conclusions and conceptual understandings about soil profiles and composition
- ✔ Explain the process of soil formation and soil erosion
- ✔ Explain the importance of preventing soil erosion

Points to Note

- Provide opportunities for students to work safely and systematically, in accordance with the process of scientific inquiry for solving problems related to soil composition, formation, erosion and as a medium for plant growth.
- Exercise care when interacting with the environment.
- Ensure that students clean up properly and wash hands after activities.

Extended Learning

Research the use of clay soils in pottery making and ceramics and use moulded clay to make an assortment of shapes and models.

RESOURCES

Computer, internet, multimedia projector, speakers, videos, Jam jars for creating soil profile, samples of soil types, measuring cylinders, funnels, hand towels for cleaning spillages, 600 ml plastic bottles, 5-litre plastic bottles, string, grass sample, vinegar and calcium carbonate to demonstrate chemical weathering;

Video: https://www.youtube.com/watch?v=im4HVXMGI68 which explains soil erosion by water

KEY VOCABULARY

Organic material, inorganic material, humus, minerals, chemical weathering, physical weathering, sandy soil, clay and loam soil, fair test, controlling variables, erosion, components

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LINKS TO OTHER SUBJECTS

English language, Visual Arts, Information Technology, Agriculture

ABOUT THE UNIT

This unit allows for an exploration of the coniferous and deciduous forests in Jamaica. To engage students within our natural environment and develop or strengthen appreciation for and desire to protect it, they will locate on the map of Jamaica large areas of coniferous and broad-leaved evergreens, coniferous forests as well as large areas of a mixture of a variety of broad leaf deciduous species of indigenous plants. They will learn to identify animals – birds, reptile and amphibian diversity, butterflies and bats and, demonstrate understanding that forests are habitats for these organisms which help to maintain the ecosystem. They will also recognise that the life of humans is intimately entwined with forests which help in replenishing the water cycle, preventing global warming and soil erosion and in providing medicines, food and building materials.

RANGE OF CONTENT

The key concepts, skills and knowledge students will learn in this unit are:

- Forests and wildlife as important resources of the earth.
- Identifying indigenous plants and animals in the forests of Jamaica.
- The forest as an ecosystem and the importance of forests in contributing to the water cycle and watersheds.
- Preventing or minimizing the greenhouse effect and acid rain.
- The importance of forests and wildlife to humans and, the preservation of endangered species.

GUIDANCE FOR THE TEACHER

In implementing this unit, opportunities should be provided for students to explore the natural environment, using appropriate methods of inquiry and the recording of data as they garner information for themselves. They should also use technology in doing research and for solving problems linked to the study of forests and wildlife, their interactions and importance to life in the environment.

Prior Learning

Check that students:

- Recall the meaning of science as a process of inquiry.

CONSERVATION OF FORESTS AND WILDLIFE

ATTAINMENT TARGET(S):
Apply scientific knowledge and processes to the solution of real-world problems.

Theme: Exploring Science and the Environment

Topic: The Importance of Earth's Resources
Duration: 12.5 hours/5 weeks

OBJECTIVES

Students will:

- Deduce that forests and wildlife are resources of the earth.
- Explain the inter-dependence of forests and wildlife.
- Explain the importance of forests in maintaining the watershed and preventing or minimizing effects such as the greenhouse effect and acid rain.
- Identify indigenous species of plants and animals and explain the importance of preserving these species.
- Be aware of their responsibility to preserve the earth's resources.
- Work cooperatively as part of a group to complete assigned tasks.
- Value individual effort and teamwork.

ICT ATTAINMENT TARGETS:

COMMUNICATION AND COLLABORATION - Use technology to communicate ideas and information, and work collaboratively to support individual needs and contribution to the learning of others.

RESEARCH, CRITICAL THINKING, PROBLEM-SOLVING AND DECISION MAKING - use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems, and make informed decisions.

DESIGNING AND PRODUCING - use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DIGITAL CITIZENSHIP - Recognise the human, ethical, social, cultural and legal issues and implications surrounding the use of technology and practice online safety and ethical behaviour.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Use the internet to research the inter-dependence and preservation of the diversity of plants and animals in the ecosystem and, collect pictures of endangered plant and animal species in Jamaica and communicate this information in one of several ways (posters, charts, plasticine models, flyers, scrap book, computer software). Present work to class and participates in a whole-class discussion on the need for conservation of forests and wildlife - two of the earth's resources and a part of our ecosystem (refer to the continued production of drugs and chemicals in the future for the preservation of human life). Complete a worksheet on the inter-dependence of forests and wildlife.	Communicate, explain, think critically - research, create, deduce	Pictures collected accurately depict endangered plant and animal species in Jamaica and are presented interestingly to depict interdependence of forests and wildlife and their preservation Worksheet accurately completed
In pairs, use a model to simulate and explain a watershed by crushing a sheet of paper (8.5 X 11) and smooth it out just sufficiently to allow some ridges to remain. Imagine that the crumpled paper represents a piece of land with mountains and hills and use a water colour marker (do not use permanent markers) to trace a line along the top of the paper folds (ridgelines of the hills/mountains). Use a spray bottle to spray a light mist of water over the paper (the water represents rainfall) and observe what happens.	Collaborate, observe, explain, record, think critically – infer, investigate, analyse	Correctly describes a watershed Logical answers to the questions provided

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Spray a mist of water over the paper several times and record observations. Observe the routes the water takes as it accumulates and flows over the paper; the places where the water collected. Participate in a teacher-led discussion as the ways in which their model illustrates a watershed is explained. Answer the questions: • Why did the water collect in certain areas on the model? • What is a watershed? • If your model had farms, houses, factories, roads and parks on it, how would these be affected if they were in watersheds? • If some of the hills or mountains on model were significantly mined, how would this affect water 'run-off', watersheds and animals in that area?		
On a map of Jamaica, locate the forested regions and watersheds. Create a three- dimensional model of a watershed and explain how trees contribute to the watershed. Display models.	Communicate, explain, think critically - analyse, create	Map of Jamaica shows locations of forests and watersheds Model clearly depicts concept of a watershed Effective explanation
In groups, research the concept of a greenhouse and create a model of a greenhouse. Use the model to explain how the greenhouse works and the greenhouse effect on the environment. Prepare a 5-minute oral presentation to explain the importance of plants in minimizing effects such as the greenhouse effect and acid rain. Research the different uses of plants in the life of humans and how the demands for trees are met. In pairs, create a poster to illustrate this relationship. Make a list of the ways forests and wildlife may be preserved.	Communicate, collaborate, explain, think critically - research, design, create, analyse	Accurate understanding of the concept 'greenhouse' Effective use of model to explain the greenhouse effect Oral presentation satisfies given criteria Logical ways to preserve forests and wildlife listed
In groups, collect waste paper which will be used to create recycled paper. Cut/tear the waste paper into small pieces and place in a blender. Add enough water to cover the paper and blend until a soft pulp is formed. Add the pulp mixture to a large container of water and mix. Place wooden screen into container and gentle move it from side to side to trap as much pulp as possible on the wire mesh.	Collaborate, communicate, think critically – create, reflect	Essay contains accurate information about the paper making activity and includes strong, logical reasons for preserving trees Attractive, creative journals Reflective entry in journal gives evidence of an understanding of the need to conserve our forests and wildlife and to become involved

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Remove mesh and carefully turn it upside down on a towel (place towel on a tray or other suitable surface). Use a sponge to collect all excess water from the pulp. Carefully raise the wooden screen to release the pulp onto the towel. Allow the pulp to completely dry (this make take a day or two). Decorate their paper or use it to create designer note paper, envelops or books. Place a sample of their paper in their scrapbook and write a short essay about the paper making activity and why it is important to preserve our trees. Answer the questions: • What forms of energy did you need to make the paper? • How is the new paper different from the old paper that you recycled? • How can I reduce the amount of paper I use? Create a personal journal (include the use of some recycled material) and make an entry under the heading, 'What is the purpose of learning about endangered plants and animals?' Watch the video: **https://www.youtube.com/watch?v=BS-gN6jiXw4** about recycling paper and paper products. Use the internet to research the recycling of paper in schools. In groups, plan, design and start a paper recycling club within their school.	Collaborate, communicate, organize, think critically – research, analyse, synthesize, evaluate, create, plan and design, investigate	Successful creation of a club that has established practical sustainable ways of recycling paper and/or paper products within the school

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Explain what are 'resources of the earth' and justify the classification of forests and wildlife as the earth's resources
- ✔ Explain the forest as an important ecosystem and describe the inter-dependence between wildlife and forests
- ✔ Explain the importance of a watershed and the role of forests in maintaining the watershed
- ✔ Explain the importance of preventing or minimizing the greenhouse effect and acid rain
- ✔ Identify indigenous species of plants and animals in a forest in Jamaica and explain the value of preserving these species

Points to Note

- Take students on field trips for first-hand information on forests.
- Work collaboratively to browse the internet for information.

Extended Learning

Create a rainforest bulletin board in a central location of the school compound. Research the effect of deforestation on the environment.

RESOURCES

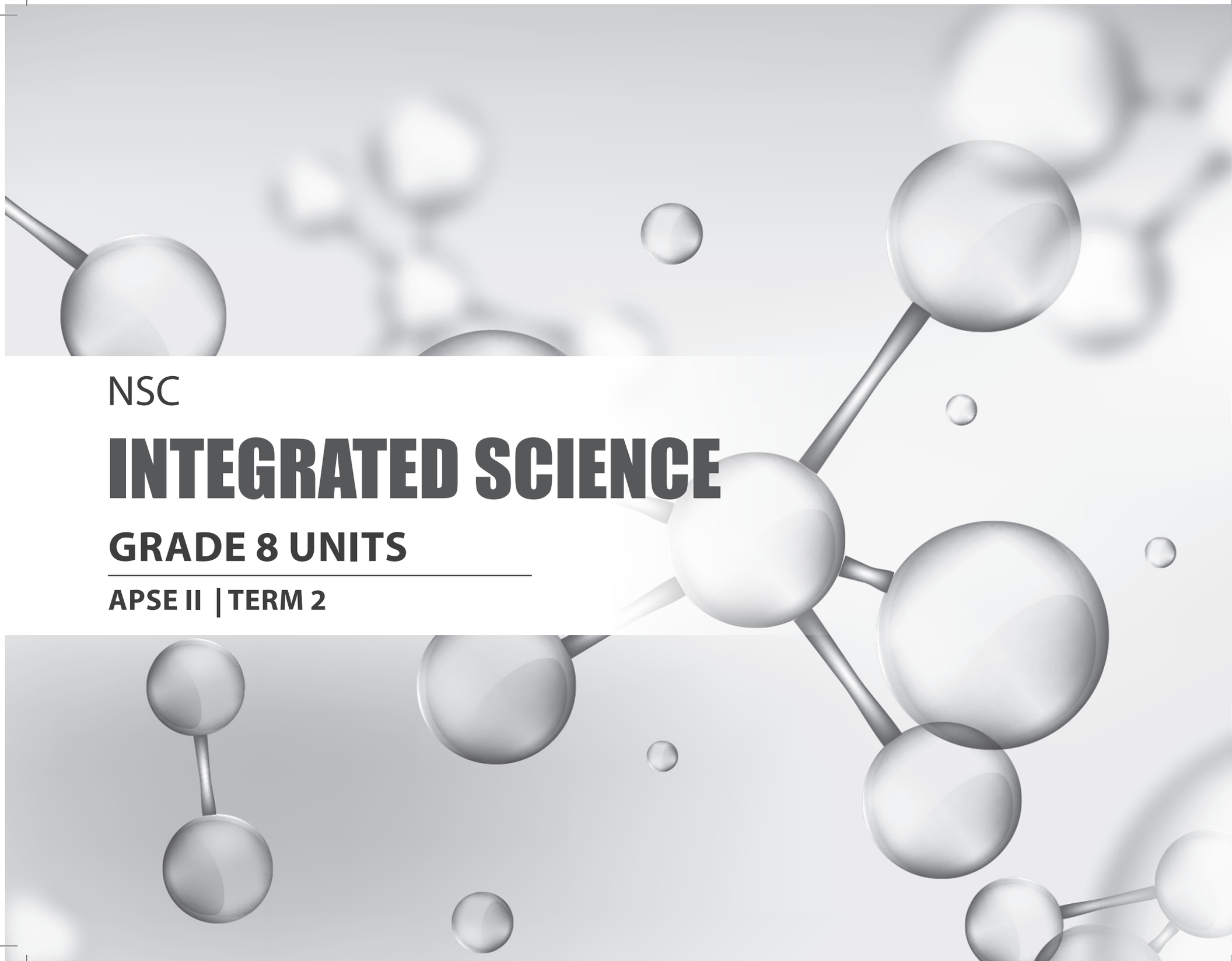
Computer, internet, PowerPoint software, multi-media projector

KEY VOCABULARY

Forest, wildlife, endangered species, coniferous, deciduous, water-cycle, global warming, greenhouse effect, watershed, wildlife, indigenous species, ecosystem

LINKS TO OTHER SUBJECTS

English Language - Reading/comprehension, Visual Arts, Information Technology



NSC

INTEGRATED SCIENCE

GRADE 8 UNITS

APSE II | TERM 2

ABOUT THE UNIT

In this unit, students will learn that the digestive system is responsible for the mechanical and chemical breakdown of food so that it can be absorbed and used by the body. Students will identify the main organs of the digestive system and the juices that are secreted in each part. They will recognise that enzymes cause the chemical break down of food in the digestive tract, trace the pathway of digestion of food along the tract and identify the products formed. Students will carry out tests to identify selected nutrients in food. They will define a balanced diet and discuss the need for variations of different nutrients in the diets of selected categories of persons – pregnant woman, farmer, clerk; identify the various food groups and work safely and collaboratively to test assumptions of nutrients in selected food items. They will research and communicate the importance of nutrients to the health of the individual and learn to make healthy food choices.

RANGE OF CONTENT

The key concepts and knowledge students will learn in this unit are:

- Carbohydrates, fats and proteins are broken down into smaller units in the digestive tract by enzymes found in digestive juices.
- Nutrition involves ingestion, digestion, absorption and assimilation
- Nutrients in foods are identified by food tests – iodine starch test, Biuret test for protein, emulsion or grease spot test for fat, Benedict's test for glucose.
- Role of osmosis in the absorption of water and diffusion in the absorption of digested food in the small and large intestines
- Analysis of food labels and comparing with daily requirements of nutrients charts
- Evaluate a variety of meals/menus/foods to determine range of nutrients and proportion – balanced diet
- Identification of the six Caribbean food groups and definition of a balanced diet

GUIDANCE FOR THE TEACHER

Every effort should be made to ensure that students work collaboratively and safely, discuss and share findings, test assumptions and arrive at scientifically acceptable consensus on meanings. Students should be supervised, particularly in the conduct of food tests and in the use of reagents and heat source. The topic should be handled in real-life contexts so that students may apply the new knowledge in their own life and be moved to make any needed changes related to diet and health.

Prior Learning

Check that students:

- Recall food nutrients and food groups.

HUMAN NUTRITION

ATTAINMENT TARGET(S):
Demonstrate an understanding of the importance of life processes, human body systems and how lifestyles determine health and well- being.

Theme: Living things and life processes

Topic: Nutrition and the Digestion of Food
Duration: 12.5 hours/5 weeks

OBJECTIVES

Students will:

- Identify the different food groups.
- Define a balanced diet.
- Explain nutrition as involving ingestion, digestion, and assimilation of food.
- Investigate the presence of the nutrients, carbohydrates (starch and simple sugars), proteins and fats in foods.
- Explore food labels and compare food contents with standard 'Daily Requirement Charts'.
- Calculate Body Mass Index and compare with BMI interpretation tables.
- Describe the human digestive system and explain the role of the mouth, stomach and small intestines in digestion of proteins, fats and carbohydrates.
- Investigate the existence of enzymes.
- Explain the role of the large intestine in egestion.
- Make healthy choices in the diet.
- Respect the ideas and choices of others.

ICT ATTAINMENT TARGETS:

COMMUNICATION AND COLLABORATION - Use technology to communicate ideas and information, and work collaboratively to support individual needs and contribution to the learning of others.

RESEARCH, CRITICAL THINKING, PROBLEM-SOLVING AND DECISION MAKING - use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems, and make informed decisions.

DESIGNING AND PRODUCING - use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DIGITAL CITIZENSHIP - Recognise the human, ethical, social, cultural and legal issues and implications surrounding the use of technology and practice online safety and ethical behaviour.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: In groups, research the different food groups and collect pictures of a variety of foods and create a display to show the different food groups and the nutrient(s) that are abundant in each group. Demonstrate on styrofoam plates, the concept of a 'balanced diet'. Research the food requirements for a pregnant woman, a farmer and a secretary, compare these requirements and tabulate findings. Prepare a diet sheet for either the pregnant woman, farmer or secretary and explain the reasons for the foods selected and their proportions. Present findings to class. Work as a whole group to create a definition for nutrition, nutrient and a balanced diet (definition of nutrition to include ingestion, digestion, absorption and assimilation). Collect pictures of balanced meals, state why the meals are balanced and place information in their scrapbooks.	Communicate, explain, define, collaborate, think critically - research, compare, justify	Display satisfies given criteria and includes accurate information on food groups and nutrients Diet sheet includes correct selection of foods and justification for food choices and proportion of nutrients Accurate definition of nutrition, nutrients, and a balanced diet Picture accurately depicts balanced meals and correct reasons given

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Watch the video that illustrates the test for protein, starch, simple sugar and fats: **https://www.youtube.com/watch?v=sLP8dcnWnJg** In groups, make a list of the materials required and the procedures to be followed for each food test. Identify foods from each food group and collect small pieces/samples of each. Make predictions about the predominant nutrient that will be found in each (starch, simple sugar, protein and fat). Follow the scientific method to test food samples for these nutrients and tabulate their findings. Write a report about the investigations (include comments on predictions made and draw evidence- based conclusions). Share results of investigations with the class. Participate in a teacher demonstration of the test for protein and record observations. View the video: **https://www.youtube.com/watch?v=iMj6ZkPlNsg** to reinforce the main points about food tests. Participate in a whole group discussion about the importance of each food nutrient to good health.	Communicate, collaborate, observe, record, tabulate, thin critically - research, predict, investigate, draw conclusions, reflect	List of materials is complete and accurate Accurate outline of procedures for each food test; steps appropriately sequenced Correct categorization of foods items into appropriate food groups Food tests carried out efficiently and safely Results accurately depict food nutrients in food samples Table shows correct information; headings appropriately labelled
Examine labels on a variety of foods (take pictures of labels or collect online). Discuss information found on these labels. Arrange the information on the foods in a table based on the amount of sugar, salt and fat they contain. Compare the quantities with the 'Daily Requirement' charts and make decisions about the foods and health. Place the food labels with annotations in their scrapbooks. Calculate their Body Mass Index and compare with Body Mass Index interpretation charts. Make entries in their journals about the packaged/processed foods they eat and how their habits affect their health and well-being; about their Body Mass Index.	Communicate, tabulate, measure, calculate, think critically – research, evaluate, compare, reflect	Tables appropriately labelled, and foods arranged according to nutrient quantities Decisions informed by knowledge of a balanced diet Accurate calculation of Body Mass Index

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Watch the video: **https://www.youtube.com/watch?v=Og5xAdC8EUI** that describes the digestion of foods in humans (only a simple treatment is required). From the video, make a list of the main organs and their functions in the digestive system. In small groups and with the whole class, discuss and record a definition for the digestive system. Make a collage of the human digestive system and explain the function of each main organ in the process of digestion, absorption and egestion. List the digestive juices involved in digestion, the foods on which they act and the end-products of digestion and add these notes to their collage. Research the meaning of ingestion, digestion, absorption, assimilation and egestion. Explain the role of diffusion in the absorption of digested food from the small intestine into the blood. State the difference between ingestion and egestion. Explain the role of osmosis in the absorption of excess water from the large intestine into the blood. Provide a brief explanation of how the body uses the end products of digestion.	Observe, explain, annotate, think critically – create	Collage accurately depicts the main organs of the human digestive system; notes on collage, brief but comprehensive to show name of organ, digestive juices produced, and nutrient acted on Correct meanings of the terms - ingestion, digestion, absorption, assimilation and egestion Correct explanation of role of osmosis and diffusion in the absorption of nutrients and water
Research the presence of enzymes in fruits (e.g. pawpaw, pineapple) and how they behave in the presence of hydrogen peroxide. In groups, crush a piece of ripe pawpaw to form a puree. Place 2 tablespoons of the pawpaw puree into a small transparent glass jar, add 3 cm3 of hydrogen peroxide and stir. Record observations. Measure the height of the foam formed after one minute. Record and explain observations. Place about 2 tablespoons of pawpaw puree into each of two separate glass jars and label one as hot water and the other as ice water. Place one jar into icy cold water and the other into hot water. Allow jars to stand for about two minutes and then add 3 cm3 of hydrogen peroxide to each jar. Measure and record the heights of the foam formed. Record and explain observations. Draw conclusions about the presence of an enzyme in pawpaw and the effect of temperature on the action of the enzyme. Share findings with class.	Observe, explain, measure, communicate, record, think critically – create, research, investigate, draw conclusion	Accurate measurements taken Accurate record of observations Conclusions based on evidence

Learning Outcomes

Students who demonstrate understanding can:

- ✔ List the main parts of the human digestive system and state their function.
- ✔ Test for protein, fat, simple sugar and starch in identified foods.
- ✔ Explain a balanced diet.
- ✔ Describe the processes involved in human nutrition.
- ✔ Use food labels to make wise food choices.

Points to Note

- Allow students to work in groups, to share idea, assess own ideas and that of their peers, reflect and work with others to arrive at a consensus on the relevant, meanings of concepts.
- Use both the emulsion and grease spot tests for fats.
- It is not necessary to treat enzymes extensively; the names of enzymes are not required.
- Always emphasize the need to work safely, particularly when students are working with heat and reagents.
- Use word processing software and other technology tools to create original work for a specific purpose and audience.

Extended Learning

Calculate individual 'Body Mass Index' (BMI) and determine if it is in the normal range.

Research diseases associated with the digestive system (e.g. Gastritis).

RESOURCES

Reagents for food tests, food samples, heat source, BMI and Daily Nutrient Requirements charts, food labels, Styrofoam plates/ plain paper cut-outs of plates, computer, internet, videos

KEY VOCABULARY

Balanced diet, food groups, nutrients, ingestion, digestion, assimilation, absorption, nutrition, digestive system, oesophagus, blood capillaries, enzyme

LINKS TO OTHER SUBJECTS

Food and Nutrition, Visual arts, Language Arts

ABOUT THE UNIT

In this unit, students will learn about the importance of responding to changes in the external and internal environment as a means of protecting themselves from danger. They will learn that the brain and spinal cord form the central nervous system and identify parts of the brain where messages from the various sense organs are received and interpreted. Students will understand that peripheral nerves connect the central nervous system to the entire body and that many processes in the body are controlled by chemicals called hormones, produced by endocrine glands. They will identify the location of selected glands and their functions.

RANGE OF CONTENT

The key concepts and knowledge students will learn in this unit are:

- The need for organisms to respond to changes in the external and internal environment.
- Sense organs contain sensory receptors which detect stimuli in the environment and pass these on to the central nervous system.
- The central nervous system coordinates the body's responses to stimuli by receiving and sending information via the nerve cells/neurones.
- Reflex actions are rapid, automatic responses to stimuli.
- Hormones are products of the endocrine glands.
- Hormones cause response to changes in the internal environment of the body.

GUIDANCE FOR THE TEACHER

In implementing this unit, opportunities should be provided for students to use technology in conducting research, creating models and presenting work.

Prior Learning

Check that students:

- Are familiar with the senses and the sense organs.

SENSORY AND ENDOCRINE ORGAN SYSTEMS

ATTAINMENT TARGET(S):
Demonstrate an understanding of the importance of life processes, human body systems and how lifestyles determine health and well- being.

Theme: Living Things and Life Processes

Topic: Sensitivity and Co-ordination
Duration: 7.5 hours/3 weeks

OBJECTIVES

Students will:

- Deduce the importance of responding to changes in the environment.
- State that each sense organ contains sensory/receptor cells that detect a specific type of stimulus.
- State that the brain and spinal cord comprise the Central Nervous System (CNS) which coordinates the body's responses.
- Differentiate between voluntary and involuntary /reflex actions.
- Describe the endocrine system as consisting of ductless glands that respond to internal stimuli by producing hormones.
- Identify selected endocrine glands (pituitary, pancreas, ovaries, testes, thyroid and adrenal), their locations, the hormones that they produce and their effects on the human body.
- Compare nervous and endocrine systems.

ICT ATTAINMENT TARGETS:

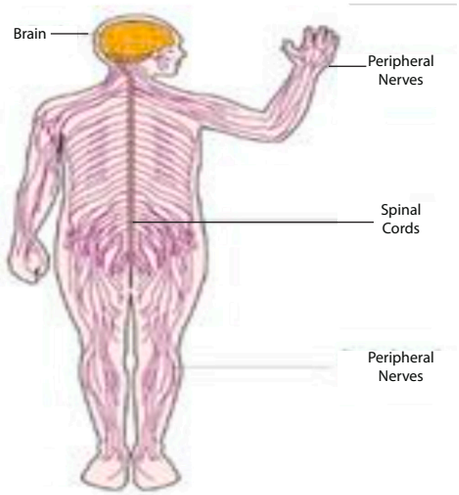
COMMUNICATION AND COLLABORATION - Use technology to communicate ideas and information, and work collaboratively to support individual needs and contribution to the learning of others.

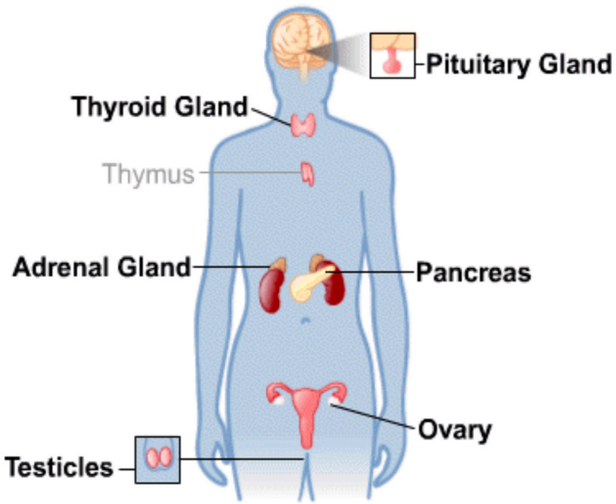
RESEARCH, CRITICAL THINKING, PROBLEM-SOLVING AND DECISION MAKING - use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems, and make informed decisions.

DESIGNING AND PRODUCING - use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DIGITAL CITIZENSHIP - Recognise the human, ethical, social, cultural and legal issues and implications surrounding the use of technology and practice online safety and ethical behaviour.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Watch the video on response to stimuli: **https://www.youtube.com/watch?v=h6-evXswaQs** Based on information gathered from video, explain why it is important for humans to respond to stimuli/changes within the environment. In groups, review the sense organs and formulate definitions for stimulus, receptor, response and effector. Share definitions with the class in a teacher led discussion. Construct a table to list each sense organ, the stimulus which it detects and its corresponding function.	Communicate, explain, define, tabulate	Logical explanation of the importance of responding to stimuli Correct definitions Table suitably represents information; correct information
In groups of threes, punch a hole into a small jar lid. Hold a pencil, with eraser at the base, upright on their desk. Slide the lid over the pointed end of the pencil and attach a paper clip about half an inch above the lid (this marks the starting point of the from which to drop the lid; lid should slide freely along the pencil). Upon signal from group member, release the lid from its starting point. Record the time it takes for another group member to use a finger to stop the lid before it falls to the base of the pencil. Repeat the activity two more times. Construct an appropriate data table and record response times. Calculate the average response time. Repeat the activity for each member of the group and compare the average response times for each group member. Share findings with the class.	Collaborate, manipulate, communicate, tabulate, calculate, think critically – compare, draw conclusion	Accurate presentation of data in table Acceptable calculation and comparison of response times

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Observe a model/picture of the human brain and identify and discuss the various areas on the brain where sensory impulses are received from the different sense organs. Label a blank diagram of the brain and include brief annotations. List the organs of the central nervous system (CNS) and briefly describe their role in coordinating the body's responses (a description of a reflex arc in not necessary; teacher mentions briefly that peripheral nerves connect the brain and spinal cord to the entire human body).  	Communication, label, annotate	Diagram correctly labelled and annotated
Participate in a teacher-led discussion then formulate a definition of involuntary /reflex actions. Demonstrate the knee-jerk reflex. In groups, generate and sort a list of actions into voluntary and involuntary. As a class, share their ideas from the lists and identify the benefits that can be derived from the involuntary/reflex actions cited. Create posters or cartoon strips to highlight the difference between a voluntary and involuntary action.	Define, collaborate, communicate, think critically - infer, classify	Acceptable definition of reflex actions given Voluntary and involuntary actions correctly identified Acceptable benefits of reflex actions identified. Posters clean/cartoon strip, attractive and accurately portrays difference between voluntary and involuntary action

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Research and explain how the body responds to internal stimuli through the endocrine system. Construct a large foldable to show the locations of the various endocrine glands, the hormone which each secretes, their target organs and the effects produced. Watch the video: **https://www.youtube.com/watch?v=R218fFZhq4c** and construct a table to summarise the differences between the Central Nervous System and the Endocrine System. Share information with the class.  	Explain, tabulate, Communicate, thin critically - compare	Table provides all relevant and correct information of the endocrine system Table differentiates, accurately and clearly and provides details of differences between the two systems

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Explain the role of the sense organs in picking up stimuli from the environment
- ✔ Demonstrate the understanding that the CNS constitutes the brain and spinal cord
- ✔ Identify three main parts of the brain as: cerebrum, medulla and cerebellum
- ✔ Using examples, explain the importance of reflex actions
- ✔ Identify selected endocrine glands in the body, the hormones they secrete, the target organs and effects
- ✔ Identify differences between the nervous system and the endocrine system

Points to Note

- Students need to know that when a reflex action occurs, a message is also sent to the brain but although this is so, the actual, direct response to the stimulus in a reflex action is coordinated completely in the spinal cord. The whole response occurs in the fraction of a second.
- An extensive description or explanation of a reflex arc is not necessary.

Extended Learning

Write a blog or newspaper article to encourage a group of motorcyclists to wear crash helmets for protection. Use a picture of the brain to explain the effects on the body if the cerebellum is damaged in a motorcycle crash.

RESOURCES

Computer, internet, videos, blank diagram of brain, pictures of brain, CNS and Endocrine System

KEY VOCABULARY

Sense organs, sensory receptors, peripheral nerves, reflex arc, reflex action, internal environment, hormones, gland, endocrine glands, endocrine system

LINKS TO OTHER SUBJECTS

English Language, Information Technology

ABOUT THE UNIT

In this unit, students will, through project-based learning, use skills of gathering, analysing and interpreting information and synthesizing new understandings of the process of development of a human baby from a fertilized ovum. They will acquire understanding of the roles of the uterine wall, placenta, amniotic sac, amniotic fluid and umbilical cord in this process of development. They will investigate the various methods of preventing pregnancy and categorize these methods correctly into the following groups: Prevention of ovulation, prevention of implantation, prevention of fertilization. Students will also identify and discuss advantages and disadvantages of surgical methods of birth control and acquire knowledge and understanding of how alcohol and other drugs and diet impact the development of a baby in the womb. Opportunities will be provided for students to plan and organise a science fair to showcase the work they produced as they explored the topic and to demonstrate their learning and collaborative skills.

RANGE OF CONTENT

The key concepts and knowledge students will learn in this unit are:

- Development of a fertilized, human ovum into a zygote and the zygote into an embryo
- Role of the uterine wall, placenta, amniotic sac, amniotic fluid and umbilical cord in the development of the embryo into a foetus and then into a fully developed baby
- Stages in the development of the embryo
- Impact of drugs and diet on the developing embryo
- The variety of ways by which birth control methods prevent pregnancy by the prevention of ovulation, implantation, fertilization
- The advantages and disadvantages of surgical methods of birth control

GUIDANCE FOR THE TEACHER

Provide guidance for students in the use of the internet for exploration of the various, relevant concepts and in the analysis and interpretation of the information. Students should communicate these understandings in a variety of ways through the use of concept maps, models, collages, drawings, flip charts, accordion charts and posters. Provide for individual students' learning needs and styles in the presentation of content where applicable and use strategies that would stimulate, guide and sustain discussions among students and keep them engaged throughout the lesson.

Prior Learning

Check that students:

- Recall the organs of the human reproductive systems.
- Recall that some cells carry out specialized functions.

EMBRYO DEVELOPMENT AND BIRTH CONTROL

ATTAINMENT TARGET(S):

Demonstrate an understanding of the importance of life processes, human body systems and how lifestyles determine health and well-being.

Theme: Living Things and Life Processes

Topic: Sexual Reproduction in Humans
Duration: 7.5 hours/3 weeks

OBJECTIVES

Students will:

- Describe the development of a fertilised egg into an embryo.
- Identify key structures in a pregnant uterus (placenta, amniotic sac, amniotic fluid, umbilical cord and uterine wall) and state their basic functions in the growth and development of the human embryo/foetus.
- Assess the effects of diet, alcohol and other drugs and, cigarette smoking on the developing embryo/foetus.
- Evaluate the methods of birth control.
- Evaluate problems associated with teenage pregnancy.
- Show respect for the views of others.

ICT ATTAINMENT TARGETS:

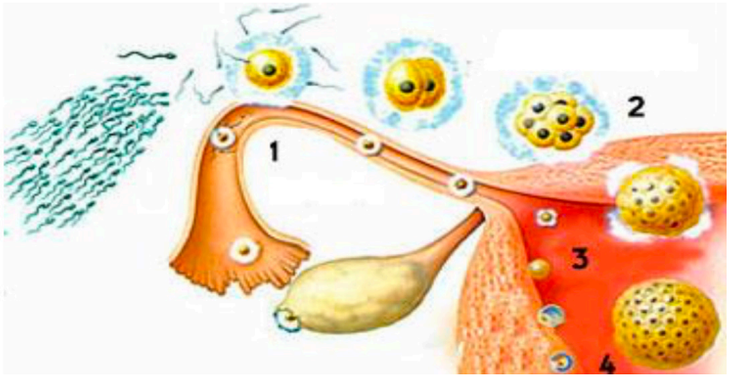
COMMUNICATION AND COLLABORATION - Use technology to communicate ideas and information, and work collaboratively to support individual needs and contribution to the learning of others.

RESEARCH, CRITICAL THINKING, PROBLEM-SOLVING AND DECISION MAKING - use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems, and make informed decisions.

DESIGNING AND PRODUCING - use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DIGITAL CITIZENSHIP - Recognise the human, ethical, social, cultural and legal issues and implications surrounding the use of technology and practice online safety and ethical behaviour.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Watch the videos: **https://www.youtube.com/watch?v=vFfqLs94iHc** **https://www.youtube.com/watch?v=VmlcRqdDqH4** showing the development of the human embryo in the uterus as part of a science project. Conduct research using the internet on the development of the human embryo. In groups, use playdough to create three dimensional models of the stages of zygote formation. Label and annotate models. Prepare model for display at a science fair under the heading, 'Human Sexuality and Reproduction' at the end of term two. Insert, in their scrapbooks, diagrams/pictures/illustrations showing the: • Pregnant uterus with the attached embryo • Stages in the development of the embryo into a baby - with brief explanations of the role of the following (placenta, amniotic sac, amniotic fluid, umbilical cord and uterine wall, as well as hormones produced by the endocrine system) in the development of the embryo.	Summarize, sequence, collaborate, think critically – create, analyse	Models accurately depicts stages in formation of zygote Scrap book provides details of pregnancy and correct sequence of stages in the development of the embryo; Provides clear, concise information in attractive ways, of the functions of the placenta, amniotic sac, amniotic fluid, umbilical cord and uterine wall, as well as hormones in the development of the human embryo

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Use the internet to explore, and in creative ways report on, the impact of diet, alcohol and cigarette smoking on the developing human foetus. In groups, design and make a poster and/movie or digital story to persuade pregnant mothers to give up negative behaviours during pregnancy. Display posters on a classroom wall or present movie to class or post movie on class page. Prepare work for display at science fair. Research methods of birth control and assess their effectiveness in preventing ovulation, fertilisation or implantation. Use group posters and/foldables to report their findings. Prepare posters and foldables for display at science fair.  	Report, communicate, collaborate, think critically - create, research	Informative report on the impact of diet, cigarette smoking, alcohol and other drugs on developing embryo/foetus Posters/movie/digital story adequately address the negative maternal behaviours and birth control methods Accurate content
Go on a field trip to the maternity ward of a hospital or children's home and complete a survey checklist provided by teacher and, participate in a teacher led discussion. Make an entry in personal journal about the visit and their thoughts/feelings after the visit.	Observe, reflect	
In groups, identify persons from the class to make brief presentations at the science fair on the effects of diet and alcohol on the developing baby. Research the planning and hosting of a science fair and create a schedule of activities for the fair. Decide on and select ushers for the science fair. Create a flow chart capture the names of the ushers and the roles they will play at the fair. Make entries in personal journals about the science fair and, under the headings, 'What do I know about science fairs? What am I expected to learn from participating in the hosting of a science fair?'	Collaborate, communicate, think critically – research, analyse, create, organise, synthesize, reflect	Schedule of activities practical and captures all relevant aspects of a school science fair Flowcharts clearly outlines the duties/roles of ushers

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Describe the development of a fertilised egg to a fully developed baby.
- ✔ Explain the role of the placenta, amniotic sac, amniotic fluid, umbilical cord and uterine wall in the development of an embryo and foetus.
- ✔ Describe the impact of diet, alcohol and other drugs and cigarette smoking on the development of the human embryo.
- ✔ Identify and evaluate various methods of birth control.

Points to Note

- Students carry out the cited activities in this unit within the context of the project-based learning approach. The product at the end is the hosting of a science fair.
- Ensure that students are given the responsibility to participate in the planning and organising of this event under the guidance of their teachers and in collaboration with the students of grade 9 on APSE pathway III (and their teachers) who will also be studying aspects of reproduction in the last unit of term 2. Students are expected to display their work at the science fair.
- Allow groups to share findings of their explorations and research with each other in inter-group and intra-group discussions.
- Collaborate with teachers of information technology and Visual Arts for the preparation of information; encourage responsible use of the internet.
- Use suitable software (e.g. presentation or moviemaking) to create digital version of the album.
- Encourage more able students to scaffold less able students to achieve above their current levels of understandings.
- Involve students in the making of their own playdough.

Extended Learning

Research and explain problems associated with teenage pregnancy.

RESOURCES

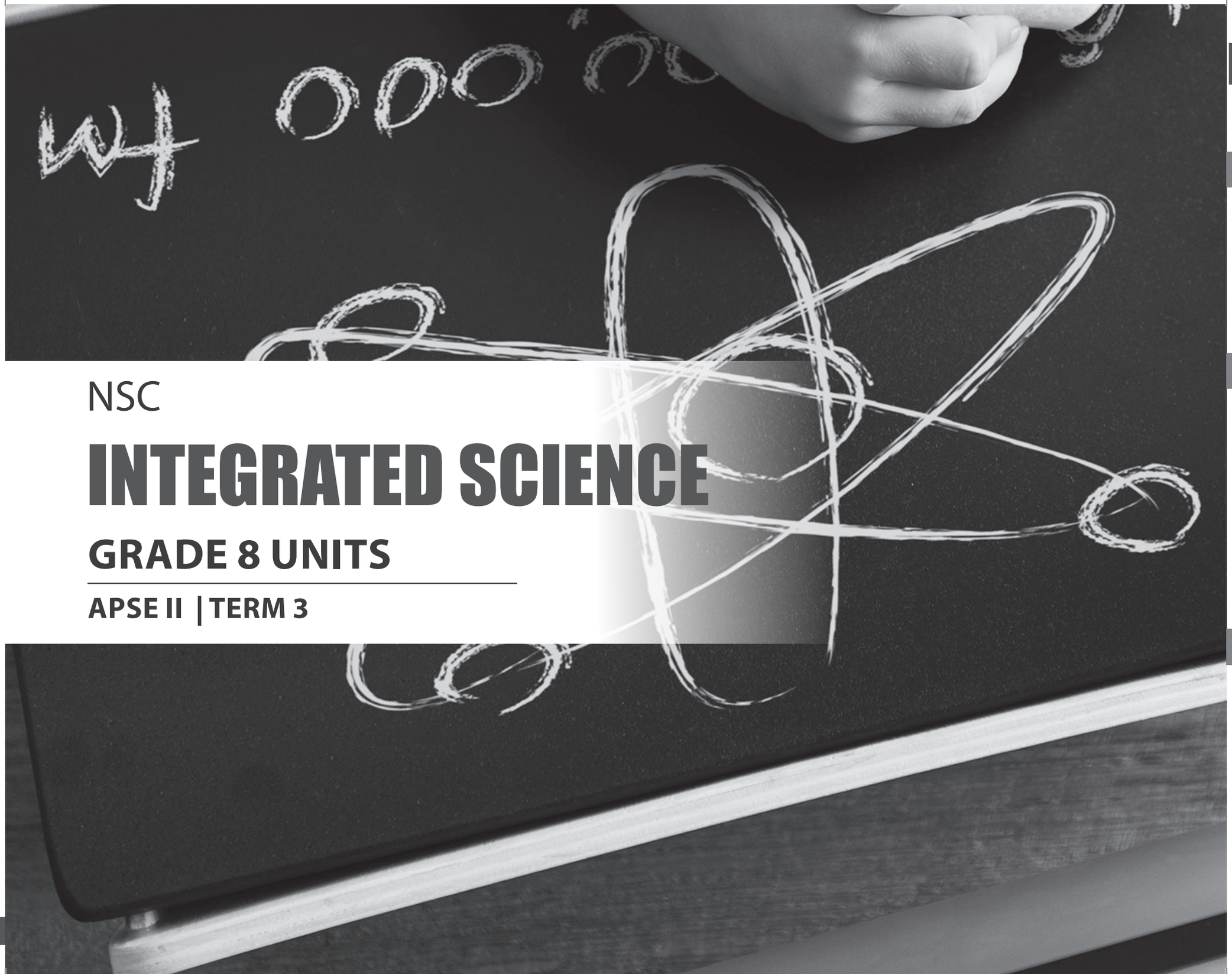
Computer, internet, videos, multimedia projector, speakers, teacher prepared survey checklist, flour, salt, oil for making playdough

KEY VOCABULARY

Zygote, foetus, embryo, amniotic sac, amniotic fluid, placenta, uterine wall, pregnancy

LINKS TO OTHER SUBJECTS

Visual Arts, Language Arts, Information Technology



NSC

INTEGRATED SCIENCE

GRADE 8 UNITS

APSE II | TERM 3

ABOUT THE UNIT

In this unit, students will learn that all living cells require energy to function and that the energy is released from food substances during respiration. They will learn that aerobic respiration uses oxygen obtained from the atmosphere during breathing, takes place inside the mitochondria of cells and produces carbon dioxide and water as by products. Students will use science process skills to investigate the products of aerobic respiration.

RANGE OF CONTENT

The key concepts and knowledge students will learn in this unit are:

- The respiratory system and the path air travels from the atmosphere to the alveoli
- Respiration is the chemical process by which energy is released from food
- Aerobic respiration requires oxygen and occurs in the mitochondria of cells
- Respiration differs from breathing
- Products of aerobic respiration

GUIDANCE FOR THE TEACHER

Ample opportunities should be provided for students to work collaboratively, share ideas, analyse, interpret, assess their own and other people's ideas and arrive at a consensus on what is scientifically acceptable. Students should always be carefully supervised and guided to observe laboratory safety rules when conducting investigations.

Prior Learning

Check that students:

- Recall the main organs of the human respiratory system and their basic functions
- Recall diffusion as the process for exchange of gases between the blood capillary and the alveoli

ENERGY FROM FOOD

ATTAINMENT TARGET(S):
Demonstrate an understanding of the importance of energy in everyday life and the classification of things.

Theme: Energy and Matter

Topic: Aerobic Respiration in Humans
Duration: 7.5 Hours/3 weeks

OBJECTIVES

Students will:

- Describe the structure and basic function of the human respiratory system.
- Trace the pathway of oxygen from the atmosphere to the alveoli.
- Describe respiration in humans as the process in which energy is released from food in the presence of oxygen.
- State that the mitochondrion is the site of respiration in human cells.
- Write a word equation to describe the process of aerobic respiration.
- Explain the importance of energy to organisms.
- Distinguish between respiration and breathing.
- Perform investigations to identify the products of aerobic respiration.

ICT ATTAINMENT TARGETS:

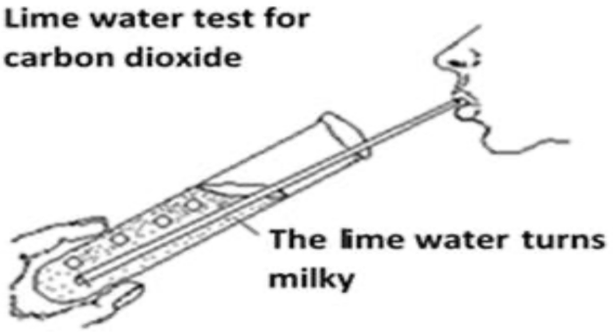
COMMUNICATION AND COLLABORATION - Use technology to communicate ideas and information, and work collaboratively to support individual needs and contribution to the learning of others.

RESEARCH, CRITICAL THINKING, PROBLEM-SOLVING AND DECISION MAKING - use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems, and make informed decisions.

DESIGNING AND PRODUCING - use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DIGITAL CITIZENSHIP - Recognise the human, ethical, social, cultural and legal issues and implications surrounding the use of technology and practice online safety and ethical behaviour.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Watch the video of the human respiratory system: **https://www.youtube.com/watch?v=ydX8Lw4q2Mk** and make a collage to illustrate the human respiratory system. Insert arrows on the collage to show the path taken by air from the atmosphere through the nostrils to the lungs. Display collages in classroom. Watch the video: **https://www.youtube.com/watch?v=JUmT24R8CyA** and create a definition for aerobic respiration. Explain, in simple terms, why the mitochondrion is considered the 'power house' of the cell. Write a word equation for aerobic respiration.	Explain, think critically - create	Collage correctly depicts the human respiratory system and correct pathway of air Accurate understanding of the mitochondrion as the cell's powerhouse Correct word equation
Watch the following video: **https://www.youtube.com/watch?v=0J4HpjwKwsg** (The teacher may select to demonstrate this test.) In groups, test for the presence of carbon dioxide in exhaled air by using a straw to blow into a transparent container of pure water. Record observations. Repeat the test with lime water (Calcium Hydroxide solution). Record observations and explain findings. List the points that were considered when setting up the fair test.	Observe, record, explain, think critically - investigate, analyse, draw conclusion	Record of observations and explanation of findings makes reference to the inclusion of a fair test and the role of the fair test Reasonable explanation of findings and logical, evidenced- based conclusion Investigation carried out with regards for safety of self and others

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will:		
		Informative report on the impact of diet, cigarette smoking, alcohol and other drugs on developing embryo/foetus Posters/movie/digital story adequately address the negative maternal behaviours and birth control methods Accurate content
Investigate the presence of water vapour in exhaled air by breathing out onto a cool mirror or glass. Observe what happens to the mirror/ glass and test for the presence of water using blue cobalt chloride paper. Use the scientific method to record the investigation. Share findings with class.	Investigate, manipulate, think critically – analyse, infer, draw conclusions	Acceptable inferences made Investigation accurately recorded using the scientific method
Create a foldable to explain the differences between respiration and breathing. Watch the following video as a reminder of the mechanics of breathing. **https://www.youtube.com/watch?v=5JrON_sm5gc&index=3&list=PL1lVFP- k_im8UXhAPQnYxQ5591TLMYQdE**	Communicate, explain. Think critically – compare, create	Foldable attractive and accurately distinguishes respiration and breathing

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Identify the main parts of the human respiratory system and trace the path taken by air from the atmosphere to the alveoli.
- ✔ Explain respiration as the process by which energy is released from food.
- ✔ Write a simple word equation to summarise the process of aerobic respiration.
- ✔ List the products of aerobic respiration.
- ✔ Identify the 'control' in an investigation.
- ✔ Use the scientific method and scientific language to write a simple laboratory report
- ✔ Plan and conduct research, using a wide variety of electronic sources e.g. online periodicals, CDs

Points to Note

- Do not allow students to share straws because of the danger of cross infections.
- Teacher should initiate discussion for students to clearly distinguish between inspired and expired air.
- Establish that carbon-dioxide reacts with lime water or calcium hydroxide to form insoluble calcium carbonate which gives a cloudy appearance.
- Ensure that students use the scientific method as they conduct investigations and always capture their observations, findings and conclusion in a laboratory report.

Extended Learning

Design a leaflet/poster/advertisement for a local radio, aimed at informing young people of the benefits of aerobic exercise and encouraging them to get fitter.

RESOURCES

Computer, internet, video, lime water or calcium hydroxide solution, cobalt chloride paper, test-tubes/small, transparent glass containers, drinking straws, mirrors

KEY VOCABULARY

Aerobic, respiration, respiratory system, alveoli, inspired air, expired air, equation

LINKS TO OTHER SUBJECTS

Visual Arts, Language Arts, Information Technology

ABOUT THE UNIT

In this unit, students will learn that all living cells require energy to function and that this energy is supplied by the sun. They will learn that green plants trap the sun's light energy and, through the process of photosynthesis, convert it to chemical energy. Green plants make their own food in the chloroplasts of leaf cells during the process of photosynthesis. Students will explore the process of photosynthesis by examining leaves to identify ways in which they are adapted to carry out the process and design experiments to determine the raw materials and conditions necessary for the process to occur. They will explore the concept that all organisms are interdependent through the examination and, creation of food chains and webs that show the flow of energy from one organism to the next within the ecosystem.

RANGE OF CONTENT

The key concepts and knowledge students will learn in this unit are:

- Photosynthesis is the process by which green plants trap solar energy and convert it into stored chemical energy
- Photosynthesis takes place in the chloroplasts of the cell and leaves are specially adapted for the process
- During photosynthesis plants use carbon dioxide and water in the presence of chlorophyll and sunlight to make sugar which is later converted to starch and stored in the body of the plant (e.g. in leaves).
- Food chains and webs show the transfer of energy from producer to consumers; energy is lost during this transfer
- Food chains and webs are pictorial representations of the interdependence among organisms and their environment

GUIDANCE FOR THE TEACHER

Ample opportunities should be provided for students to work collaboratively, share ideas, analyse, interpret, assess their own and other people's ideas and arrive at a consensus on what is scientifically acceptable. Students should always be carefully supervised and guided to observe laboratory safety rules when conducting investigations.

Prior Learning

Check that students can :

- Describe the basic structure of plants.
- Recall that organisms depend on each other for survival.
- Tell that iodine solution becomes bluish-black whenever it comes in contact with starch.

ENERGY TRANSFER IN THE ECOSYSTEM

ATTAINMENT TARGET(S):
Demonstrate an understanding of the importance of energy in everyday life and the classification of things.

Theme: Living Things and Life Processes

Topic: Photosynthesis and the Inter-dependence of Organisms
Duration: 10 hours/4 weeks

OBJECTIVES

Students will:

- Recall that sunlight is the ultimate source of energy in the ecosystem.
- Examine the external adaptations of the leaf for photosynthesis.
- Investigate the raw materials and conditions necessary for photosynthesis.
- Explain the process of photosynthesis in simple terms.
- Construct the word equation for photosynthesis.
- Formulate definitions of the terms food chain, food web, producer, consumer, carnivore, herbivore, omnivore and habitat.
- Construct terrestrial and aquatic food chains and webs using familiar organisms.
- Identify the producers and consumers in given food chains and food webs.
- Describe the energy flow in a food chain.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Watch the video: **https://www.youtube.com/watch?v=yHVhM-pLRXk** Using information from the video, identify three conditions essential for photosynthesis and write a definition for process. In small groups, use hand lenses to investigate how the leaf is adapted to carry out photosynthesis. (examine the leaves as they are found attached to the plant in the natural environment). Use a teacher prepared checklist to record the external adaptations. Draw annotated pictures of various leaves. Construct a word equation for photosynthesis. Share information with class.	Observe, explain, draw, annotate, communicate, think critically - investigate	Accurate explanation for photosynthesis and identification of the three conditions required for photosynthesis Checklist and drawings accurately capture features adaptations of the leaf
In groups, identify the presence of starch in a green leaf by placing a freshly picked healthy green leaf into a beaker of hot water (provided by the teacher) for about three minutes. Transfer the leaf to a test tube containing ethanol or alcohol. Place the test tube in another beaker of hot water for about five minutes. (Turn off the flame before placing the test tube with the alcohol in the hot water.) Remove the leaf from the alcohol and rinse it in cold water. Spread the leaf on a white tile and place a few drops of Iodine solution on it and observe. Record the colour changes that occur and explain the reason for these changes. Share findings with class. 	Manipulate, observe, explain	Use of the scientific method to conduct and record investigation Accurate observations made
In small groups and using their knowledge of how to test a leaf for starch, design and carry out an experiment to show that sunlight (solar energy) is essential for photosynthesis. Draw conclusions supported by evidence. Write the laboratory report for the experiment. Communicate the experiment and results to the class. In small groups and using their knowledge of how to test a leaf for starch and, the findings from the experiment designed to determine if solar energy is needed for photosynthesis, design another experiment to test whether chlorophyll is needed for photosynthesis.	Communicate, collaborate, record, think critically – plan and design, investigate, draw conclusion	Plan and carry out controlled experiment with due regard to safety Use of the scientific method to conduct and record investigation Accurate observations made

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Watch the video: **https://www.youtube.com/watch?v=SWvtRf4TAO4** and create definitions for the following terms: food chain, food web, producer, consumer, carnivore, herbivore, omnivore, energy pyramid. Go on a nature walk and observe organisms and what they do and what are they feeding on. List the organisms observed and categorize them as producers, herbivores, carnivores and omnivores. Construct food chains and food webs, following the examples seen in the video. Share information with class. List a number of aquatic plants and animals and, using this information, construct models of food chains and food webs to show how these organisms depend on each other for energy. Take pictures of the models and place in scrapbook. Reflect on the energy flow in the ecosystem through food chains and food webs and share information with the class. Account for the sun as the ultimate source of energy within the ecosystem and use the energy pyramid to explain how energy decreases along food chains and food webs. Make an entry in journals under the headings, 'What do I know about this topic? What can I do to improve my understanding or my work?'	Define, observe, classify, explain, think critically - analyse, construct, reflect	Accurate definitions and correct grouping of organisms Construction of correct food chains and webs Models satisfy given criteria and accurately represent food chains and webs Accurate explanation of the energy pyramid and why energy decreases along food chains and food webs

Learning Outcomes

Students who demonstrate understanding can:

- Demonstrate an understanding that the sun is the ultimate source of all energy in the ecosystem and, sustains life.
- Explain that plants convert solar energy to chemical energy during photosynthesis.
- Demonstrate the understanding that plants are the only organisms which can make direct use of the sun's energy.
- Explain that food chains and food webs indicate a transfer of energy, in the form of food from one consumer to another.
- Describe the flow of energy among organisms in a food chain or food web.
- Account for the decrease of energy as we move up the different levels of the energy pyramid.

Points to Note

- As far as possible allow students to research information for themselves, select what is relevant, organize and present information in a variety of creative ways.
- Exercise care when exploring the natural environment.
- Plan and carry out investigations with regard for safety for self and others.
- Check students experiment designs and guide them into making any needed adjustments to ensure safety but not necessarily workability.
- Train students to exercise honesty when reporting on the implementation of their designed experiments.
- Credit students for their ability to justify their results or logically explain unexpected results.
- Ensure that students use the scientific method as they conduct investigations and always capture their observations, findings and conclusion in a laboratory report.

Extended Learning

Research the effects of deforestation on ecosystems.

Create a brochure outlining the interdependence of living organisms.

Explore the use of greenhouses to improve crop productivity.

RESOURCES

Electric water baths/hot plate/kettle of boiling water, eye protection, beaker for boiling water (250 cm3), forceps, boiling tube, leaf (e.g. hibiscus), petri dish, white tile, checklist

KEY VOCABULARY

Photosynthesis, energy pyramid, producer, consumer, herbivore, carnivore, omnivore, food chain, food web, adapted

LINKS TO OTHER SUBJECTS

Chemistry, Physics, Language Arts

ABOUT THE UNIT

In this unit, students will explore the concepts of physical and chemical changes through experimentation. They will also use these concepts to explain the formation of compounds and mixtures. The conditions necessary for rusting of iron will also be investigated.

RANGE OF CONTENT

- Chemical change produces a new substance (compound), is usually irreversible and involves changes in heat, mass or energy.
- During a physical change (e.g. state changes), the process is reversible, and no new substance is formed.
- Mixtures are formed from physical changes while compounds are formed from chemical changes
- Rusting is a chemical change where the surface of iron objects deteriorates when exposed to moisture and air.

GUIDANCE FOR THE TEACHER

The entire topic lends itself to investigative Science activities which should be explored. The use of the Inquiry-based approach will serve to bring out both the skills and content knowledge needed.

Ample opportunities should be provided for students to work collaboratively, share ideas, analyse, interpret, assess own and other people's ideas and arrive at a consensus on what is scientifically acceptable. Students should be carefully supervised and guided to observe laboratory safety rules at all times when conducting investigations.

Prior Learning

Check that students:

- Know that some changes can be reversible or irreversible.

PHYSICAL AND CHEMICAL CHANGES

ATTAINMENT TARGET(S):
Demonstrate an understanding of the importance of energy in our everyday life, and the need for grouping things.

Theme: Living Things and Life Processes

Topic: Physical and Chemical Changes
Duration: 7.5 hours/3 weeks

OBJECTIVES

Students will:

- Define the terms "physical change" and "chemical change".
- Explain the differences between physical and chemical changes in terms of composition, reversibility and properties.
- Perform experiments to distinguish physical and chemical changes.
- Collect and display information on physical and chemical changes.
- Investigate the conditions necessary for rusting.
- Use appropriate scientific language.
- Value individual effort and team work.

ICT ATTAINMENT TARGETS:

COMMUNICATION AND COLLABORATION - Use technology to communicate ideas and information, and work collaboratively to support individual needs and contribution to the learning of others.

RESEARCH, CRITICAL THINKING, PROBLEM-SOLVING AND DECISION MAKING - use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems, and make informed decisions.

DESIGNING AND PRODUCING - use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DIGITAL CITIZENSHIP - Recognise the human, ethical, social, cultural and legal issues and implications surrounding the use of technology and practice online safety and ethical behaviour.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Observe and record what happens when they: - gently heat a square of butter in a hot water bath and then allows the butter to cool - inflate then deflate a balloon - cut a sheet of paper into four pieces then put it back together - boil water and place a mirror (or other cold surface) directly above the steam As a class, discuss the changes that occurred in each case and state whether any new materials have been formed. (In discussions, teacher should introduce the term physical change to describe changes in which no new materials are formed.) Write a simple description of the meaning of the term 'physical change'. Share their descriptions with the class.	Observe, record, collaborate, communicate, manipulate, define, think critically - analyse, investigate draw conclusions	Observations accurately recorded Acceptable description given for the term 'physical change'

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Observe and record what happens when the teacher: - cracks and heats a raw egg and then allows the egg to cool - burns paper - mixes vinegar and baking soda Discuss the changes that occurred in each case and state whether any new materials have been formed. (In discussions, teacher should introduce the term chemical changes to describe changes in which new materials are formed.) Write a simple description of the meaning of the term 'chemical change'. Share their descriptions with the class.	Observe, record, collaborate, communicate, manipulate, define, think critically - analyse, investigate draw conclusions	Observations accurately recorded Acceptable description given for the term 'chemical change'
Watch the video: **https://www.youtube.com/watch?v=gCbqjs-pqJo** to identify characteristics of chemical and physical changes. In groups, use the information to define chemical and physical changes and give examples of these changes using everyday experiences. Compare physical and chemical changes based on composition, properties, reversibility, change in mass of substance, heat involvement. Construct a table to show the differences between physical and chemical changes.	Record, communicate, define, compare, tabulate, think critically – analyse, apply, interpret	Characteristics of physical and chemical changes correctly recorded Everyday examples correctly grouped Accurate comparisons made Properly constructed table with accurate information
In groups perform the following experiments to investigate chemical and physical changes. Record, possibly using word processing software, which ones are physical and which are chemical. Give a reason for answer in each case. **Physical Change:** Put one spatula of salt into a beaker. Add 5 ml of water into the beaker and stir. Wait 15 seconds. Do not taste! Record their observations. Heat solution to dryness and record observations.	Collaborate, measure, observe, manipulate, think critically – investigate, analyse, classify, draw conclusions, communicate	Correctly identifies which changes are physical or chemical Accurate explanation given for each choice Accurate observations made Logical conclusions arrived at

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: **Chemical Change**: Put one spatula of baking soda into a beaker. Add 5 ml of vinegar into the beaker and wait 15 seconds. Do not taste! Record their observations. **Physical Change**: Add 2 antacid tablets to a cup of water, followed by 3 or 4 raisins. Record observations and draw conclusions. OR Add 3 or 4 raisins to a cup of cream soda/sprite soda. Record observations and draw conclusions. **Physical Change:** Place four ice cubes in a dish and leave for five minutes. Record observations and draw conclusions. **Chemical Change:** Place some copper sulphate solution in a test tube and add a strip of magnesium ribbon or zinc strip. Record observations and draw conclusions. **Chemical Change:** Place large crystals of ammonium dichromate on a sand tray and then on a tripod. Heat with a Bunsen burner flame until crystals begin to change. Record observations and draw conclusions.	Observe, record, collaborate, communicate, manipulate, define, think critically - analyse, investigate draw conclusions	Observations accurately recorded Acceptable description given for the term 'chemical change'
In groups, review the mixing of the elements iron and sulphur (by video or demonstration). Separate the mixture using a magnet. Deduce the type of change that occurred. Compare with the heating of iron and sulphur in an evaporating dish. Try to separate the components. Deduce the type of change that occurred. Provide reasons for deductions. Share findings with the class.	Collaborate, communicate, observe, manipulate, think critically – analyse, compare, draw conclusions	Correct deductions made Logical reasons given.
In groups discuss and predict whether some simple activities will result in physical or chemical changes (e.g. mixing sand and water, striking a match and letting it burn etc.). In groups, carry out or make observations as the teacher demonstrates the activities, and record their observations in a variety of ways. Discuss findings with the class and compare their predictions with the class consensus.	Collaborate, communicate, observe, classify, think critically - predict, compare, investigate	Accurate classification of changes as reversible or irreversible

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Observe nails with a reddish-brown covering (rust) and make inferences about the cause. In groups, perform an experiment to investigate the conditions necessary for rusting. Label four test tubes 1-4. Place one nail into tube 1 and use deionised water to partially cover the nail. Place a second nail into tube 2 and use boiled deionised water to partially cover the nail. Carefully pour a little oil over the surface to prevent air from reaching the water. Mix some salt with some deionised water to make a solution. Place a third nail into tube 3 and add enough of the solution to cover the nail. Put a nail into tube 4 and add about 2 cm depth of anhydrous calcium chloride granules (these absorb water.) Put a bung in this tube to prevent any further water from getting in. Leave the nails for at least three days and note any changes in their appearance. Record observations and tabulate, using word processing software, which conditions are present or absent in each of the tubes (e.g. Tube 1 – water and air, Tube 2 – water but no air, Tube 3 – water, air and salt, Tube 4 – air, no water). Use the results to suggest whether rusting is a physical or chemical change. Make an entry in their journal about how the knowledge gained from this investigation can be applied in daily living.	Manipulate, measure, observe, collaborate, communicate, tabulate, think critically – infer, draw conclusions, reflect	Rusting process correctly identified Plausible causes of rusting suggested Correct deduction that rusting is a chemical change Conditions that promote rusting correctly identified
In groups, plan and design an experiment to prevent rusting. Identify materials and method to be used. Explain how the materials chosen will prevent rusting. Use class wiki/blogs to collaborate and share information in planning and designing the experiment. Carry out the experiment and display items to show how rusting was prevented. Record experiment using the scientific method.	Collaborate, communicate, manipulate, think critically - plan and design	Hypothesis clearly stated and testable Workable plan and design Chosen materials prevented rusting

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Explain the differences between physical and chemical changes and cite examples of physical and chemical changes.
- ✔ State the conditions necessary for rusting to occur.
- ✔ Collaborate and communicate ideas and information using class wiki/blogs and WebQuest and, word processing and multimedia software.

Points to Note

- Deionised water can be purchased at gas stations/stores. It is best if the deionised water is boiled e.g. in a kettle, as close to the start of the lesson as possible and supplied warm to the students.
- In tube 2, air is removed during boiling and the oil prevents any extra from dissolving in the water and reaching the nail. In tube 4, calcium chloride removes the water from the air and the bung prevents any extra from entering.
- Ensure that the room is well ventilated when sulphur is being burned.
- Use word processing software and other technology tools to create original work for a specific purpose and audience.

Extended Learning

Explore ways to minimize rusting.

RESOURCES

Salt, water, vinegar, beaker, copper sulphate, magnesium ribbon, ice, antacid tablets, raisins, wax, iodine, ammonium dichromate, chalk, wood, paper. Iron (II) sulphide, sulphur, iron, internet, multimedia projector, computer, speakers, video CDs/DVDs, word processing, multimedia and graphic software tools, audio capturing software, WebQuest site

KEY VOCABULARY

Physical change, chemical change, rusting, bonds, reactants, products, atoms

LINKS TO OTHER SUBJECTS

Language Arts, Mathematics

APPENDICES

SUBJECT GLOSSARY

TERMS	DEFINITIONS/MEANINGS
Analyse	to examine in order to explain and interpret data
Annotated diagram	a labelled scientific drawing with brief notes within the diagram
Annotate	to supply additional information to further explain elements in a diagram
Assess	to evaluate or make judgements to determine value or importance
Classify	to use observable characteristics to form groups
Conclusion	findings obtained through experimenting or research
Construct	to make or draw using data or material provided
Control (constant) variable	the variable that is not changed during the investigation
Criteria	pre-determined principles used to make decisions or judgements
Deduce	use information presented to reach a conclusion
Engineering Design Process	a problem-solving method that consists of a series of steps used to design a product to meet certain criteria
Evaluate	to make judgements based on analysis
Evidence	data obtained during an investigation
Fair test	a scientific investigation in which one variable is changed while all other variables remain the same
Formulate	to develop a plan or strategy
Findings	the results of a scientific investigation
Hypothesis	a part of the Scientific method in which a proposed explanation is given for an observed phenomenon. It is also a testable answer to a scientific question
Identify	name or point out specific features or structures
Illustrate	explain using examples or diagrams
Infer	make deductions based on observations

SUBJECT GLOSSARY

TERMS	DEFINITIONS/MEANINGS
Inferences	a conclusion that is based on observation and reasoning
Investigate	to use a systematic inquiry to find answers
Investigation	the process of research and experimentation to find answers
Justify	provide reasons or an acceptable explanation of a phenomenon
Laboratory report	a record of the steps in an experiment
Manipulate	a scientific process skill that describes handling and control of scientific apparatus
Manipulating variable	the independent variable in an investigation that is changed by the scientist
Model	3-D representation of an object done on a smaller scale
Observe	to gather information in a scientific investigation through use of all the senses
Observations	information obtained through the use of all senses
Predict	suggest a possible outcome based on information given
Problem statement	the statement that outlines the problem to be investigated
Prove	to show using evidence or arguments
Responding variable	he dependent variable in an investigation that responds to changes and is measured or observed
Scientific drawings	line drawings done in pencil with no shading
Scientific method	a series of steps used to answer questions through observation, formulating and testing hypotheses and drawing conclusions
Suggest	to offer an explanation for observations
Test	to find out by investigating
Variable	a factor or condition that can be changed or manipulated in an experiment

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Below are tips you may find usefulwhen teaching students with special needs:

- Get to know your students and their individual needs.
- Ensure that classroom procedures and routines are flexible enough to accommodate individual differences
- Use positive non-discriminatory language
- Be deliberate in including students with special needs in all activities
- Communicate high expectations
- Model and reinforce appropriate social skills
- Use assessment data to plan instructions
- Teach to students' strengths and learning styles
- Students with special needs respond well to direct instructions or guided discovery
- Use multisensory teaching approaches that engage two or more learning modalities simultaneously
- Break content into small steps and teach each step to mastery
- Differentiate objectives based on students' functioning levels
- Make ample use of mnemonics and other memory aids
- Pair students with special needs with learning partners/buddies
- Provide appropriate accommodations as needed during instruction and assessment:
    a. Extra time
    b. Reduced work load
    c. Material in alternative formats
    d. Visual cues
    e. Technological aids
    f. Alternate activities

ALTERNATIVE PATHWAYS TO SECONDAY EDUCATION (APSE)

The 21st century is a time of rapid technological growth and social change. The school curriculum must, therefore, ensure that young people are well prepared for the challenges and opportunities that they will meet as adults in this century. The MoEYI is making every effort to provide for the multiple intelligences of our children and cater to their diverse needs in order to fully maximize their capabilities. Hence, the MoEYI has created alternative pathways to receiving an education at the secondary level.

Providing alternative pathways will be far-reaching in carrying out the Ministry's mantra, "Every child can learn....every child must learn". Learning pathways will allow for an inclusive approach in which instruction is based on tailored curricula, enabling each learner to perform to his/her fullest potential based on aptitude, interest and ability. Alternative Pathways represent a new approach to secondary education. Secondary education in Jamaica is being reframed and re-positioned as customised, diverse, relevant, equitable, outcomes-based, and inclusive; and significantly, this approach will signal the introduction of a seven year (Grades 7-13) period of instruction for students on all secondary pathways.

Goals of the APSE

- Design the school system to offer differentiated instructional programmes, informed by the National Standards Curriculum (NSC).
- Develop individualized intervention/learning plans based on students' performance profile.
- Provide special educators as Pathway Coaches to support subject teachers of students on Secondary Pathways II and III in the delivery of instruction.
- Facilitate a functional academic approach at the secondary level characterised by response to intervention (RtI) methodology, interactive, learner-centred, project-based and problem- based learning, reflection and alternative forms of assessment.
- Foster a system for ALL students to exit the secondary level with the knowledge, skills, competences and attitudes which will have them ready for the world of work or to access tertiary level education.

Secondary Pathways I, II & III (SP I, II & III)

All students will access secondary education via the prevailing Grade Six examination. The exit examination will provide individual profiles to inform decisions for pathway access and standards for differentiation.

SPI is a 7-year programme with a curriculum based on the constructivist approach. At Grades 7-9 students will access the National Standards Curriculum (NSC), and at Grades 10, 11, 12 & 13, they will access the curricula/syllabi of the examining body.

SP II is a 2-year transitional programme with a curriculum based on the constructivist approach. Special educators/pathway coaches will work with teachers and students on this pathway. Students will be provided the required intervention and support to allow for transition. At the end of Grade 8 students will be re-evaluated through psycho-educational evaluation to determine their readiness for crossing over into either SP I or SP III.

SP III is a 7-year programme with a curriculum based on the constructivist approach. At Grades 7-9 students will access the National Standards Curriculum (NSC), and at Grades 10 & 11, they will access the curricula/syllabi of the examining body. At the end of Grade 11 SP III students will transition into the Career Advancement Programme.

At Grades 7-9 the NSC, will be modified to meet the needs of the SP III students. Students in SP III will be instructed through a functional academics curriculum in the core subjects- Mathematics, English Language, Communication, Social Studies and Science. Their instruction will be further enriched with Personal Empowerment, Technical and Vocational instruction, as well as the performing and creative arts. Pathway Coaches will collaborate with subject teachers to prepare content, ensuring differentiation in instruction for students on SP II and III. These students will also be supported through use of the Response to Intervention (RtI) methodology.

PERSPECTIVES OF SCIENCE, TECHNOLOGY, ENGINEERING, MATHEMATICS & THE AESTHETICS (STEM/STEAM) IN RELATION TO THE NATIONAL STANDARD CURRICULUM (NSC)

INTRODUCTION & BACKGROUND

The integration of theoretical principles that relate to STEM/STEAM Education in the NSC began in June 2014. This move was influenced by recommendations of the STEM Steering Committee that emphasized the need to develop learners who are not just productive, but who would also be innovative Jamaicans. STEM integration was also regarded as one of the strategic long term means of addressing the economic challenges being faced by Jamaica using education as a primary vehicle for the implied transformational change to happen, beginning from short term efforts.

Initial discussions and deliberations promoted an emphasis on STEM rather than STEAM Education. However, critical analysis of the conversations conveyed the perspective of STEM as a collection of related disciplines that all learners should have the opportunity of pursuing, to develop the competencies they offer and as a consequence be able to gain employment or become employers in STEM related areas. As stakeholders from different backgrounds processed their understanding of STEM, new meanings of the concept emerged from the discussions. One was the perspective of STEM as a methodology. There was, however, concern about the exclusion of “A” in STEM. This “A” component however, brought to the discussion, multiple meanings. In some Aesthetics as a field and was considered an important component to be included if educators are serious about issues of discrimination, holistic learning and current research on the iterative function of the brain that warrants attention to brain based learning and the role of the Arts in promoting knowledge integration to cater to multiple domains of learning. There was also discontent about neglecting the Performing Arts when related creative industries contribute significantly to economic development. The concern was that the role of the Arts to economic development was being trivialized.

The call for the integration of the Aesthetics or Art forms became more pronounced as STEM took on more national significance. This was supported by research that indicates the importance of the Aesthetics in developing values and attitudes, in promoting holistic learning and in serving as drivers of innovations. By integrating principles from STEM with those from the Arts/Aesthetics, the approach to problem solving would encourage greater appreciation for and reliance on the interdependent nature of knowledge when science and arts intersect. Additionally, STEAM as a methodology encourages the harmonizing of the cognitive and the emotional domains in the problem-solving process.

The concept of STEAM was adopted in 2015, as an integrative approach to education and a methodology that pays attention to the benefits to be derived from the inclusion of the Arts or Aesthetics with STEM related principles. These collective benefits are supported by Jolly (2014), Sousa and Pilecki (2013) and include divergent thinking; differentiated learning; Arts integration; focus on intrinsic motivation and informed decision-making.

PERSPECTIVES OF STEM/STEAM IN THE CONTEXT OF THE NSC

In the context of the NSC, STEM/STEAM is used in a number of ways. These include:

STEM/STEAM as an integrative learning approach and methodology in facilitating learning. This perspective places emphasis on STEM/STEAM as a means of helping learners become creative or innovative problem solvers and lifelong learners who rely on scientific principles (laws and theories) to address issues/concerns or to deal with observed phenomenon that are puzzling for them or that inspire interest. As an approach, the focus is on solving problems based on principles. As methodology, the focus is on the system of practical procedures to be used to translate principles into the problem - solving processes or to choose from available problem- solving models.

STEM/STEAM as an Experiential-Vocational Learning Framework that is based on problem solving through the project-based approach. Emphasis is placed on solving real life problems in a context that requires learners and their facilitators to observe work-based principles. The primary purpose for this focus is for learners to: (i) become employable (ii) prepare for further education and/or for occupational or work readiness.

STEM as types of institutions in which learning is organized as a meta-discipline as described by Morrison and Bartlet (2009). Based on this perspective, STEM facilitates the demonstration of knowledge in a manner that removes the boundaries of each discipline for application to problem as would be practised in the real world.

IMPLICATIONS OF PERSPECTIVES OF STEM/STEAM IN LIGHT OF THE NSC

Since the NSC is based on Constructivism principles, STEM/STEAM as an approach and methodology, has to be established on post-positivistic thinking. From this position, STEM/STEAM influences the kind of practice that promotes collaboration, negotiation of meaning and openness to scrutiny.

The NSC developers selected a Constructivist approach that included the deliberation, designing and development stages of the curriculum process. Evidence of the influence of Constructivism can be seen the NSC Framework Document that conveys the following emphasis:

(i) **The element of objectives** is presented in two forms; firstly as **Learning Objective**s to focus attention on process and experience rather than product. Secondly as Learning Outcomes that serve as some of the outputs of the process. They include the basic understandings, skills and dispositions anticipated from learners' engagement in the planned experiences.

(ii) **The element of content** is treated as contexts for learners to think critically, solve problems creatively while developing their identity as Jamaicans. Content is not expected to be treated as disciplines to be mastered but as areas that contribute knowledge, skill sets and attitudes that form the composite of competencies to be acquired from their integration in the learning situations.

(iii) **The element of learning experiences (method)** is presented as a set of learning activities that serves as a source of problems to be addressed as a part of the learning process. These real-life activities provide the scope of knowledge, skills and required dispositions or character traits for learners to make sense of that aspect of life or the world that they represent. They are the threads that connect all the other elements of the curriculum and allow for the integration of STEM/STEAM in the following ways:

- Identification of activities that are presented as problems to be solved using the STEM/STEAM approach based on contextual factors that include the profile of the learner, the learning conditions and the anticipated impact.
- Integrating activities to form a real problem to be solved as a short, medium or long term project to which the project based learning would be applied.
- The examination of learning activities by learners and teachers as co-learners through multiplelenses using content of science, technology, mathematics and the humanities that they have already explored to engage in the problem identification and definition processes.
- Extending learning in the formal setting to the informal by connecting co-curricular initiatives that are STEM/STEAM based that learners are undertaking at the institutional level through clubs and societies, as whole school projects or in partner ship with external stakeholders.
- Using the learning activities to review STEM/STEAM initiatives that form a part of the informal curriculum to and for reflection on action.

- Using activities as springboards for reflecting on career or occupational interest in STEM/STEAM related areas.

(iv) The element of evaluation is communicated in two major ways; firstly as prior learning which serves diagnostic purpose and secondly as an on-going developmental process. This formative focus is indicated by the inclusion of explicitly stated assessment criteria that are to be used alongside the learning activities. The use of assessment criteria as counterparts of the learning activities also indicates that assessment is learner centred since it is serving developmental rather than promotional purpose and as a consequence, allows learners to self-correct as they use feedback to develop feed-forward capabilities. Evidence of learning, based on the learning outcomes, can be collected from various types of assessment methods that emphasize the learner centred constructivist orientation. This brings to the fore the need for serious consideration to be given to differentiation in assessment for fairness and credibility of claims about learners' capabilities and to inform decisions that will impact their educational journey.

In general, this integrated approach, which is the context of STEAM, is aimed at improving the quality of the educational experience for learners while influencing the achievement of the aims of education that relate to productivity and creativity as part of the profile of the Jamaican learner.

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The 5Es Overview: "The 5E Learning Cycle"

What is a 5E Learning Cycle?

This model describes an approach for facilitating learning that can be used for entire programmes, specific units and individual lessons. The NSC supports the 5E constructivist learning cycle, as it places emphasis on the processes that may be used to help students to be personally involved in the learning situation as they are guided to build their own understandings from experiences and new ideas.

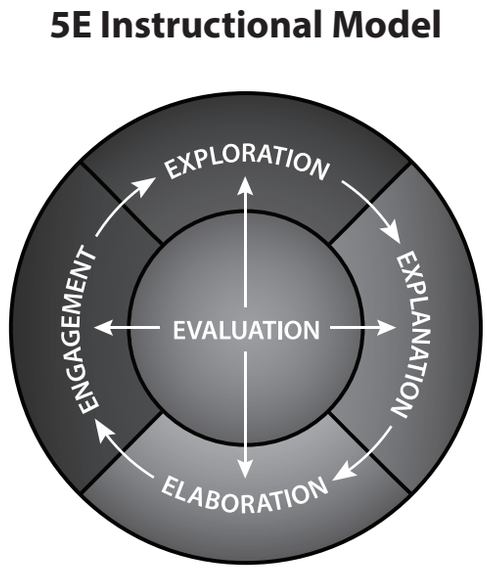

Figure 1. Illustrating one version of the 5E model that conveys the role of valuation as an interconnecting process that is at the core of the learning experience.

Figure 2, illustrating a cyclical perspective of the model with each process being given similar emphasis in contributing to the learning experience on a whole.

EXPLANATION OF THE INSTRUCTIONAL MODEL

What are the 5Es?

The 5Es represent five key interrelated processes that provide the kind of learning experiences for learners to experience the curriculum or planned learning episodes: Engage, Explore, Explain, Extend (or Elaborate), and **Evaluate**.

ENGAGE: The purpose of the ENGAGEMENT dimension is to help students to be ready intellectually, socially, emotionally etc. for the session. Attention is given to the students' interests and to getting them personally involved in the lesson, while pre-assessing prior understandings, attitudes and/or skills. During the experience, students first encounter and identify the instructional task and their roles and responsibilities. During the ENGAGEMENT activity, students make connections between past and present learning experiences, setting the organizational groundwork for upcoming activities. The engagement activity may be used to (a) help student unearth prior knowledge (b) arouse their curiosity (c) encourage students to ask questions as a sign that they have wonderments or are puzzled.

EXPLORE: The purpose of the EXPLORATION dimension is to get students involved in solving a real problem that is based on a selected context. EXPLORATION provides them with a chance to build their own understanding of the phenomenon being investigated and the attitude and skills involved for arriving at a workable solution. In exploring the students have the opportunity to get directly involved with the phenomenon and materials. As they work together in learning teams or independently, the need to share and communicate becomes necessary from the experiences. The teacher functions as a facilitator, providing materials, guarding against obstacles to learning and guiding the students to operate based on agreements. The students become inquirers and co-owners of the learning process. In exploring, they also ask questions, formulate hypothesis, search for answers or information/ data, reflect with others, test their own predictions and draw conclusions.

EXPLAIN: The purpose of the EXPLANATORY dimension is to provide students with an opportunity to assess their thinking and to use intellectual standards as critical thinkers to communicate their perspectives and/or the meaning of the experiences. They rely on communication tools and their skills as Language users to: (a) organize their thoughts so that they are clear, relevant, significant, fair, accurate etc. (b) validate or affirm others (c) self-motivate. Reflection also occurs during the process and may cause students to adjust their perspective or justify their claims and summarise the lessons being learned. Providing explanations contributes to vocabulary building and self-corrective actions to deal with misconceptions that they become aware of from feedback of their peers and/or their facilitator.

EXTEND: The purpose of this dimension is to allow students to use their new knowledge and continue to explore its significance and implications. Students work independently or with others to expand on the concepts and principles they have learned, make connections to other related concepts and principles within and/or across disciplines, and apply their understandings in new ways to unfamiliar situations.

EVALUATE: The purpose of the EVALUATION dimension is for both students and facilitator to determine progress being made or the extent to which learning has taken place based on the stated objectives or emergent objectives. EVALUATION is treated primarily as an on-going diagnostic and developmental process that allows the learner to become aware of gaps to be treated and progress made from their efforts to acquire the competencies that were the focus of the session. Examples of competencies include understanding of concepts, principles and processes and demonstrating various skills. Evaluation and assessment can occur at different points during the learning episode. Some of the tools that assist in this diagnostic and formative process include rubrics, teacher observation log, self-inventories, peer critique, student interviews, reflective presentations, displays/expositions,

portfolios, performances, project and problem-based learning products. Analysis of reflections, video recordings are useful in helping students to determine the depth of their thinking and understanding and the objectives they have or have not achieved.

Who developed the 5E model?

The Biological Science Curriculum Study (BSCS), a team led by Principal Investigator Roger Bybee, developed the instructional model for constructivism, called the “Five Es”.

The Link between the 5E model and Types of Learning Activities

The five (5) types of Learning Activities purported by Yelon (1996) can be integrated with the 5E’s so as to enrich the teaching and learning process. He noted that every instructional plan should include the following learning activities

1. Motivation Activities: Intended to help learners to be ready for the session
2. Orientation Activities: Inform students of their roles and responsibilities based the purpose or objectives of a learning episode.
3. Information Activities: Allow students to manipulate current knowledge, access/retrieve and generate new ideas
4. Application Activities: Allow for the use of knowledge and skills in novel situations
5. Evaluation Activities: Allow for reflection, corrective actions and sourcing of evidence to confirm/refute claims about learning.

These activities can be planned to serve one of the purposes of each dimension of the 5E model. For example, ENGAGEMENT may be comprised a Motivation Activity and an Orientation Activity. EXPLORATION and EXPLANATION require an Information Activity, while EXTEND requires an Application Activity. EVALUATION requires the kind of activity that will contribute to the collection of data for assessing and arriving at a conclusion about performance based on stated or expected purpose for which learning is being facilitated.

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SUBJECT: INTEGRATED SCIENCE
GRADE: 7 (APSE II)
DATE: February 2019
DURATION: 3 hours (one hour to plan and design experiment)
TOPIC: Osmosis

ATTAINMENT TARGET

- Demonstrate understanding of the importance of the life processes and body systems, health and well-being.

SPECIFIC OBJECTIVES

- Investigate the process of osmosis
- Compare diffusion and osmosis

KEY SKILLS

Main Activity: predict, observe, measure, analyse, compare, draw conclusions, problem-solve, report Challenge: plan and design, problem-solve, create, apply, communicate, investigate

MATERIALS/RESOURCES

Chicken eggs, vinegar, containers, string, ruler, hand towel, sugar, bucket balance/ digital scale

CONTENT OUTLINE: [Brief notes on main points/concepts]

For example, cite notes for: Simple description of process of osmosis with necessary diagrams and examples; definition of osmosis. Include video description and link for videos to be used in lesson; reference texts and relevant page numbers.

PRIOR LEARNING

Check that students:

- Know the basic functions of the cell membrane and that it is selectively permeable
- Can explain diffusion

Strategy: Each student completes a worksheet that requires them to label the animal cell; complete an activity on diffusion and then answer short questions about diffusion.

LEARNING OUTCOME

- Demonstrate an understanding of diffusion and osmosis as fundamental events which enable living organisms to carry out life processes.

ASSESSMENT:

Main Activity: Use a rubric to score investigation reports for students' ability to record accurate observations and in appropriate formats; analyse observations and data and draw logical conclusions that make reference to predictions and questions asked; communicate orally; measure accurately and make comparisons.

The Challenge: Use a rubric to score the experiment design plan for application of the scientific method process, application of the concept of osmosis and evidence of problem-solving strategies, students' collaborative skills.

PROCEDURE:

Engage - How can I get students interested in this? Use of an interesting picture, video, story etc. to hook students' attention.

Select a sample of simple but exciting activities with eggs from the video https://www.youtube.com/watch?v=6KCmrc043Kk and conduct with students to hook their interest (students may be allowed to participate) and to help them recognize that eggs have a selectively permeable membrane (include activity that isolates the selectively permeable membrane of the egg).

Explore - What tasks/questions can I offer to help students puzzle through this? Use of a simple investigation.

The case of the incredible eggs!!

CASE as reported: Mrs. Gordon reported to our chief inspector that she went to the supermarket on Thursday at about five o'clock in the evening. She purchased groceries including one dozen fresh brown eggs with speckles. In an alarmed voice and with great distress, she added that as soon as she got home she placed the eggs in the refrigerator but the next morning, all twelve eggs had changed colour to become either red, yellow, blue, green or even pink! And what's more, they were all bigger and bounced when she dropped them on the table!! Mrs. Gordon strongly believes that the supermarket is selling eggs from defective chickens!

Solve this mystery, please!

PROBLEM: WHAT CAUSED THE EGGS TO GET BIGGER AND BOUNCY?

Activity: Investigating osmosis in animal material - What caused the eggs to get bigger?
Working in small groups, students:

- Formulate a hypothesis about the possible answer to the stated problem. Use the 'Guided Enquiry' approach to find out what caused the eggs to become bouncy by completing the following steps.
- Label container with group name.
- Measure the mass and circumference of 4 eggs (use a string and ruler) and place them in a container. Record the measurements in a suitable table.
- Pour in enough vinegar to completely cover the eggs.

- Cover the container loosely and leave for two days.
- After two days, carefully rinse the de-shelled eggs and gently pat them dry.
- Observe the eggs and record all observations. Try bouncing one of the eggs at different heights above the table (egg will likely break at about 12 inches above the table; use only one egg for this test).
- Pour 300 ml of pure water, a strong sugar solution and a dilute sugar solution separately into 3 different containers and label.
- Place one egg in each container.
- Cover containers and leave for 12 - 24 hours.
- Make predictions about the expected changes in the physical appearance, mass and circumference of the eggs during and after leaving them in the pure water, strong sugar solution and dilute sugar solution.
- After 12 – 24 hours, remove the eggs, rinse in tap water and dry.
- Compare the eggs before and after placing them in the liquids and record observations.
- Measure the mass and circumference of each egg and add the measurements to the table and draw an evidence-based conclusion about the size of the eggs before and after treatment.
- Explain the changes observed in the eggs in terms of osmosis.
- Provide an answer to the question, 'What caused the eggs to get bigger'?

Explain - How can I help students make sense of their observations? Class presentation and discussions.

Main Activity

- Students share their observations with the class and suggest reasons for the changes.

Facilitator: Guides students in inferring from their observations that water particles move from an area where they are in greater amounts to an area where they are in smaller amounts.

Guiding Questions

- What caused water to move from the dilute sugar solution and into the egg?
- What caused water to move out of the egg and into the strong sugar solution?
- What role, if any, do you think the investigation that was set up with the egg and pure water only played?

Facilitator: Shows video of what happens to the eggs at a molecular level and introduces, 'osmosis' as the term used to describe the phenomenon. Students are allowed to modify their explanation if necessary.

- Students compare osmosis and diffusion.

Facilitator: Guides students in accurately distinguishing between osmosis and diffusion.

Guiding Questions

- **In osmosis, what types of particles move from an area where there are a lot of them to an area where they are in small amounts?**
- **What major characteristic of the cell membrane makes it suited for osmosis?** (Draw the students' attention to the membrane of the egg that was in the 'bounce' test).
- **In diffusion, what types of particles move from an area where there are a lot of them to an area where they are in small amounts?**

Facilitator: Guides students in making the connection that osmosis takes place both in plant and animal matter and that the same conditions are necessary for the process to occur.

- Students use a template to construct a laboratory report and provide an answer to the question, '**What caused the eggs to get bigger?**' In addition, the report should include the answer to the question, **'How is osmosis different from diffusion?'**

Elaborate - How can my students apply their new knowledge to other situations? Application of what was learned.

Facilitator: With the aid of a video, introduces the students to dialysis and explains the role of diffusion and osmosis in the process.

- Students carry out research to identify and explain at least one simple example of osmosis in everyday life situations.

Evaluate - How can I help my students self-evaluate and reflect on the teaching and learning, and how can I evaluate the students learning of concepts and skills.

The Challenge: In groups, students plan, design and conduct an experiment to make 'Coloured Eggs'.

Reflection

In their journals, students record their thoughts/feelings about osmosis as a life sustaining process both in plants and animals.

EXTENDED LEARNING [Differentiated]

GROUP 1

It has been observed that when fruits, example mangoes and apples, are available in large quantities, much of these are wasted because of spoilage.
Design a container that can be used to keep dried fruits dry.
Highlight the role of osmosis.

GROUP 2

It has been observed that when fruits, example mangoes and apples, are available in large quantities, much of these are wasted because of spoilage.
Create a four-page annotated picture brochure to illustrate how the process of dehydration is used in preserving grapes.
Highlight the role of osmosis.

GROUP 3

Create a poster showing processed or preserved foods found around the home and indicate the role osmosis in their preservation. Highlight the role of osmosis.

Facilitator: Schedules time for viewing of presentations by class.

LINKS TO OTHER SUBJECTS: Food and Nutrition, Chemistry, Mathematics, Information Technology

POST-LESSON REFLECTION

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