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

NATIONAL STANDARDS CURRICULUM

INTEGRATED SCIENCE

GRADE 7-9 APSE1

NATIONAL STANDARDS CURRICULUM GUIDE

GRADES 7-9

INTEGRATED SCIENCE

APSE1

Ministry of Education, Youth and Information, Jamaica. 2018

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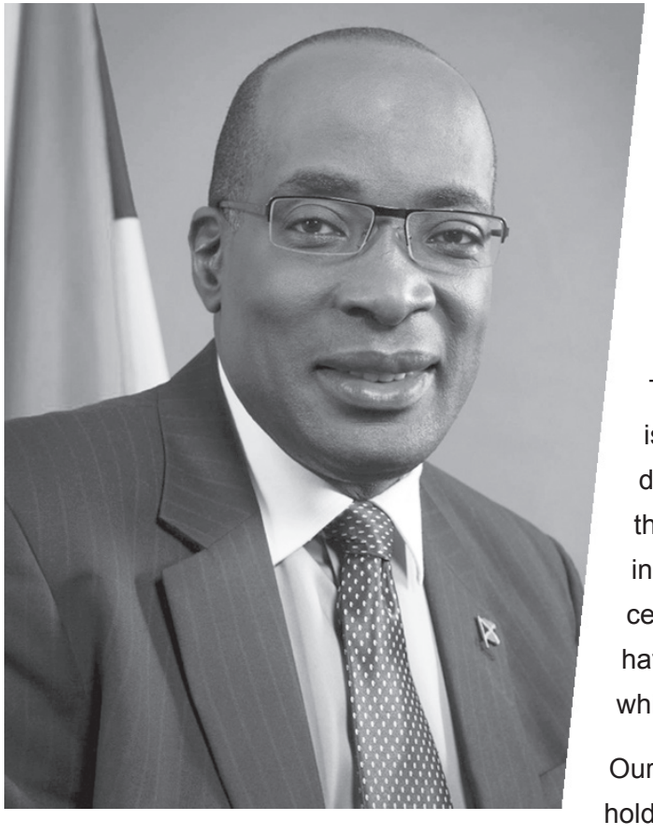


Education has always been pivotal to societal and economic development. It is for this reason that Jamaica remains unshaken and hopeful of a realized vision to be “the place of choice to live, work, raise families and do business.” The assurance of the possibility of all that such a vision entails comes from the recognition that Jamaica is endowed with tremendous God-given talent and creative potential and as a people of strong faith in spiritual principles and resilience; we are able to harness our capabilities, to make significant influence on the world. It is through this new National Standards Curriculum (NSC) that we hope to propel this vision of the education system whilst becoming more relevant, current and dynamic.

The team at the Ministry of Education Youth and Information is cognizant of the fact that the curriculum is the heart and mind of education and remains the most powerful means by which any country can develop and be sustainable. It is for this reason that the NSC has been designed with the understanding that people, learning and national development are at the core of our existence in a time of rapid change in the physical, social, economic and other dimensions of the global landscape. As a consequence, we celebrate the wisdom of the developers who through the engagement of numerous stakeholder groups, have responded favourably to the need for that kind of education that prepares our young people for life; while challenging our more mature to join in this lifelong journey of learning to learn.

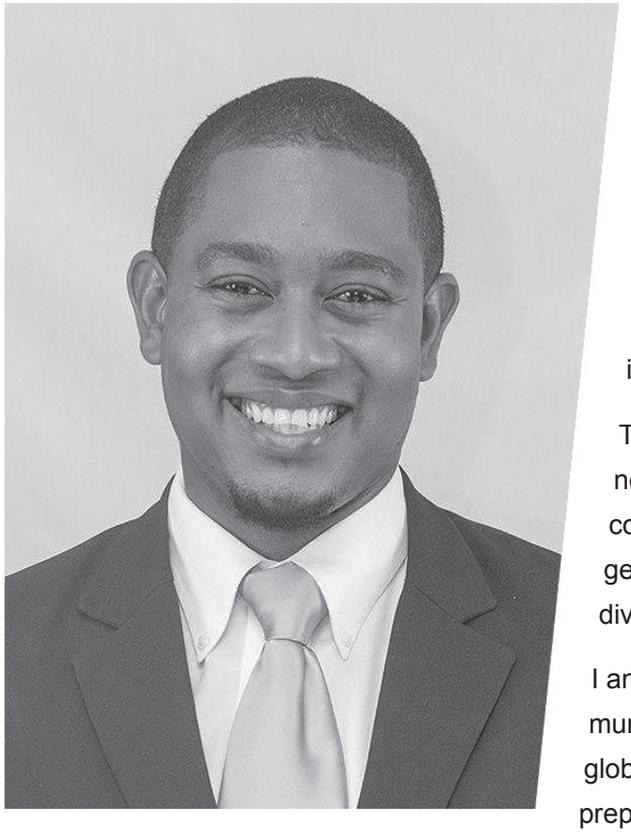
Our commitment to the development of each learner and our support and appreciation of the various stakeholder groups that are partnering with us in providing quality education, remain at the forefront of our efforts in ensuring that this journey transforms education. This commitment is conveyed through our adoption of a Pathway Approach to learning that demands of us to provide customized programmes, differentiated learning experiences and specialized support for our learners. Our actions have been fruitful as is evident by the systems and conditions we have put in place for successful implementation.

Like the rest of Jamaica, I look forward to the testimonials of students, parents, teachers and other stakeholders of the empowering effect of this learner- centred curriculum and remain confident that it will contribute to make Jamaica renown.

The Honourable, Senator Ruel Reid,CD

Minister of Education, Youth & Information

MESSAGE



Building a modern society where young people can prosper and achieve their aspirations is paramount on the Ministry of Education, Youth and Information's (MOEYI) agenda. In its bid to advance this agenda the team at the MOEYI has developed the National Standards Curriculum (NSC) on a clear set of values that will permeate learning and become embedded in young people's approach to life. Young people need to be clear about their Jamaican identity. Justice, democracy, tolerance and respect need to be more than mere words; they need to become an essential part of people's lives. Young people's understanding of, and commitment to, sustainable development is critical to the future of Jamaica and of the world. These values that permeate the new curriculum and more importantly, will by its use, be ingrained in the fabric of the Jamaican society.

The development of a new curriculum is a major achievement in the life of any country. It is even more noteworthy because this curriculum embodies the set of knowledge, skills, values and attitudes that our country deems relevant at this particular time. It is intended that these attributes be conveyed to the next generation as a means of cultural continuity in preparation to cope with the future, both nationally and individually.

I am particularly excited about the prospects of the NSC honing key twenty-first century skills such as communication, collaboration, critical thinking and creativity in our youth as they prepare to take on their roles as global citizens. I encourage parents, students, teachers and indeed the community to partner with us as we prepare our young people not just for today, but for the rapidly changing times ahead.

The Honourable, Floyd Green, MP

State Minister in the Ministry of Education, Youth & Information

MESSAGE

In responding to the challenges confronting education in Jamaica, The Ministry of Education Youth and Information has taken strategic measures to address the need for a national curriculum that is relevant for the 21st century, the dynamics of the Jamaican context and the profile of the learners at the pre-primary, primary and secondary levels. One major output of these strategic actions is the National Standards Curriculum. This curriculum is intended to be one of the means by which the Jamaican child is able to gain access to the kind of education that is based on developmentally-appropriate practice and the supporting systems and conditions that are associated with high quality education.

This curriculum has the potential to inspire and provide challenges in the form of problem situations that all our learners can handle in ways that are developmentally appropriate. It compels us to move beyond the traditional functional perspectives of being literate to a focus on the physical and physiological as well as the ethical, social and spiritual.

I invite all our stakeholders to fully embrace this new curriculum which promises to excite imaginations, raise aspirations and widen horizons. Learners will become critical and creative thinkers with the mindset required for them to be confident and productive Jamaicans who are able to thrive in global settings as they take their place in the world of uninhibited change.

Mr. Dean Roy Bernard

Permanent Secretary , Ministry of Education, Youth & Information

MESSAGE

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 1 and 9; to reduce the scope, 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.

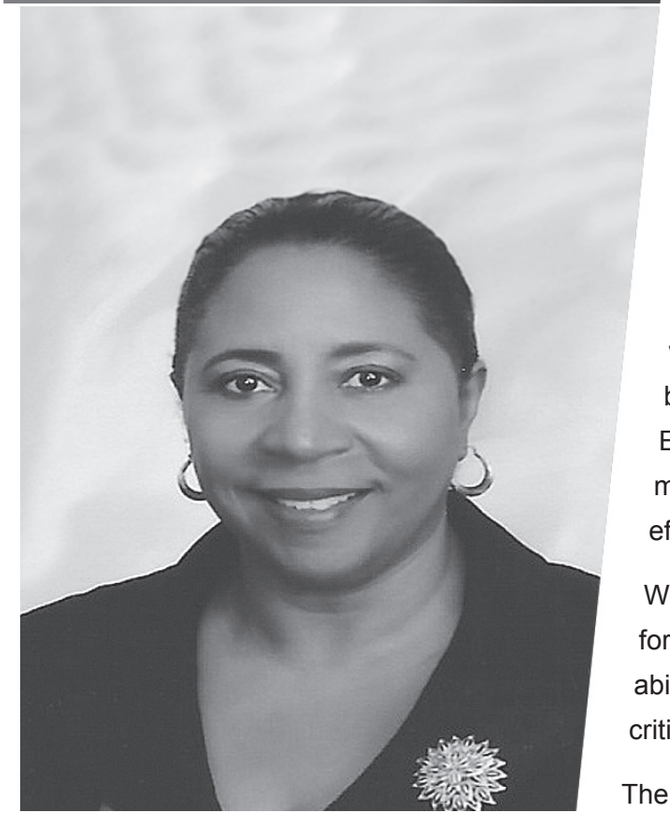
It is anticipated that as school administrators and teachers system-wide implement the National Standards Curriculum that improvements will be evident in the general academic performance, attitude and behaviour of our students.

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

Chief Education Officer, Ministry of Education, Youth & Information

MESSAGE



The Ministry of Education Youth and Information (MoEYI) is committed to providing high quality education to all Jamaican children. We have heard the cries from the various sectors of the Jamaican society about the level of preparedness/readiness of our students for life in the 21st century; and we are taking the necessary steps to ensure that our students graduate with marketable skills. The MoEYI has reviewed and redesigned the Grades 1-9 curricula around the principles of Vision 2030 Goal number one; “Jamaicans are empowered to achieve their fullest potential”.

The National Standards Curriculum (NSC) will lay the foundation for students by preparing them for working lives that may span a range of occupations, many of which do not currently exist. This has been done by way of designers carefully integrating the theoretical principles of Science, Technology, Engineering and Mathematics/Science, Technology, Engineering, Arts and Mathematics (STEM/STEAM) methodologies into the curricula at all grade levels. The NSC illustrates that in order to make education effective for our 21st century children; we need to change how we teach, and what we teach.

We are satisfied that the curriculum designers and writers have produced a curriculum that is indeed fitting for the 21st century. The NSC was designed to develop students’ understandings of subject matter and their ability to apply what is learnt; it fosters their ability to communicate and solve problems collaboratively, think critically and create novel solutions.

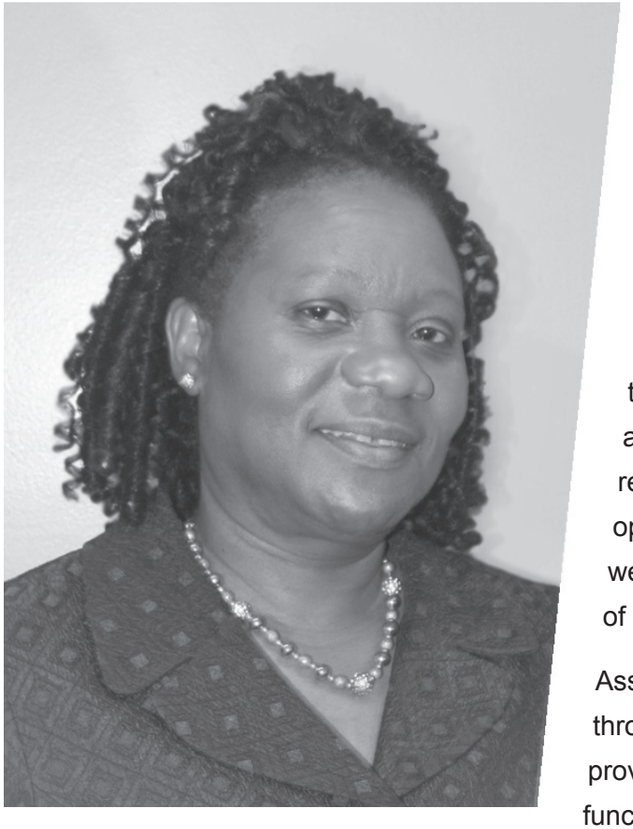
The success of our children is dependent on the participation of all stakeholders in the learning process. We encourage you all to be our committed partners in education as the true impact of this curriculum will only be felt when we have all hands on board. I am indeed proud to be associated with the development and implementation of this curriculum; it will inspire hope in our nation and future generations; kudos to the various teams that contributed to its development.

Mrs Lena Buckle Scott

Deputy Chief Education Officer,

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

MESSAGE



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).

TERMS	DEFINITIONS/MEANINGS
Key Skills	Indicate the important skills that students should develop duringthe 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.
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 instruments (e.g. via writen 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.

PHILOSOPHICAL STATEMENT

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.

AIMS OF SCIENCE

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.

THEMES, STANDARDS AND ATTAINMENT TARGETS

THEMES	STANDARDS	ATTAINMENT TARGETS		
		GRADES 1-3	GRADES 4-6	GRADES 7-9
Science Exploration, Application and Design Practice	Develop problem solving, decision making, and inquiry skills, reflected by formulating questions and hypotheses, planning experiments/investigations, conducting systematic observations, interpreting and analysing data, drawing conclusions, and communicating results. Develop an understanding of technology as an application of scientific principles	Begin to explore the environment in order to relate everyday experiences to simple scientific concepts and processes. Begin to understand and apply aspects of the scientific method.	Gain an understanding of and apply the engineering design process. Gain an understanding of and apply aspects of the scientific method.	Apply scientific knowledge and processes to the solution of real world problems. Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
Living Things, Life Processes and the Environment	Develop an understanding of the structure, characteristics and basic needs of organisms, the diversity of life, and how lifestyles determine health and well-being. Develop an understanding of the environment as a system of interdependent components affected by human activity and natural phenomena.	Begin to explore selected life processes in humans, the interdependence between living things in the environment, and how lifestyles affect health and well-being in humans. Begin to appreciate the impact of selected human activity and natural phenomena on the environment	Gain an understanding of some life processes in plants and animals, and how lifestyle choices impact health and well-being in humans. Recognise the variety of living things, their interdependence and their inter-relationship with the environment.	Understand the importance of the life processes in plants and animals, their interdependence, their interaction with the environment, and how lifestyles determine health and well-being. Gain an understanding of the components and structure of the universe, and how advances in science and technology have enabled space exploration.

THEMES	STANDARDS	ATTAINMENT TARGETS		
		GRADES 1-3	GRADES 4-6	GRADES 7-9
Energy, Forces and Matter	Develop an understanding of the structure and behavior of matter. Develop an understanding of natural laws as they apply to motion, forces, and energy transformations.	Begin to explore the properties of various materials, substances, selected forces and forms of energy through the use of the senses.	Recognise the importance of energy to life processes, everyday life, and the relationship between energy and matter.	Understand natural laws as they apply to motion, forces, and energy transformations. Understand the importance of energy in our everyday life, the range of available energy sources and some environmental impacts of utilising these resources. Understand the existence of materials such as solids, liquids and gases, the particulate nature of matter, and simple chemical reactions that change one material into another.
Scientific Attitudes and Ethics	Develop a spirit of scientific enquiry, open-mindedness and perseverance, and scientific literacy. Develop creativity, integrity, responsibility, and value science and technology as important tools for exploring the environment.	Begin to demonstrate stewardship for living things and the environment. Begin to demonstrate a positive attitude towards the use of scientific language. Begin to demonstrate positive interpersonal skills in order to foster good working relationships.	Begin to appreciate the influence and limitations of science. Demonstrate a positive attitude towards the use of scientific language. Demonstrate positive inter-personal skills in order to foster good working relationships.	Appreciate the influence and limitations of science with consideration for ethical issues. Demonstrate a positive attitude towards the use of scientific language. Demonstrate positive interper-sonal skills in order to foster good working relationships.

THEMES	BENCHMARKS					
	GRADE 1	GRADE 2	GRADE 3	GRADE 4	GRADE 5	GRADE 6
Science Exploration, Application and Design Practice	Ask questions and contribute to discussions about how to seek answers. Use the senses to observe objects/events in order to describe/ explain them. Begin to share ideas in writing/orally using scientific language and illustrations such as simple sketches, drawings or models.	Use simple apparatus/ equipment to make observations and record information in a variety of ways and begin to compare one thing with another. Share ideas in writing/ orally using scientific language and illustrations such as simple sketches, drawings or models.	Measure quantities to make comparisons, identify simple relationships, draw conclusions from results, use scientific language and begin to use scientific knowledge to suggest explanations. Communicate ideas in writing/orally using scientific language and illustrations such as simple sketches, drawings or models.	Devise and carry out fair tests in familiar contexts. Predict the outcomes of events based on their knowledge. Describe a simple design that addresses a specific challenge and indicate what defines success and what limitations exist.	Make predictions of what will happen based on scientific knowledge and understanding. Suggest and communicate how to test these predictions. Interpret data and decide whether results support predictions, and are sufficient to draw conclusions. Generate and compare possible solutions to a problem based on how well each is likely to meet the criteria and limitations of the problem.	Use prior experiences and scientific knowledge to formulate and test hypotheses, and interpret results. Make a series of measurements of quantities and make inferences from observations in order to draw conclusions. Plan and carry out fair tests to identify aspects of a model or prototype that can be improved.
Living Things, Life Processes and the Environment	Recognise some important features of the environment. Understand the functions of some external parts of the human body. Appreciate that living things depend on each other.	Recognise the importance of the environment to living organisms. Know the location and simple related functions of some internal parts of the human body (heart, brain and skeleton). Understand the need for taking care of the body. Recognise similarities differences between living and non-living things.	Know that some activities can harm the environment. Understand the basic functions of the teeth, stomach and lungs. Recognise that most foods originate from plants and animals and that some foods can be harmful to the body. Recognise that living things have life cycles.	Know the characteristics of living things and recognise that all living things have similar basic requirements (air, water, nutrients). Know the basic functions of the sense organs in humans and other animals. Know some key structures of flowering plants and their basic functions.	Be familiar with weather instruments. Use and share observations of local weather conditions to describe patterns overtime. Begin to understand the interdependence of living things in the environment. Know that foods are produced in different ways (organic, non-organic and genetically modified).	Be aware of some environmental problems (climate change, solid waste disposal, soil degradation) and how to mitigate against them. Know the structure and functions of the main parts of flowering plants. Know the structure and functions of selected animal systems.

THEMES	BENCHMARKS					
	GRADE 1	GRADE 2	GRADE 3	GRADE 4	GRADE 5	GRADE 6
Living Things, Life Processes and the Environment				Know some characteristics of water and understand its importance to life. Know the effects of water pollution, and ways of reducing it. Know some characteristics of air and its importance to life. Know the effects of air pollution, and ways of reducing it.	Be aware of food nutrients and their importance to humans.	Realise that an unbalanced diet may result in disease *(obesity, malnutrition, diabetes) and be aware of the dangers of drug misuse.*
Energy, Forces and Matter	Explore different kinds of materials using observable characteristics. Use the senses to explore the different forms of energy (heat, light and sound) in their immediate environment.	Explore the inherent physical properties of everyday materials (such as hardness, flexibility, durability). Recognise that a push or pull is needed for movement and determines how fast an object will move and its direction.	Categorise materials in a variety of ways, and explain why some materials are suited to specific purposes. Know that heating and cooling materials can cause them to change. Explore non-contact forces using magnets	Know that materials can exist as solid, liquid or gas, and explore selected properties and the composition of everyday materials.	Understand the effects of forces and the concept of work. Be aware of energy forms, their sources, and how heat is transferred. Understand how machines make work and life easier.	Explore what happens when some materials are mixed and how they may be separated. Explore the properties of light and sound, and how different materials affect their behaviour. Know how to safely use, store and dispose of everyday materials, and how their properties determine their uses. Recognise that some changes are irreversible and others are reversible.

THEMES	BENCHMARKS					
	GRADE 1	GRADE 2	GRADE 3	GRADE 4	GRADE 5	GRADE 6
Energy, Forces and Matter						Understand the processes involved when a solid changes to liquid (and vice-versa) and a liquid changes to gas (and vice-versa).
Scientific Attitudes and Ethics	Show concern by being responsible towards the environment. Demonstrate care and concern for living things and the environment. Demonstrate concern for safety of self and others. Display curiosity, objectivity and perseverance in their approach to activities.	Show concern by being responsible towards their bodies. Value the need for personal hygiene as a means of maintaining good health. Appreciate the importance of the environment to living organisms. Display curiosity, objectivity and perseverance in their approach to activities.	Demonstrate care and concern for living things and the environment. Display curiosity, objectivity and perseverance in their approach to activities.	Show concern for water as a limited natural resource and the need for water conservation. Display curiosity, objectivity and perseverance in their approach to activities.	Show concern for man's impact on the environment. Show concern for the need to conserve energy usage in our everyday life. Display curiosity, objectivity and perseverance in their approach to activities.	Show responsibility in food choices. Show sensitivity to others who make unhealthy eating choices. Show concern by being respectful and responsible towards the environment and the organisms living in it. Display curiosity, objectivity and perseverance in their approach to activities.

THEMES	BENCHMARKS		
	GRADE 7	GRADE 8	GRADE 9
Science Exploration, Application and Design Practice	Apply scientific skills, processes and methods in everyday situations and be aware of safety precautions involved in scientific work. Use scientific principles in the design of solutions to a problem taking into account potential impacts on man and the natural environment.	Analyse and interpret experimental data to determine similarities and differences in findings. Analyse several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success	Apply the principles of measurement in the solution of everyday problems. Use scientific knowledge to select appropriate experimental methods. Construct explanations, design and evaluate solutions to complex real-world problems, based on scientific knowledge.
Living Things, Life Processes and the Environment	Understand the impact of climate change on living things and on the environment. Know that the cell is the basic unit of structure and function of all living organisms and be aware of the differences between plant and animal cells. Understand the hierarchical relationship from cells to organism. Understand the process of sexual maturity, and reproduction, in plants and animals. Understand the importance of maintaining a healthy lifestyle.	Know the properties, sources and uses of water. Know the percentage composition of air and understand how carbon is cycled in the atmosphere. Understand the intake, digestion and absorption of food in animals, and how energy is released through respiration. Understand how plants make their food, and how this forms the basis of energy chains and webs. Understand the importance of nutrients, their functions and food tests. Be aware of the impact that diet, cleanliness, exercise and rest have in maintaining good health. Understand the physical characteristics of the universe and how technology has enabled its exploration.	Understand the role of the key organs and systems in humans and animals in sensing and responding to the environment. Demonstrate an understanding of transport systems in plants and animals. Understand embryo development and birth, appreciate the importance of maintaining a healthy lifestyle during pregnancy, and be aware of birth control methods.

THEMES	BENCHMARKS		
	GRADE 7	GRADE 8	GRADE 9
Energy, Forces and Matter	Explore the various properties of matter and know that atoms are the basic unit of structure, and that atoms form molecules, elements and compounds. Know that mixtures represent a physical change and are either heterogeneous or homogenous. Be familiar with the nature of energy transformations, the various types of energy sources and the importance of energy. Understand the importance of energy to society, and know how alternative energy sources are harnessed.	Understand physical and chemical changes and know that chemical changes take place through the re-arrangement of atoms. Know that chemical symbols are used to represent elements on the periodic table, and how selected elements are grouped in the periodic table. Know the structure of an atom. Know how substances can be classified by their chemical nature and how this relates to the way they react. Explore the relationships between forces and motion, and illustrate these relationships in the environment and living things.	Be aware of the types of currents and understand the effects of resistance and voltage on current flow. Recognise the connection between electricity and magnetism. Be familiar with the nature of electricity and understand the different types of electrical circuits. Understand and apply the law of conservation of mass. Understand how substances can be classified by their chemical nature and how this relates to the way they react.
Scientific Attitudes and Ethics	Appreciate the importance of scientific methods. Demonstrate objectivity by seeking data and information to validate observations and explanations. Demonstrate care and concern for living things and the environment. Demonstrate concern for safety of self and others. Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities. Demonstrate concern for the preservation of natural resources. Demonstrate concern for man's impact on the environment. Demonstrate sensitivity to others who are different.		

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.

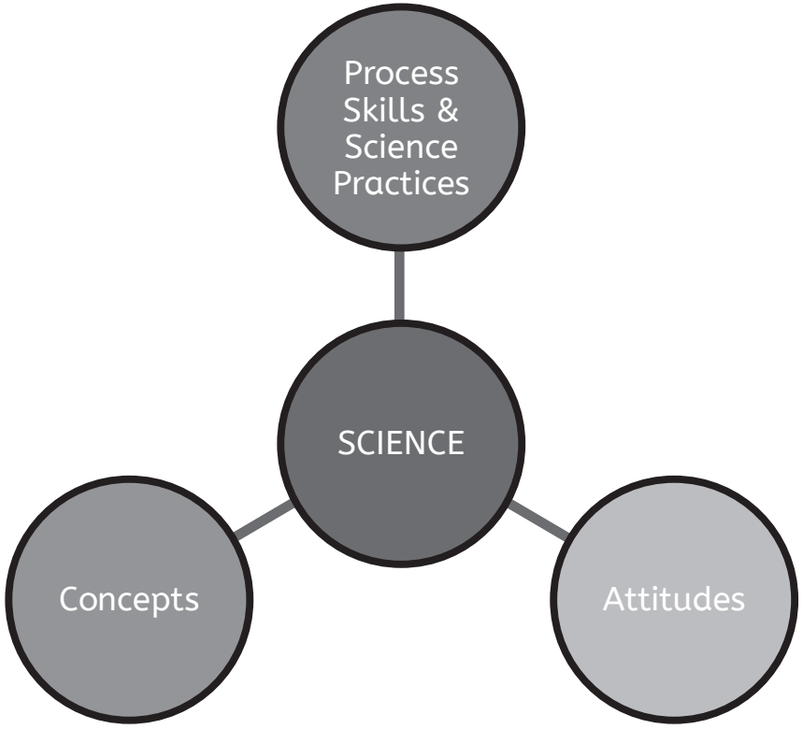


Figure 1. Elements of Science

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.

NSC

INTEGRATED SCIENCE

GRADE 7 UNITS

TERM 1

Unit 1

Working Like a Scientist 1

Safety practices in the home, school & work environment
Significance of safety signs and symbols
Examples of science and technology
Defining science and technology
Works of selected Jamaican and international scientists
Application of the Scientific Method & Engineering
Design Process to solve problems
Scientific Process skills
Identifying fair tests
Laboratory Report Writing
Fundamental measurement quantities and related base units
SI units and Metric System
Methods of presenting data

Unit 2

The Nature of Matter

Classification of Matter
Definition of Matter
Investigations showing particles in matter
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
Definitions and examples of melting, freezing, evaporation and condensation

TERM 2

Unit 1

Energy

Differentiating energy forms and sources
Investigating energy conversions
Classifying energy forms as kinetic or potential
Differentiating renewable and non-renewable energy sources
Advantages and disadvantages of renewable and non-renewable sources
Investigating alternative energy solutions

Unit 2

Plant Reproduction

Dissecting and drawing reproductive structures in the flower
Comparing wind and insect-pollinated flowers
Describing fertilization
Formation of seeds and fruits
Relating seed and fruit structure to the flower
Annotated drawings of seed and fruit
Differentiating seed and fruit
Main parts of a seed
Identifying plants that produce without seeds
Ways of growing plants without seeds
Comparing sexual and asexual reproduction in plants

TERM 3

Unit 1

Sexually Transmitted Infections and Drug Abuse

Importance of responsible sexual behaviour
Risks associated with irresponsible sexual behaviour
Defining sexually transmitted infection (STI)
Effects of common sexually transmitted diseases
Symptoms and treatment of selected STIs
Interpreting data on STIs
Distinguishing drug use, abuse and misuse
Dangers of commonly abused drugs
Defining drug addiction
Effects of drugs on the human body and society
Ways of rehabilitating addicted persons
Ethics involved in drug research and development

Unit 2

Climate Change

Defining Climate Change
Factors causing Climate Change
Investigating the Greenhouse effect
Comparing natural and manmade Greenhouse effect
Relationship between Greenhouse effect and Global warming
Impact of Climate Change on habitats and environment
Impact of Human activities on Climate Change
Identification of Greenhouse gases
Natural and Manmade sources of greenhouse gases
Ways of reducing greenhouse gases
Interpreting data on climate change indicators
Initiatives (local and national) to mitigate climate change

**Table continues on following page*

TERM 1

Unit 3

Cells and Organisms

Examining cells under a microscope

Drawing generalized plant and animal cells

Relating cell structures to their functions

Differentiating between plant and animal cells

Functions of specialized cells

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

Functions of selected tissues, organs and systems

TERM 2

Unit 3

Sexual Maturity, Reproduction and Personal Hygiene

Describing the human life cycle

Distinguishing puberty and adolescence

Male and Female changes in puberty

Identifying hormones that initiate puberty

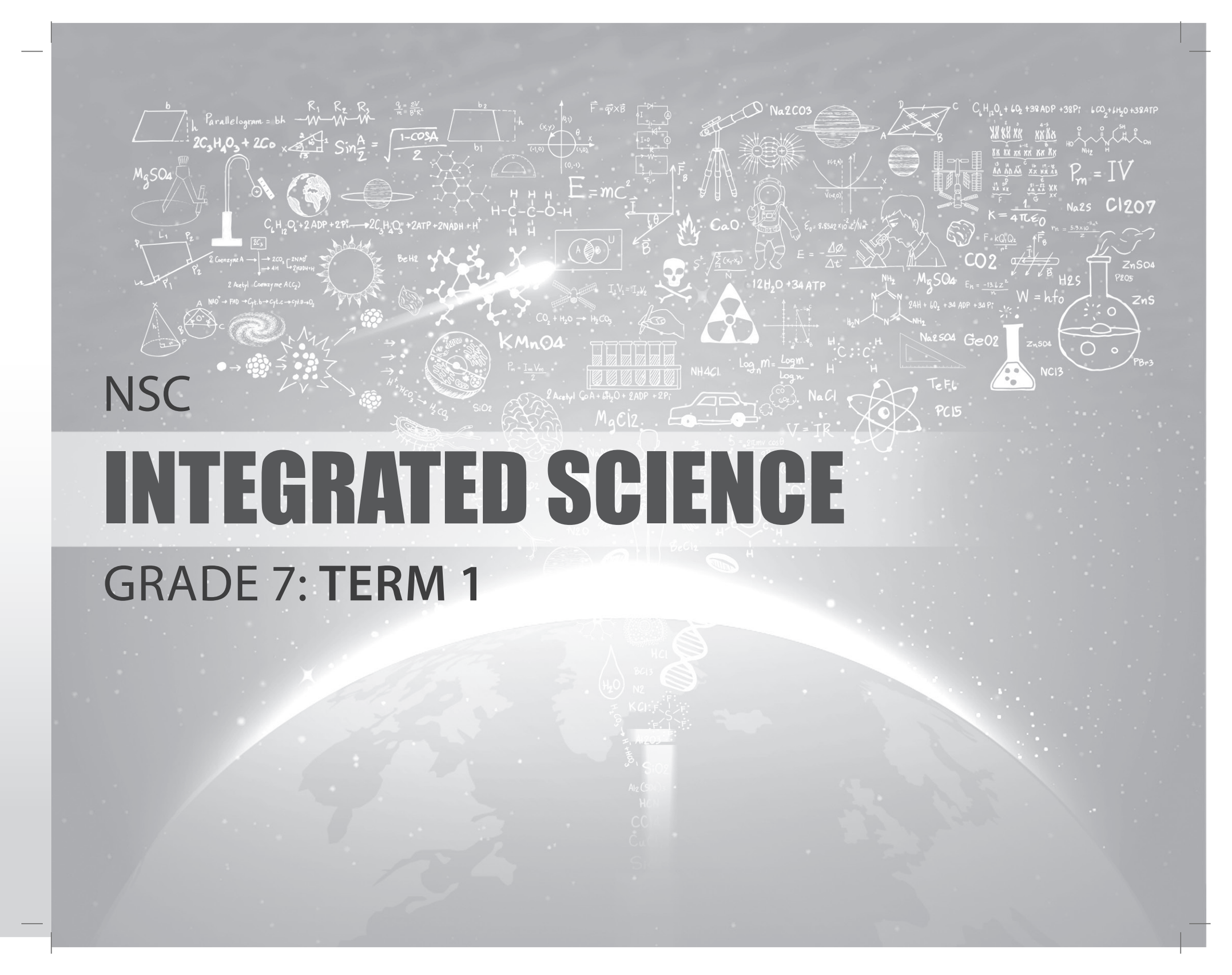
Relating structure of reproductive system to their functions

Relating male/ female sex cells to their function

Sexual reproduction in humans

Changes during menstrual cycle

Personal hygiene



NSC

INTEGRATED SCIENCE

GRADE 7: TERM 1

About the Unit

In this unit, students will explore the relationship between science and technology. Through practical approaches, they will learn about the methods of scientific investigation, while learning about safety practices involved in scientific work. Students will study the approaches taken by prominent Jamaican scientists and explore the various science associated careers.

Range of Content

- Science and technology are related. Science is a way of knowing and understanding the natural and physical world while technology is the application of knowledge to solve problems or meet a specific need.
- Science and technology have impacted the way we live, influencing health, food, transportation and communication.
- Scientists solve everyday problems using the Scientific Method and the Engineering Design Process.
- T.P. Lecky and Professor Manley West are known Jamaican scientists who have contributed significantly to the development of Science.
- The Scientific Process Skills include observing, measuring, reporting, interpreting, inferring and making conclusions.
- Time, temperature, mass, length and current are the fundamental quantities in Science.
- Standard units of measurement use Metric System (SI units).
- Laboratory safety practices require knowledge of safety rules, signs, symbols and safety equipment.
- Scientific data can be presented in a variety of ways; reports, diagrams, drawings, tables, graphs and bar charts.
- Careers in science span a number of different fields including health, education, environment, engineering and manufacturing.

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.

UNIT TITLE: Working like a scientist 1.1

Theme: Science Exploration, Application and Design Practice

Prior Learning

Check that students:

- Know the functions of signs and symbols in their environment.

ATTAINMENT TARGET(S):

- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

BENCHMARK(S):

- Apply scientific skills, processes and methods in everyday situations and be aware of safety precautions involved in scientific work
- Use scientific principles in the design of solutions to a problem taking into account potential impacts on man and the natural environment.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.

Topic: Safety Precautions in Exploring the Environment

Duration: 2.5 hours/1 week

OBJECTIVES

Students will:

- Identify specific situations in the home, classroom and science laboratory which may be potentially dangerous
- Describe ways in which potentially dangerous situations may be corrected
- Use common safety signs and symbols
- Formulate safety rules for selected working environments
- Apply safety rules to selected working environments
- Predict the consequences that may result from not following safety rules
- Use available safety equipment
- Evaluate the environmental impact relating to disposal of selected substances
- Work cooperatively in groups

ICT ATTAINMENT TARGETS:

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

RESEARCH, CRITICAL THINKING AND DECISION MAKING - Students use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DESIGNING AND PRODUCING - Students use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems and make informed decisions.

DIGITAL CITIZENSHIP - Students 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: Brainstorm signs and symbols that they come across in their daily lives. Discuss the importance of these signs and symbols. Create posters with signs and symbols that relate to the school environment. Hang posters around the class/ school.	Communicate, create, think critically - analyse, justify	Creative posters containing accurate information Justifiable reasons given for importance of safety signs/ symbols
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 Conduct Internet search	At least five logical dangers and five valid safety practices identified. Possible outcomes/benefits relate to potentially dangerous situations/safe practices
In groups develop rules that would help to reduce potentially dangerous situations in the community, home and classroom environments. Create a chart/multimedia presentation to promote awareness of the consequences and solutions to dangerous situations. Share their creation with the class. Evaluate the rules they developed for the community, home and classroom to determine their appropriateness.	Collaborate, communicate, create, think critically manipulate digital content	Chart/presentation content is accurate Chart/presentation is creative and communicates information effectively Plausible reasons given to support developed rules
Examine caution/warning labels found on chemical containers, such as bleach, pesticide found in the home, laboratory and/or vehicles that transport chemicals. Make drawings and/or take pictures of the safety symbols (colour codes included) and explain what each of the safety symbols/colours mean. Write a paragraph on the importance of caution/warning labels. Collate the information and use it to create a safety manual (electronic/non-electronic) on warning labels. As a class, develop a checklist to evaluate the safety manuals and use it to make improvements to them.	Collaborate, communicate, create, observe, draw, think critically - interpret Create digital images	Manual contains accurate information on caution/ warning labels Checklist useful in evaluating safety manuals

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: In groups, research the methods of disposal of different categories of waste eg. radioactive, corrosive, organic solvents etc. Discuss how cell phones, car batteries, paints, oil and grease, lab chemicals should be disposed of. Answer questions such as "Why should materials be disposed of properly?", "How do these materials affect the environment?", "Could these materials enter water bodies?, "How will they affect animals and plants in the environment?" Suggest safe disposal practices for different categories of waste in their school environment.	Collaborate, research, communicate, create, think critically – analyse, make conclusions, justify	Logical suggestions made Creative presentations Accurate information presented Tags/ labels/ colours correctly used
Set up (with Teacher's help) a waste area for collection and disposal of hazardous chemicals in the laboratory. Construct tags/ labels to identify the containers and the related waste allowed. Colour code labels to match the category of waste. Make class presentations orally, in writing or using role play.		
Be introduced to the safety equipment available in the class/ school (or online/ offline). Investigate how to operate a fire extinguisher, safety shower, eye wash station, fume hood etc. Write a report on their investigations, including pictures of use by students.	Observe, record, manipulate, communicate, report, think critically – analyse, draw conclusions	Operate the safety equipment properly Report contains accurate information

Learning Outcomes

Students who demonstrate understanding can:

- Apply appropriate safety precautions in various environments
- Recognize common safety signs and symbols
- Use available safety equipment
- Display respect for safety of self and others
- Use graphic organizers software and multimedia software to communicate information on the environment and safety precautions
- Create and publish original documents using graphic organizers software and multimedia software

Points to Note

The charts made by student 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.

Extended Learning

Identify persons who implement rules e.g. police officers, traffic wardens, food inspectors. Explain why these persons are important and how they help to improve the quality of life for people.

Research occupational health guidelines. Write a short composition about how any one of these guidelines protects employees.

RESOURCES

Materials for making charts

Pictures/videos depicting safe/unsafe scenes

Computers, Internet, speaker, multimedia projector, interactive video tutorials, CDs/DVDs, graphic organizer and multimedia software

KEY VOCABULARY

precaution, pesticide, safety, danger, safety symbols, signs

LINKS TO OTHER SUBJECTS

Technical Vocational Education, Social Studies, English Language

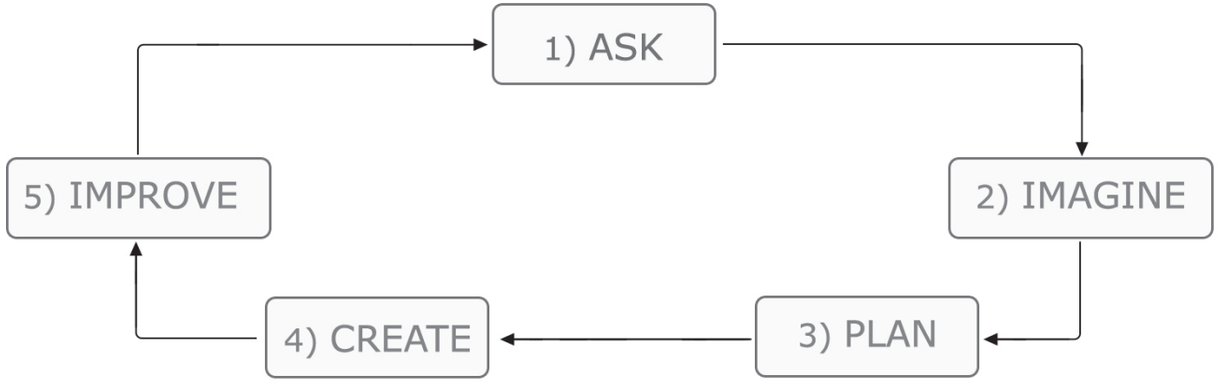
UNIT TITLE: Working like a scientist 1.2

Theme: Science Exploration, Application and Design Practice

Prior Learning

Check that students can:

- Explain what constitutes a fair test



ATTAINMENT TARGET(S):

- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.

BENCHMARK(S):

- Apply scientific skills, processes and methods in everyday situations and be aware of safety precautions involved in scientific work.
- Use scientific principles in the design of solutions to a problem taking into account potential impacts on man and the natural environment.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Appreciate the importance of scientific methods.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

Topic: Scientific Method and Engineering and Designing Process

Duration: 7.5 hours/3 weeks

OBJECTIVES

Students will:

- Explain how science and technology are related
- Describe the work of a named Jamaican and an international scientist/ innovator.
- Explain the stages in the scientific method
- Apply the scientific method to formulate explanations about observed occurrences
- Write a report of a laboratory investigation
- Explain the stages in the engineering design process
- Apply the engineering design process to solve everyday problems
- Write a report of an engineering design project.
- Describe a variety of science-related careers.
- Show respect for another person's idea.

ICT ATTAINMENT TARGETS:

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

RESEARCH, CRITICAL THINKING AND DECISION MAKING - Students use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DESIGNING AND PRODUCING - Students use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems and make informed decisions.

DIGITAL CITIZENSHIP - Students 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 brainstorm definitions of the term 'science'. Use a variety of media (on-line/off-line) to research definitions of science. Participate in teacher guided class discussion on what is science. In groups, describe examples of science in the home, school, community and industry (national and international) and share examples with the class in a variety of ways.	Collaborate, communicate, research, create, think critically - analyse	At least two correct examples of science given for each category: home, school, community and industry
In groups, describe ways in which science is used to improve the quality of life (example communication, transportation, medicine, manufacturing etc.) Discuss the application of science in each description and present to the class in a variety of ways e.g., using graphic organizer, digital story presentations. In class discussion, formulate a definition of technology. Research definitions of technology and compare with their formulated definitions. In groups, describe at least ten technologies that can be found in Jamaica.	Collaborate, communicate, define operationally, record, think critically - compare Create digital content	Appropriate descriptions of how science has improved the quality of life At least ten technologies, found in Jamaica, described Acceptable definition of technology
Examine a case study and/or watch video on a scientist at work. Identify the various steps, skills and attitudes displayed by the scientist. In groups carry out research (online/offline) on assigned eminent Jamaican and international scientists (e.g. T.P Lecky, Prof. Manley West, Albert Einstein) and make a presentation to the class in a variety of ways.	Communicate, collaborate, create, research	Correct information presented on Jamaican and international scientists and their work. Group collaboration evident
Use research skills to identify at least 10 careers related to Science. Research the nature of these careers by interviewing persons in these areas or use online/ offline methods. Present information creatively using displays, scrap books or projects.	Research, gather data, record, think critically - formulate questions, create, communicate	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 particular pair of shoes they needed that day. Share and discuss their answers to the question posed.	Collaborate, research, manipulate, communicate, create, think critically - compare, solve problems,	Displays contain the basic steps in the scientific method and engineering design process, and steps are correctly sequenced.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
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 and the Engineering Design Process as two such methods. In groups research the steps involved in the Scientific Method and the Engineering Design Process. Compare the methods and suggest reasons for the differences in the methods. Create displays (electronic/non-electronic) depicting the steps involved in the scientific method and engineering design process. Present the display to class for discussion. Mount the display in the class. Use the Scientific Method and Engineering Design Process to solve a variety of real-world problems identified by the teacher/class.	Communicate, create, think critically - analyse, justify, compare	Creative displays containing accurate information Justifiable reasons given for differences in methods Steps of the Scientific method and Engineering Design process evident in investigations
In class discussion, explore the process skills that are employed in scientific work (observe, manipulate, classify, communicate, measure, infer, predict, question etc.). In groups, examine scenarios provided by the teacher identifying the process skill(s) being used. Share information with class.	Think critically - analyse, communicate, collaborate	Process skills correctly identified in each scenario. An acceptable sequence of skills used to solve problems is outlined.
Examine several scenarios to identify which ones are fair tests. Justify their choices using simple scientific language. (Teacher should emphasize the importance of identifying and controlling variables to ensure fair testing.) Build fair testing components into a selected scenario or investigation. Present modified fair test to the class for discussion.	Think critically - analyse, apply, justify, plan and design, communicate,	Fair tests correctly identified. Appropriate reasons given (using appropriate scientific language) for fair tests identified. Fair tests contain all required elements
Be given reports, one on a scientific experiment and the other on an engineering design projects. In groups, identify and compare the main components of each report (e.g. hypothesis, procedure, results etc.). Be given partially completed reports and asked to complete them.	Collaborate, communicate, think critically -	Completed reports with correct information and logically sequenced. Experimental reports properly completed.
As a class, discuss the processes involved in experimenting and engineering solutions to problems.	Communicate	

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Be provided with various simple problems (e.g. what will affect how fast a pendulum swings), and discuss with the aid of the teacher the logical sequence of steps that would lead to a solution. Based on the solutions developed, carry out experiments to solve the problems and write a report on the experiment, using an appropriate format/template decided by the class.	Observe, manipulate, communicate, think critically – analyse, predict, formulate hypotheses, plan and design, solve problems,	Report and experiments correctly reflect the scientific method. Report is done in the correct format

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Explain how science and technology has led to advancement in society
- ✔ Use the scientific method to solve problems
- ✔ Use the engineering design process to solve problems
- ✔ Prepare simple scientific reports
- ✔ Communicate information using productivity tools (e.g. presentation software, graphic organizer, word processing)
- ✔ Conduct electronic search for 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 units.
- Technology is defined as the application of science to improve the quality of life.
- Information on Jamaican scientists can be obtained from University of the West Indies or the Scientific Research Council.
- Basic steps in the scientific method: Question ⇨ research hypothesis ⇨ experiment ⇨ analyse results ⇨ communicate findings)
- Basic steps in the engineering design process: Problem ⇨ research ⇨ specify requirements ⇨ generate solutions and create best one ⇨ build prototype ⇨ test and redesign if necessary ⇨ communicate results)

Extended Learning

Select a problem in their school/community and use the engineering design process to solve it.

Points to Note	Extended Learning
Use digital graphic organisers to structure, analyze and evaluate information and aid problem solving and decision making processes Recognise some of the dangers associated with internet use and demonstrate safe online behaviours	

RESOURCES

Information sheets/multimedia materials containing scenarios in which science skills are used.

Books/magazines/newspaper articles on Jamaican scientists
Computers, internet

Computers, Internet, speaker, multimedia projector, interactive video tutorials, CDs/DVDs, multimedia, word processing and graphic software tools

KEY VOCABULARY

Science , technology, hypotheses, variables, design requirements, problem specification, observe, manipulate, classify, communicate, measure, infer, predict

LINKS TO OTHER SUBJECTS

Technical Vocational Education – AT1, AT2 and AT3

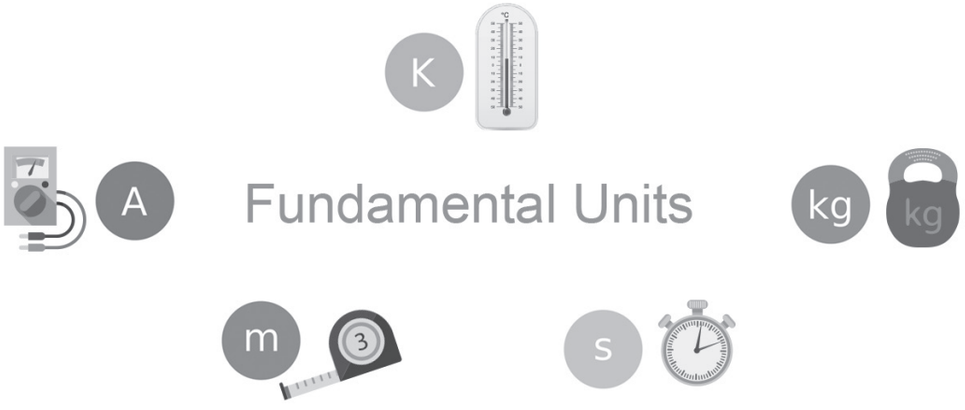
UNIT TITLE: Working like a scientist 1.3

Theme: Science Exploration, Application and Design Practice

Prior Learning

Check that students can:

- Identify common measuring instruments



ATTAINMENT TARGET(S):

- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.

BENCHMARK(S):

- Apply scientific skills, processes and methods in everyday situations and be aware of safety precautions involved in scientific work.
- Use scientific principles in the design of solutions to a problem taking into account potential impacts on man and the natural environment.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

Topic: Basic Quantities and Laboratory Apparatus

Duration: 2.5 hours/1 week

OBJECTIVES

Students will:

- List the fundamental quantities and their base SI units
- Identify and correctly use instruments to measure the fundamental quantities
- Show safety consciousness for self and others when doing practical activities

ICT ATTAINMENT TARGETS:

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

RESEARCH, CRITICAL THINKING AND DECISION MAKING - Students use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DESIGNING AND PRODUCING - Students use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems and make informed decisions.

DIGITAL CITIZENSHIP - Students 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, identify some physical quantities that are measured in the home, school and community, and their associated units. Record their findings in a table (possibly **using word processing software**) and share with class. *(In class discussion, teacher should introduce the concept of fundamental quantities – time, temperature, current, length and mass – and guide students to associate the quantities with their base units. Note that a quantity may have several units but only one base unit.)*	Collaborate, observe, communicate, think critically – infer, classify	Table contains correctly identified quantities. Correct units given for quantities Table meets appropriate criteria: neatly drawn, title, headings etc
In groups, examine the labels of various household items (e.g. aluminium foil, medicines, food packaged for microwave, TV, battery, radio and CD players) to identify the various quantities present on them. List the quantities identified and their units, e.g. soda – litres, tin mackerel- grams. Discuss and give two importance of units of measurements, and present findings to the class, possibly **using online collaborative writing tools e.g., class Wiki and Pinterest**. *(Teacher should emphasize the need for standard measurements and relate these to the SI system of units.)* Create a list of ten units of measurement used in the SI/metric system.	Observe, communicate, think critically - classify Collaborate online	Two logical importance given for units Correct metric units listed
Identify various apparatus used to measure different quantities (including all the fundamental quantities – length, mass, time, temperature, electric current) and suggest possible situations in which they may be used.	Communicate, observe, think critically - infer, interpret	In tabular form or otherwise correctly associate each apparatus with the quantity it is used to measure.
After observing teacher demonstration on the use of some apparatus (e.g. measuring cylinder, balance, thermometer), in groups, use the apparatus to measure the relevant quantities for various objects provided by the teacher. Share measurements with class. Draw, label and describe the use of selected apparatus and/or use digital drawing tools to draw and label images. Complete a teacher prepared worksheet.	Draw, measure, manipulate, communicate, collaborate Create digital images	Instruments correctly used Measurements correctly stated with units Accurate drawings of apparatus and correct labelling

Learning Outcomes

Students who demonstrate understanding can:

- Identify and use metric units
- Measure various quantities using appropriate instruments
- Communicate and collaborate using online writing tools
- Use digital drawing tools to create and format images

Points to Note

The objective which shows safety consciousness for self and others when doing practical activities should be constantly highlighted throughout the unit.

Balance the sample of apparatus to include those related to biology, chemistry and physics.

Demonstrate safe, respectful, responsible and clear online communication

Extended Learning

Construct a simple measuring equipment that can be used in home or school e.g. a simple balance

RESOURCES

Various laboratory instruments: balance, thermometer, measuring cylinder, ammeter, clock, metre rule

Computers, Internet, speaker, multimedia projector, interactive video tutorials, CDs/DVDs, digital software tools, class online collaborative Wiki/Pinterest site.

KEY VOCABULARY

Fundamental quantity, unit, measurement, balance, thermometer, SI/metric system, measuring cylinder, ammeter, clock, metre rule

LINKS TO OTHER SUBJECTS

Mathematics – measurement

UNIT TITLE: Working like a scientist 1.4

Theme: Science Exploration, Application and Design Practice

Prior Learning

Check that students can:

- Identify the steps in the scientific method
- Write a laboratory report
- Use some laboratory apparatus
- Construct simple pie charts, bar and line graphs

ATTAINMENT TARGET(S):

- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.

BENCHMARK(S):

- Apply scientific skills, processes and methods in everyday situations and be aware of safety precautions involved in scientific work.
- Use scientific principles in the design of solutions to a problem taking into account potential impacts on man and the natural environment.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

Topic: Presentation of Data

Duration: 10 hours/4 weeks

OBJECTIVES

Students will:

- Formulate criteria for the presentation of observations /data in tabular form
- Construct data tables using agreed criteria
- Present observations /data in graphical form using accepted criteria
- Formulate criteria for representing observations as drawings/diagrams
- Make drawings/diagrams using agreed criteria
- Apply standard criteria for representing data consistently

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: In groups, observe samples of data tables provided by the teacher. Make a list of criteria used in the presentation of data tables. Share criteria with class. As a class, with the aid of the teacher, develop standard criteria for the presentation of data in tabular form.	Collaborate, communicate, think critically – analyse, formulate,	
Create data tables to represent data sets provided by the teacher.	Communicate, construct tables	Table reflects agreed criteria
Observe a member of the class roll their tongue. As a class identify and record the number of students that can and cannot roll their tongues. Individually, record the data in a table.	Observe, record, communicate, construct tables	Table reflects agreed criteria
Observe as teacher demonstrates how to construct a bar graph to illustrate data. Record the criteria as given by the teacher. Individually construct a bar graph using the tongue-rolling data.	Communicate, construct bar graphs	Bar graphs reflect agreed criteria
Create simple bar graphs to represent data sets provided by the teacher.	Communicate, construct bar graphs	
In groups determine the time a small solid (stone/ball etc.) takes to fall from various heights (at least six heights). Record the data in a table and share the information with the class.	Collaborate, manipulate, measure, record, communicate, construct tables	Table reflects agreed criteria
Observe as teacher demonstrates how to construct a line graph to illustrate data. Record the criteria as given by the teacher. Individually construct a line graph using the data recorded in the table (Height and time).	Communicate, construct line graphs	Line graphs reflect agreed criteria
Create simple line graphs to represent data sets provided by the teacher.	Communicate, construct line graphs	
As a class, participate in teacher-led discussions to identify when it is most appropriate to use bar graphs/line graphs to represent data sets. In groups, identify the most suitable type of graph to represent each data set provided by the teacher.	Communicate, think critically - assess, justify,	Correct type of graph matched with each data set Justifiable reasons given for choice of graph

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
In groups/as class, examine samples of drawings/diagrams provided by the teacher. List the common features observed in the samples. Share list with class. As a class, with the aid of the teacher, develop standard criteria for the presentation of drawings/diagrams. In groups make a poster highlighting the criteria for making labelled drawings/diagrams. Display posters in class.	Collaborate, observe, create, draw, communicate	Poster contains correct criteria for drawings/diagrams
Individually, make a labelled drawing of the leaf provided by the teacher. Measure the length of the leaf and the length of the drawing in millimetres. Calculate the magnification of the drawing by dividing the length of the drawing by the length of the leaf (*magnification* = $\frac{\text{length of drawing}}{\text{length of specimen}}$). Record the magnification next to the title (*mag. x value from calculation, e.g. mag. x15*).	Draw, measure, calculate	Drawing reflects agreed criteria Magnification accurately calculated and represented

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Construct tables, bar graphs and line graphs to required standards
- ✔ Choose the appropriate type of graph (bar/line) to represent data
- ✔ Make labelled drawings/diagrams to required standards

Points to Note

Students must be given as much opportunities as possible to practise the construction of tables, bar graphs and line graphs.

Extended Learning

Make a pamphlet/brochure on 'Data Presentations in Science'.

RESOURCES

Graph sheets, small solid object (ball/stone etc.), tape measure/ metre rule, 30 cm ruler

KEY VOCABULARY

data, table, bar graph, line graph, x-axis, y-axis, variable, title, label

LINKS TO OTHER SUBJECTS

Mathematics – statistics

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 use experiment to investigate the effect of heat on matter.

Range of Content

- 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 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 KWL approach (K-W-L) is an instructional strategy that is used to guide students through a topic. It stands for what I **Know,** what I **Want** to learn, and what I did **Learn**. Students begin by brainstorming everything they Know about a topic. This information is recorded in the K column of a K-W-L chart. Students then generate a list of questions about what they Want to Know about the topic. These questions are listed in the W column of the chart. During or after the lesson, students answer the questions that are in the W column. This new information that they have Learned is recorded in the L column of the K-W-L chart. *(http://www.nea.org/tools/k-w-l-know-want-to-know-learned.html)*

K-W-L Chart

TOPIC: _____

KNOW	WANT	LEARN

UNIT TITLE: Matter

Theme: Energy, Forces and Matter

Prior Learning

Check that students can:

- Identify examples of materials as solids, liquids and gases

ATTAINMENT TARGET(S):

- Understand the existence of materials such as solids, liquids and gases, the particulate nature of matter, and simple chemical reactions that change one material into another.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

BENCHMARK(S):

- Explore the various properties of matter and know that atoms are the basic unit of structure, and that atoms form molecules, elements and compounds.
- Know that mixtures represent a physical change and are either heterogeneous or homogenous.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.

Topic: The Nature of Matter

Duration: 5 hours/2 weeks

OBJECTIVES

Students will:

- Classify materials as solids, liquids and gases
- Demonstrate that solids and liquids are made up of tiny particles
- Relate the arrangement of tiny particles to the states of matter
- Compare the three states of matter in terms of physical properties
- Plan and design an investigation to show how matter changes state
- Formulate a working definition of matter
- Work cooperatively in groups

ICT ATTAINMENT TARGETS:

COMMUNICATION AND COLLABORATION - Use technology to communicate ideas, information and understandings for a variety of purposes.

RESEARCH, CRITICAL THINKING AND DECISION MAKING - Use technology to develop a logical process for decision making and problem solving.

DESIGNING AND PRODUCING - Use technology to design and produce multimedia products to demonstrate their creative thinking.

DIGITAL CITIZENSHIP - Follow guidelines to promote healthy use of ICT tools.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Review the terms 'solid', 'liquid' and 'gas'. Be presented with a range of materials to classify as solid, liquid and gas. (*Teacher should include some materials that students will find difficult to classify, e.g. paper, sand, petroleum jelly, jam, toothpaste.*)	Think critically – analyse, classify, justify	Materials correctly classified Plausible reasons given for classification
In groups, carry out some short activities which will help them explain why solids, liquids and gases behave differently, e.g. • comparing the masses of identically-sized blocks of two or three different materials such as wood, glass and metal • putting one small coloured crystal into a beaker of cold water and one into a beaker of hot water • 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. (*Teacher may introduce the concept of diffusion here, however it should be done in a simple way. Do NOT talk about 'concentration gradients'.*)	Manipulate, observe, communicate, think critically- analyse, classify, compare, draw conclusions,	Logical explanations given for observations.
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

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
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. Ask pupils to 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 pupils 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. Logical conclusions drawn about movement and energy of particles in the three states.
Use a KWL chart to arrive at a definition for matter. View a video on matter to complete the L-column of the KWL chart. 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 working definition of matter.
In small groups, read literature/research/watch video on the states of matter and make a four-page booklet on their understanding of solids, liquids and gases (use word processing/graphic software if available). Booklet should contain the following: • Page 1-Cover page: design a suitable cover page with colours and diagrams, suitable title, name, date, etc. • Page 2-Solids Page- neatly type/write the characteristics of solid matter. Then, search through old magazines and newspapers for pictures of solid matter. Cut out the pictures and neatly glue them to the page and label each picture. Include five or more pictures of solid matter. • Page 3 (Liquid Page) and Page 4(gas page) should be done like the solid page Combine pages into a neat looking booklet and staple the pages together	Collaborate, gather information, communicate, create, think critically – analyse, interpret data Navigate and manipulate digital content Create and format document	Cover Page includes the title, name, date and illustration. Solids page has characteristics of a solid correctly written and includes labelled pictures. Liquids page has characteristics of a liquid correctly written and includes labelled pictures. Gases page has characteristics of a gas correctly written and includes labelled pictures. Booklet is neat and presentable.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
In groups, plan, design and carry out an investigation on how matter (e.g. water) changes from solid to liquid to gas. Make inferences from observations, provide simple explanations. Write a report on your investigation, paying special attention to method, observations and conclusions, and share with class.	Communicate, Investigate, manipulation, collaborate, think critically - make inferences, plan and design	Plan reflects a fair test. Logical explanations offered for observations. Conclusions consistent with observations.
As recap, view videos showing how matter changes from one state to another. List and provide a working definition for the processes involved in the various state changes (freezing, evaporation, melting, and condensation). Represent the processes on a diagram (this could be done using an appropriate software)..	Observe, define operationally, communicate, create, think critically – design, analyse, synthesize	Acceptable working definitions Diagram correctly represents processes.

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Give physical characteristics of solids, liquids and gases: based on shape, volume, particle arrangement and particle movement
- ✔ Define condensation, evaporation, melting and freezing
- ✔ Plan and design investigations which incorporate fair tests
- ✔ Cite examples of changes of state
- ✔ Publish original documents

Points to Note

- Demonstration to investigate sublimation should be carried out in a well ventilated laboratory.
- Publish original documents using word processing software and other technology tools
- Recognise some of the dangers associated with internet use and demonstrate safe online behaviours.

Extended Learning

Describe how the behaviour of tiny particles of matter can be used to explain 'diffusion'.

RESOURCES

Newspaper, magazines, ice, heating apparatus, measuring cylinder, ammonium chloride/naphthalene, dry ice, perfume, chalk, multi - media material on state changes and the atom, iodine crystals, solid air fresheners computer, Internet, multimedia projector, word processing and graphic organizer software, CDs/DVDs

KEY VOCABULARY

Matter, condensation, evaporation, freezing, melting, particles

LINKS TO OTHER SUBJECTS

Grade 8 (Physical and Chemical Changes)

About the Unit

In this Unit, students will learn that the cell is the unit of structure and function of all living organisms. By examining plant and animal cells using a light microscope, they will make labelled drawings to compare both types of cells. Students examine diagrams and study a range of specialised plant and animal cells and relate the changes in their structure to their specific functions. They will describe how cells work together and contribute to the formation of tissues, organs, organ-systems and the whole organism and explore a variety of examples in each category. They will investigate diffusion and osmosis as methods by which substances move into and out of cells and identify some examples of these processes in both plants and animals.

Range of Content

- The cell is the unit of structure and function of living organisms
- Plant cells are different from animal cells
- Cells are specialised to carry out unique functions
- Cells work together and are organised as tissues, organs, and organ-systems in an organism
- Substances move into and out of cells by diffusion and osmosis

Guidance for the Teacher

1. Cell structure must be focused only on those visible under the light microscope.
2. Cell structures to include only: cell wall, cell membrane, nucleus, vacuole, cytoplasm and chloroplasts.
3. Mitochondria, though not usually visible under the light microscope, should be discussed.
4. Discuss guidelines for making appropriate scientific drawings.
5. Self-made posters and hand-outs must reflect the guidelines for scientific drawings.
6. Models of cells can be exhibited as a mini expo in which all Grade 7 classes showcase their work.
7. 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).

UNIT TITLE: Cells and Organisms

Theme: Living Things, Life Processes and the Environment

Prior Learning

Check that students can:

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

ATTAINMENT TARGET(S):

- Understand the importance of the life processes in plants and animals, their interdependence, their interaction with the environment, and how lifestyles determine health and well-being.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

BENCHMARK(S):

- Know that the cell is the basic unit of structure and function of all living organisms and be aware of the differences between plant and animal cells.
- Understand the hierarchical relationship from cells to organism.
- Apply scientific skills, processes and methods in everyday situations and be aware of safety precautions involved in scientific work.
- Use scientific principles in the design of solutions to a problem taking into account potential impacts on man and the natural environment.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate care and concern for living things and the environment.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: Cells and cellular organisation

Duration: 7.5 hours/3 weeks

OBJECTIVES

Students will:

- Define the cell as the basic unit of structure and function of living organisms
- Examine plant and animal cells using the light microscope
- Draw and label diagrams of generalised plant and animal cells as seen under the light microscope
- Relate selected cell structures/organelles to their specific functions
- Compare the structure of typical plant and animal cells as seen under the light microscope
- Differentiate between generalized plant and animal cells
- State that organisms can be unicellular or multicellular and give examples of each
- Compare specialised plant and animal cells and state their basic functions – e.g. red blood cells transport oxygen around the body and root hair cells absorb water and mineral salts from the soil
- Define cells, tissues, organs, organ-systems and organisms and explain their hierarchical relationship
- Describe the functions of selected basic tissues, organs and organ systems (e.g. blood as tissue – transports substances)
- Assess the impact of cell biology on society

ICT ATTAINMENT TARGETS:

COMMUNICATION AND COLLABORATION - Use technology to communicate ideas, information and understandings for a variety of purposes.

RESEARCH, CRITICAL THINKING AND DECISION MAKING - Use technology to develop a logical process for decision making and problem solving.

DESIGNING AND PRODUCING - Use technology to design and produce multimedia products to demonstrate their creative thinking.

DIGITAL CITIZENSHIP - Follow guidelines to promote healthy use of ICT tools.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: View picture of Rhoeo cell as seen under the light microscope or digital graphic display. Visit different work stations each set up with a specimen of Rhoeo (Purple water grass) and a magnifying instrument (e.g. binoculars, spectacles, hand lens, microscope). View the specimens and select the most appropriate instrument for observing cells.	Observe, think critically - evaluate Manipulate digital content	Appropriate instrument selected
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. Describe and explain their observations.	Manipulate, observe, create, communicate, think critically - analyse, draw conclusions	Instructions accurately carried out - the water drop lens worked! Correct conclusions drawn
Examine a light microscope and using a teacher prepared hand-out/chart of a microscope, identify the main parts and state their function(s). Complete a worksheet on the basic structure and function of the light microscope.	Communicate, Manipulate, Observe, record	Main parts correctly identified and functions accurately stated
View posters/hand-outs/ interactive tutorials/power point etc. of generalised plant and animal cells and identify their main parts/ organelles. Discuss the basic functions of the structures identified through a teacher-led discussion. Compare the two cell types (similarities and differences) and record the information in a table (this could be done using a word processing program).	Communicate, observe, draw, think critically – compare, infer, Create and record information in table	Table constructed accurately – title, straight lines, headings - rows and columns Contents recorded correctly
Draw and label diagrams from posters/hand-outs/text books of generalised plant and animal cells. [All diagrams/drawings must meet the accepted guidelines for scientific presentation]		Diagrams/drawings accurately represented in PENCIL ONLY- clean continuous lines; label lines – straight, no arrow heads, do not cross each other, drawn to right of drawing; title below diagram/ drawing in capitals and underlined; Labels – accurate, written in script entirely in lower case
Observe teacher-created /interactive presentations/digital graphic display on the structure and basic function of selected specialised cells and comment on how they compare with the generalised plant and animal cells.	Think critically - identify patterns, compare Communicate information using digital graphic displays	

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Collect information and pictures of cells, tissues, organs and organ systems in plants and animals from books/magazines or by navigating digital content on websites and storage devices, and create posters defining the terms and demonstrating the hierarchical relationship from cells to organism. Present and display posters (Posters may be created using graphic organizers/presentation software).	Create, communicate, navigate digital content, format, present multimedia content	Definitions convey understanding of terms. Correct sequencing of hierarchy.
Work in groups to construct models of cells (generalised plant or animal or specialised cells) using available resources – plastic bag, balloon, newspaper (papier-mâché) or fabric. Set up class exhibition and make presentation on cell models to the class.	Manipulate, design, create, collaborate, communicate	Model accurately represents selected cell
In groups, use research skills to determine how knowledge of cells benefits society. Examine use of cell theory in different scenarios e.g. treating diseases, in identifying birth defects and for in vitro fertilization. Make a report on the findings.	Research, communicate, collaborate, investigate	Report contains accurate information

Learning Outcomes

Students who demonstrate understanding can:

- Make labelled drawings of generalised plant and animal cells
- Distinguish between generalised plant and animal cells
- Distinguish between specialised and generalised plant and animal cells
- Explain the hierarchy of cellular organisation
- Use digital graphic organisers to structure, analyse and evaluate information and aid problem solving and decision making processes
- Collect, edit and organize images to represent information
- Organize data in tables
- Create multimedia presentation to communicate information

Points to Note

1. Examples of tissues, organs and organ systems that should be considered include:
   - Animal tissues – epithelial, blood, nerve
   - Plant tissues – epidermis, xylem, phloem
   - Animal organs - sense organs, stomach, heart, lungs, kidney, ovaries, testes,
   - Plant organs - root, stem, leaf, flower
   - Animal systems - digestive, circulatory, respiratory, excretory, reproductive, skeletal, nervous
   - Plant systems – transport, reproductive
2. Additional examples of selected specialised cells – red blood cells, nerve, sperm, egg, guard cells, epidermal cells

Extended Learning

Survey the history of the microscope.

Compare the use of the electron and light microscopes.

Critique the use of tissue/organ transplants in the health services.

RESOURCES

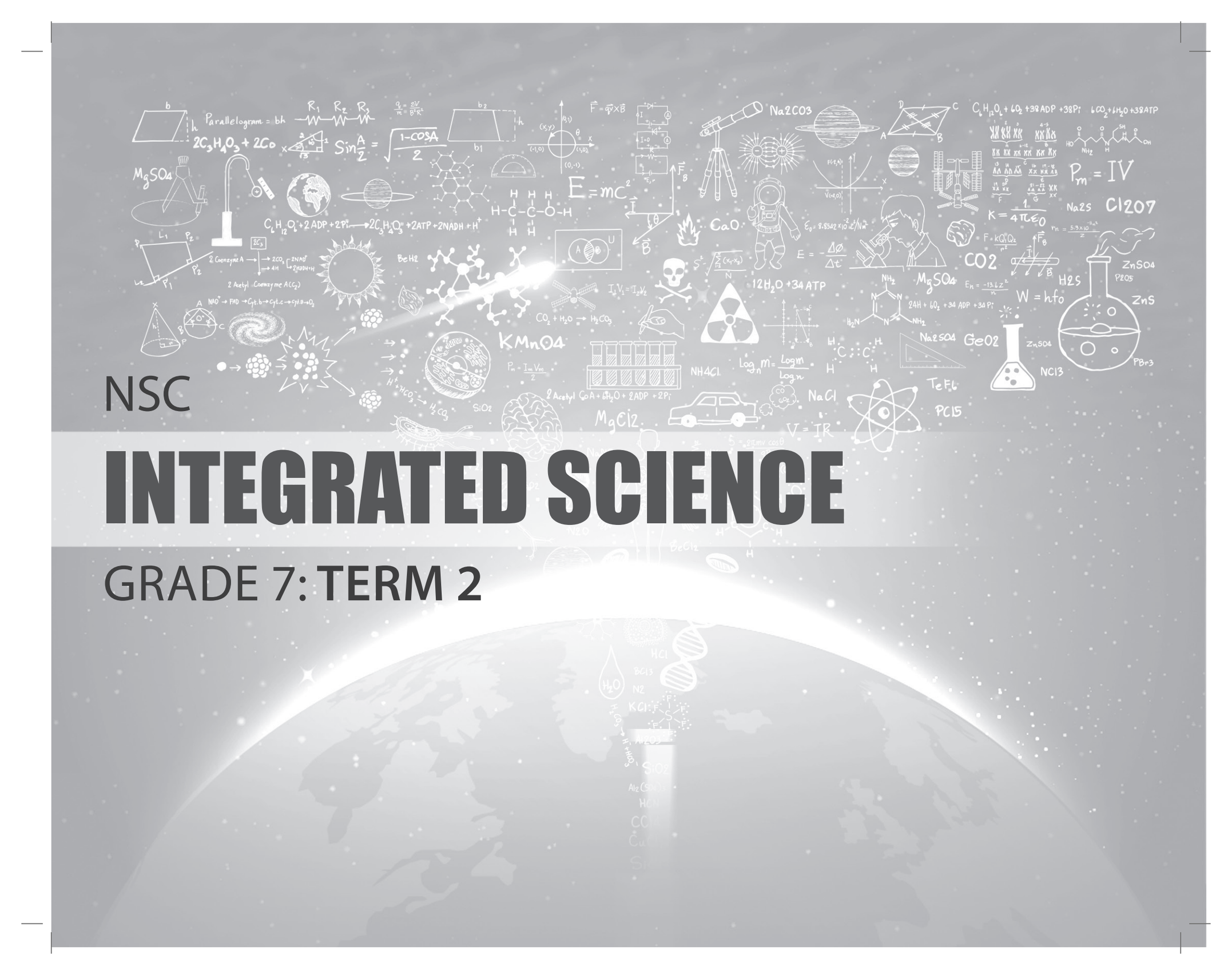
Microscopes, slides and cover-slips, chart showing specialisation of cells, binoculars, hand lens, spectacles, Rhoeo, computer, multimedia projector, graphic organizer software, interactive presentation, CDs/DVDs

KEY VOCABULARY

Cell wall, cytoplasm, cell membrane
Organelles - chloroplast, nucleus, vacuole, mitochondria
Hierarchy - tissue, organ, organ-system, organism,
microscope, specialisation
multicellular organism

LINKS TO OTHER SUBJECTS

Mathematics – scale factor, geometry (links to the calculation of magnification of drawings)



NSC

INTEGRATED SCIENCE

GRADE 7: TERM 2

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 with opportunities to demonstrate the efficient use of energy and energy conservation practical applications..

Range of Content

- Energy is required to do work. Energy is stored in various forms, such as light energy, heat (thermal) energy and chemical energy.
- All forms of energy may be classified as either Kinetic energy or Potential energy. Kinetic energy is the energy possessed a body in motion, e.g. electrical energy, thermal energy and sound energy. Potential energy is stored energy and the energy of position, e.g. chemical energy, gravitational energy and nuclear energy.
- To be useful in particular situations, energy has to be changed from one form to another. This is called energy transformation.
- People get energy from numerous sources (or resources), e.g. the sun, fossil fuels (coal, oil and natural gas), biomass (made form plant and animal matter). Energy resources are classified as either renewable (can be replaced, e.g. wind) or non-renewable energy (cannot be replaced, e.g. fossil fuels).
- The term 'alternative energy' refers to an energy source that is an alternative to using fossil fuels. Generally, it indicates energy resources that are non-traditional and have low environmental impact, e.g. sunlight, wind, tides and geothermal energy.
- Alternative energy is important for the future viability of the economies of Caribbean countries, and to protect their environments.

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. Note that alternative energy can be replenished and is environmentally safe.

UNIT TITLE: Energy

Theme: Energy, Forces and Matter

ATTAINMENT TARGET(S):

- Understand natural laws as they apply to motion, forces, and energy transformations.
- Understand the importance of energy in our everyday life, the range of available energy sources and some environmental impacts of utilising these resources.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

BENCHMARKS:

- Be familiar with the nature of energy transformations, the various types of energy sources and the importance of energy.
- Understand the importance of energy to society, and know how alternative energy sources are harnessed.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate concern for the preservation of natural resources.
- Demonstrate concern for man's impact on the environment.
- Demonstrate concern for man's impact on the environment.

Topic: Alternative Energy

Duration: 7.5 hours/3 weeks

Prior Learning

Check that students:

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

OBJECTIVES

Students will:

- Recall that energy is the ability to do work
- Differentiate between energy forms and energy sources/resources
- Investigate the energy conversions occurring in some devices
- Use the terms kinetic energy and potential energy in describing energy transformations.
- Differentiate between renewable and non-renewable sources/resources of energy
- Justify the need for alternative energy resources
- Assess the advantages and disadvantages of using renewable and non-renewable sources of energy
- Evaluate the importance of alternative energy solutions to Jamaica and the Caribbean
- Investigate ways in which alternative energy sources are harnessed
- Work cooperatively in groups
- Show respect for the ideas of their peers

ICT ATTAINMENT TARGETS:

COMMUNICATION AND COLLABORATION - Use technology to communicate ideas, information and understandings for a variety of purposes.

RESEARCH, CRITICAL THINKING AND DECISION MAKING - Use technology to develop a logical process for decision making and problem solving.

DESIGNING AND PRODUCING - Use technology to design and produce multimedia products to demonstrate their creative thinking.

DIGITAL CITIZENSHIP - Follow guidelines to promote healthy use of ICT tools.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Participate in a teacher led discussion in order to recap the meaning of the term energy. Discuss the between energy forms and sources of energy. In groups, identify various forms of energy and give an example of a source in each case. Tabulate the information, possibly using word processing software, and share with the class.	Collaborate, communicate, record Create table Record information	Table contains correctly identified forms of 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 at this time.*)	Communicate, collaborate, think critically - analyse, investigate, define operationally,	Acceptable definitions for kinetic and potential energy
Classify energy forms given as kinetic and potential.	Think critically - classify	Forms of energy correctly classified as potential and kinetic
In groups, examine some simple devices that transform energy e.g. flashlight, radio, iron, electric kettle, yo-yo, solar calculator, battery-operated/spring operated toy car. Identify how the energy changes occurring in the device when it is being used and record the energy transformation (e.g. flashlight: chemical → light).	Collaborate, communicate, think critically - analyse, record,	Correct descriptions of energy conversions
Describe the energy conversions involved in the different complex systems, provided by the teacher (e.g. energy conversions in a car).	Think critically – analyse, draw conclusions	Correct transformations stated
In groups, using the Engineering Design Process, develop a plan for and build a device that transforms energy, such as a wind mill or solar cooker, using available resources.	Collaborate, communicate, manipulate, create, think critically – plan and design, investigate, construct models	Plan reflects the Engineering Design Process Device meets design requirements

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
In groups brainstorm the meaning of the terms renewable and non-renewable energy, and write down their thoughts. View a video on, or research renewable and non-renewable energy sources. Be given a list of energy sources to categorize as renewable and non-renewable. Present the information to the class in a variety of ways. Research the meaning of the term "alternative energy," and list examples of alternative energy sources.	Observe, collaborate, communicate, think critically - classify, research	Energy sources correctly classified as renewable and non-renewable Correct meaning for and examples of alternative energy resources presented
In groups, discuss the advantages and disadvantages of renewable and non-renewable energy sources. Participate in panel discussion on the advantages and disadvantages of renewable and non-renewable energy sources as it relates to uses in the home, school and the country. Discuss the need for alternative sources of energy. (*The panel should consist of at least one member from each group.*) In groups create a leaflet/poster (electronic/non-electronic), for distribution in the school, on the different types of alternative/ renewable and non-renewable energy sources and their pros and cons.	Collaborate, communicate, think critically – analyse, evaluate, create	Leaflet/poster contains correct information on the different types of energy sources and their pros and cons
In groups, read the information provided by teacher on energy use in various industries in the Caribbean. Summarise the information and present it to the class in a variety of ways, including multimedia presentations. As a class, discuss the importance of energy to Caribbean societies and identify challenges (cost, availability, accessibility etc.) faced by these countries in meeting their energy needs (Teacher should guide discussion).	Collaborate, communicate, think critically - synthesise Create multimedia content	Information presented accurately summarise information provided
In groups, propose ways to address the energy problems faced by Caribbean countries. Present proposal to the class and discuss. (*Teacher should highlight the use of alternative energy and energy conservation as means of addressing the energy issues*).	Collaborate, communicate, think critically - evaluate	Proposal contains logical solutions for addressing the energy problems
In groups, create a list of energy conservation practices. Share list/ ideas with class in a variety of ways (electronic/non-electronic).	Collaborate, communicate, create	List contains acceptable energy conservation practices
Participate in a class debate on the moral and social issues related to energy use in the Caribbean. (T*his could involve the use of 'role cards', e.g. the views of scientists of different specialisms, of consumers, members of conservation organisations.*)	Communicate, collaborate, think critically – analyse, justify	Arguments presented are scientifically sound, that is, supported by relevant data

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Visit a wind farm/hydroelectric power station/view a solar energy system display/watch videos on the generation of electricity from various types of alternative energy resources. Compile a simple report (electronic/non-electronic) on how electricity is generated from one or more renewable energy sources.	Record, communicate, report	Accurate information presented in report
In groups use the Engineering Design process to plan, design and/or build a model energy efficient house.	Collaborate, construct models, measure, manipulate, create, communicate, think critically -plan and design, research	Model reflects at least three energy efficient considerations

Learning Outcomes

Students who demonstrate understanding can:

- Justify the need for alternative energy solutions
- Identify sources of renewable/alternative and non- renewable in Jamaica and the Caribbean
- Suggest relevant solutions to energy problem in Jamaica and the Caribbean
- Contribute a view or appropriate evidence to a debate
- Create digital content using word processing and multimedia software
- Communicate and collaborate using class email and wiki

Points to Note

Objectives 1 and 2 are for the purpose of recap.

Allow students to formulate their own solutions for the problems presented, as much as is possible.

Follow guidelines to promote healthy use of ICT tools

Class email account and wiki site will be teacher created

Guided communication and collaboration in using class email and wiki, to facilitate respectful, responsible and clear online communication

Extended Learning

Research the use of alternative energy resources globally

RESOURCES

Energy conversion devices, e.g. flashlights, buzzers, radios, materials to build model energy efficient house computer, Internet, multimedia projector, word processing and multimedia software, CDs/DVDs, class email account, class wiki site

KEY VOCABULARY

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

LINKS TO OTHER SUBJECTS

Technical Vocational Education – Energy

About the Unit

In this unit, students will learn about sexual and asexual reproduction in plants. They will review the reproductive structures of a typical flower and explore the adaptations of selected flowers in order to classify them as wind or insect pollinated. They will trace the events from pollination to fertilisation and fruit formation. They will also compare seeds and fruits and make annotated drawings of selected samples of both.

Students will learn that asexual reproduction takes place in vegetative parts of the plant – root, leaf and stem – not in specialised reproductive cells. They will examine asexual reproduction in selected plants (root stem and leaf).

Students will compare sexual and asexual reproduction in plants.

Range of Content

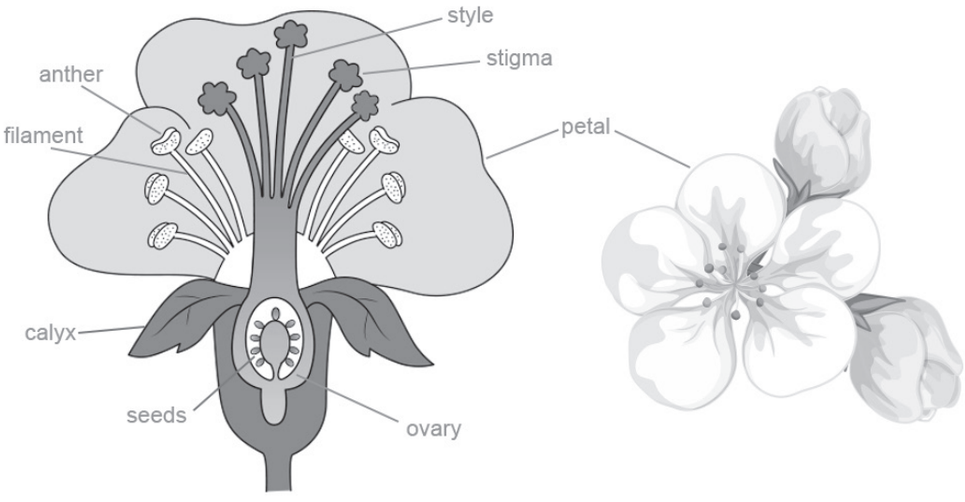
- The flower is the sexual reproductive structure/shoot of flowering plants.
- Flowers are specially designed for sexual reproduction.
- Wind and insects are two common agents of pollination.
- Flowers are specially adapted to their pollinating agent.
- Pollination is important for fertilisation of gametes and development of the seeds and fruits
- After fertilisation the ovule develops into the seed and the ovary into the fruit.
- A seed contains an embryo (young plant) with a radicle (root) and a plumule (shoot).
- A seed can grow into a young plant or seedling.
- Some plants can reproduce without making seeds – asexual reproduction.
- Asexual and sexual reproduction are different.

Guidance for the Teacher

1. During teacher led demonstration, take care to explain the proper use of cutting implements in dissection of the flower
2. Discuss the general safety tips when working with sharp instruments
3. Illustrate the cutting of a longitudinal section (LS) of the flower
4. Discuss ways in which students may demonstrate concern or preserve living things and the environment as they extract samples for their investigation

UNIT TITLE: Reproduction in Flowering Plants

Theme: Living Things, Life Processes and the Environment



Prior Learning

Check that students can:

- Name the reproductive organs of a flowering plant
- State the functions of selected parts of the flower
- State that pollen grains contain the male sex cells
- State that the female sex cells are found in the ovary

ATTAINMENT TARGET(S):

- Understand the importance of the life processes in plants and animals, their interdependence, their interaction with the environment, and how lifestyles determine health and well-being.
- Gain an understanding of the components and structure of the universe, and how advances in science and technology have enabled space exploration.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

OBJECTIVES

Students will:

- Dissect and draw the reproductive structures of a flower
- Compare the structure of wind and insect pollinated flowers
- Explain the process of fertilisation
- Describe what happens after fertilisation to form seeds and fruits
- Relate the structure of seeds and fruits to the structure of the flower
- Make annotated drawings of the external and internal structure of seed and fruit
- Differentiate between seed and fruit
- Identify the main parts of a seed (testa, hilum, cotyledons, micropyle)
- Perform activities in a safe and tidy way
- Use cutting instruments correctly and with care

BENCHMARK(S):

- Understand the impact of climate change on living things and on the environment.
- Know that the cell is the basic unit of structure and function of all living organisms and be aware of the differences between plant and animal cells.
- Understand the hierarchical relationship from cells to organism.
- Understand the process of sexual maturity, and reproduction, in plants and animals.
- Understand the importance of maintaining a healthy lifestyle.
- Apply scientific skills, processes and methods in everyday situations and be aware of safety precautions involved in scientific work.
- Use scientific principles in the design of solutions to a problem taking into account potential impacts on man and the natural environment.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate care and concern for living things and the environment.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate concern for the preservation of natural resources.
- Demonstrate concern for man's impact on the environment.
- Demonstrate sensitivity to others who are different.

Topic: Sexual Reproduction in Plants

Duration: 7.5 hours/3 weeks

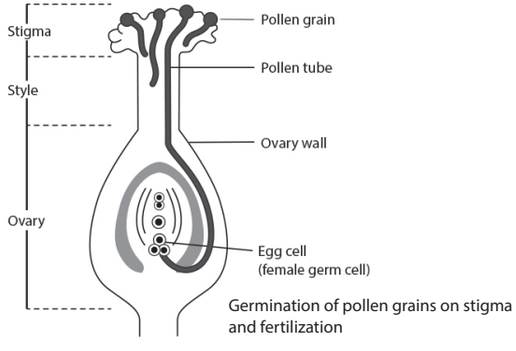
ICT ATTAINMENT TARGETS:

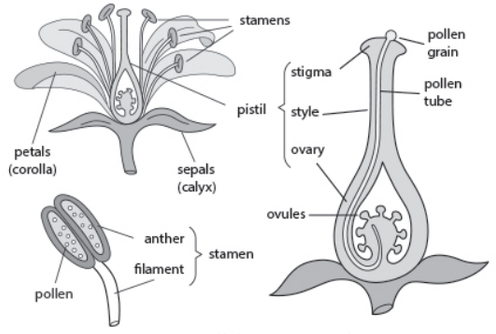
COMMUNICATION AND COLLABORATION - Use technology to communicate ideas and information, and work collaboratively to support individual needs and contribution to the learning of others.

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, use a hand lens to examine the flower of Poinciana, Pride of Barbados, Poor man's Orchid or Hibiscus. Identify and make labelled drawings of the male and female reproductive organs.	Collaborate, observe, draw	Acceptable presentation of drawings Drawings accurately labelled
In groups, under the guidance of the teacher and after teacher demonstration, make a longitudinal section (L/S) of the ovary of chosen flower. Identify the ovules using a hand lens. Make a labelled drawing of the L/S ovary to show the ovules. Use a hand lens to examine pollen grains from a mature anther from the same flower. In a teacher led discussion, arrive at a simple working definition for pollination.	Collaborate, manipulate, draw, think critically - define operationally	Acceptable presentation of drawings. Drawing accurately labelled Acceptable definition of pollination
In groups, collect at least 10 different types of flowers from their local environment. Examine each flower using a hand lens and record all the features observed. Use the information to decide whether each flower is wind- or insect- pollinated and explain how they arrived at the decision. Construct a table comparing wind and insect pollinated flowers. Share the information with the class. Under the guidance of the teacher summarise the similarities and differences between wind and insect pollinated flowers.	Collaborate, observe, tabulate, communicate, think critically – compare, classify, justify	Accurate comparison of wind and insect pollinated flowers Accurate grouping of flowers Acceptable presentation of table Logical reasons given
In a teacher led discussion describe the events taking place in the diagram/poster/chart etc., similar to the one provided. Generate a simple working definition for fertilisation. In groups, use the diagram provided to compose a song about pollination and fertilisation and share with the class.  *(Retrieved from http://cdn.biologydiscussion.com/wp-content/uploads/2014/01/clip_loads/2014/01/clip_image0047.jpg)*	Collaborate, communicate, define operationally, create	Acceptable definition of fertilisation given Song includes accurate information about pollination and fertilisation

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
 *(Retrieved from http://www.askiitians.com/biology/sexual-reproduction-in-flowering-plants/)*		
Explore how flowers develop into fruits using the flowering shoot of Pride of Barbados or Poinciana or Gungo peas. Observe the top of the flowering shoot and identify the buds, the opened flowers and the green fruits/pods. Examine one of the large green fruits/pods. Carefully open the fruit/pod, identify the structures and make an annotated drawing.	Collaborate, communicate, think critically - investigate, annotate drawings,	Acceptable presentation of drawings Drawing accurately annotated
In groups, develop a flow diagram showing the sequence of events from pollination to fruit formation and share with the class in a variety of ways.	Communicate, collaborate, create	Flow diagram accurately represents events
Examine a soaked pea or bean seed to identify the testa and hilum. Gently squeeze the seed between finger and thumb and observe what happens. (Teacher should inform students that the drop of water that is observed identifies the position of the micropyle.) Make an annotated drawing of the external structure of the seed. Calculate the magnification of the drawing.	Manipulate, observe, annotate drawings, calculate magnification	Magnification accurately calculated and presented on drawing Drawing accurately annotated
Open the bean seed down the middle and identify the embryo (plumule –shoot and radicle-root) and cotyledons. Make an annotated drawing of the internal structure of the seed. Calculate the magnification of the drawing.	Manipulate, observe, annotate drawings, calculate magnification	Magnification accurately calculated and presented on drawing Drawing accurately annotated
Examine selected fruits (e.g. lime/orange, tomato, mango, cucumber, coconut, peanut, etc.). Cut a transverse/cross section through the middle of one of the fruits, examine and draw the half fruit. Label the fruit wall and the seeds.	Manipulate, observe, draw and label, calculate magnification	Magnification accurately calculated and presented on drawing Drawing accurately labelled

Learning Outcomes

Students who demonstrate understanding can:

- Describe the reproductive structures of a flower
- Differentiate between wind and insect pollinated flowers
- Explain the process of fertilisation
- Trace the development of seeds and fruits
- Make annotated drawings of the external and internal structure of seed and fruit
- Calculate the magnification of a drawing
- Use cutting instruments correctly and with care

Points to Note

Care must be taken when using flowers that produce large amounts of pollen as some students have allergic reactions to different pollen. Ensure flowers are not shaken so pollen does not become airborne.

Remind students to wash hands thoroughly after handling flowers and seeds.

Calculate magnification of a drawing using the formula:

$$\text{Magnication} = \frac{\text{size of drawing}}{\text{size of specimen}}$$

Magnification is written beside the Title of the drawing and calculated to one decimal place.
E.g. Drawing showing External Features of the Pea x1.2

Magnification MUST be included on **ALL** future drawings

Ensure students use cutting instruments correctly and with care

Extended Learning

Research the development of the fruits of strawberry, pineapple and soursop and banana.

Research and prepare a presentation on the classification of fruits.

RESOURCES

Hand lenses, posters, charts, scalpel, white tiles/petri dishes

KEY VOCABULARY

gamete, ovule, pollination, fertilisation, fruit, seed, micropyle, hilum, cotyledon, testa, plumule, radicle

LINKS TO OTHER SUBJECTS

Agriculture

UNIT TITLE: Reproduction in Flowering Plants

Theme: Living Things, Life Processes and the Environment

ATTAINMENT TARGET(S):

- Understand the importance of the life processes in plants and animals, their interdependence, their interaction with the environment, and how lifestyles determine health and well-being.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

BENCHMARK(S):

- Understand the process of sexual maturity, and reproduction, in plants and animals.
- Apply scientific skills, processes and methods in everyday situations and be aware of safety precautions involved in scientific work.
- Use scientific principles in the design of solutions to a problem taking into account potential impacts on man and the natural environment.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate care and concern for living things and the environment.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: Asexual Reproduction in Plants

Duration: 5 hours/2 weeks

OBJECTIVES

Students will:

- Identify and list some plants that can reproduce without making seeds
- Describe ways in which new plants can be grown without seeds
- Investigate asexual reproduction in selected plants
- Compare asexual and sexual reproduction in plants
- Demonstrate caring for plants
- Make and record observations using a range of methods

ICT ATTAINMENT TARGETS:

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

RESEARCH, CRITICAL THINKING AND DECISION MAKING - Students use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DESIGNING AND PRODUCING - Students use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems and make informed decisions.

DIGITAL CITIZENSHIP - Students 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, predict what they think will happen when a leaf is removed from the *Leaf of life* plant and placed in a cup containing water. Share ideas with the class. Place a leaf from the *Leaf of life (Bryophyllum)* plant into a small container such as a Styrofoam cup or box drink carton with water. Make daily observations for two weeks. Record and explain their observations in writing and drawing/photos. Relate observations to predictions. Present findings to the class.	Collaborate, communiate, draw, observe, think critically– infer, predict, analyse, draw conclusions, investigate	Logical inferences made Observations accurately capture daily changes Conclusions reflect predictions and observations
In groups, cut ends from a sweet potato and place them in a container with water. Observe for two weeks and record their observations in a variety of ways. Summarise and present their observations to the class.	Collaborate, communicate, draw, observe, think critically - infer, investigate	Observations accurately capture changes Conclusions reflect observations
In groups, carefully cut 3-5 pieces with 'eyes' from the Irish potato provided. Press each piece of potato with eye upright onto the surface of moist paper towel/saw dust/potting soil in a suitable container and cover with cling film. Place the container in a cool place and record observations each day for 2 weeks. Summarise and present their observations to the class.	Collaborate, communicate, draw, observe, think critically - infer, investigate	Observations accurately capture changes Conclusions reflect observations
In groups, use the information gained from the previous activities to arrive at a working definition for asexual reproduction. In a teacher led discussion derive a common definition for asexual reproduction.	Collaborate, communicate, think critically – analyse, synthesize, define operationally	Acceptable definition of asexual reproduction developed
As a class, compare sexual and asexual reproduction and summarise the information in a suitable table. Complete a teacher developed worksheet on asexual reproduction in plants.	Collaborate, communicate, tabulate, think critically – compare	Acceptable presentation of table Accurate information recorded Worksheet accurately completed

Learning Outcomes

Students who demonstrate understanding can:

- Give examples of some plants that can reproduce without making seeds.
- Explain some ways in which new plants can be grown without seeds
- Describe asexual reproduction in selected plants
- Differentiate between asexual and sexual reproduction in plants
- Present observations and data using appropriate methods
- Show caring for plants

Points to Note

When identifying plants that can reproduce without making seeds try to include some plants that do not grow in Jamaica

Allow the stated objectives to guide the scope of the content under consideration (only a simple treatment of a-sexual reproduction is required)

Extended Learning

Research asexual reproduction in commercial farming and horticulture (e.g. the use of ratooning and replanting of Sugar cane; bananas, pineapple)

RESOURCES

Styrofoam cups , drink cartons, plates, potting soil, paper towel, cling film

KEY VOCABULARY

Asexual reproduction, cuttings, bulbs, rhizomes, tubers

LINKS TO OTHER SUBJECTS

Agriculture

About the Unit

In this Unit, students will learn about puberty and adolescence and identify the physical and emotional changes that take place in males and females. They will relate the changes to the sex hormones and to the overall sexual reproductive process. Students will describe how male and female sex cells (gametes) meet and fuse during fertilisation to produce a zygote which will develop into an embryo then into a foetus. They will learn that the menstrual cycle in females consists of several phases controlled by hormones. They will recognize that good personal hygiene is an important part of a healthy lifestyle.

Range of Content

- Physical and emotional changes take place at different rates in males and females during puberty and adolescence
- Puberty and adolescent changes are controlled by hormones
- During sexual reproduction egg and sperm fuse to produce a zygote
- During pregnancy the zygote develops into an embryo and later into a foetus
- The monthly menstrual cycle in females is controlled by hormones
- Personal hygiene is important for healthy living

Guidance for the Teacher

Handle topic very carefully with sensitivity considering students who are shy. Reassurance about the range of different secondary sexual characteristics can alleviate students' concerns and sensitivities about their stage of development. Many students are sensitive about their weight. Sensitivity is needed with height because a small but significant number of children have growth problems. Height/weight charts used by health professionals illustrate the range of expected heights and weights. These can be used to reassure students at the extremes of the range. Teachers should be aware of the need for sensitivity to students who may mature earlier or later than the majority of their peers.

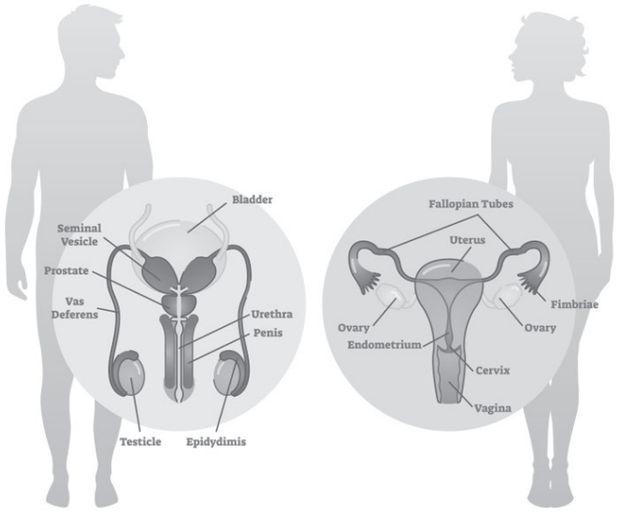
UNIT TITLE: Sexual maturity and reproduction in humans

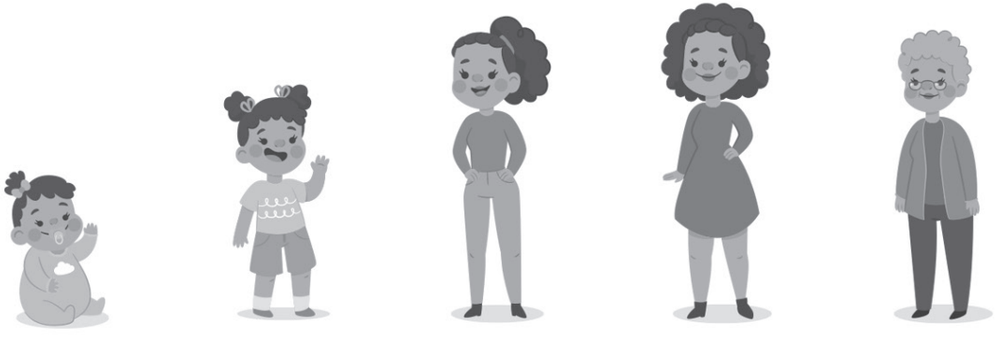
Theme: Living Things, Life Processes and the Environment

Prior Learning

Check that students can:

- Identify the main parts of male and female reproductive systems
- State the functions of the main parts of the male and female reproductive systems
- Recall that organisms are made up of cells and that cells are specialised for their functions





ATTAINMENT TARGET(S):

- Understand the importance of the life processes in plants and animals, their interdependence, their interaction with the environment, and how lifestyles determine health and well-being.
- Gain an understanding of the components and structure of the universe, and how advances in science and technology have enabled space exploration.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

OBJECTIVES

Students will:

- Describe the human life cycle in terms of infancy, childhood, adolescence, maturity and ageing
- Distinguish between puberty and adolescence
- Identify the changes in males and females during puberty
- Identify the hormones that initiate puberty in males and females
- Relate the structure of the main parts of male and female reproductive systems to their function
- Relate the structure of the male and female sex cells (gametes) to their function
- Explain the process of sexual reproduction in humans
- Describe the main changes that occur during the menstrual cycle
- Explain the importance of personal hygiene

BENCHMARK(S):

- Understand the process of sexual maturity, and reproduction, in plants and animals.
- Use scientific principles in the design of solutions to a problem taking into account potential impacts on man and the natural environment.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: Sexual Maturity and Reproduction in Humans

Duration: 7.5 Hours/3 weeks

ICT ATTAINMENT TARGETS:

COMMUNICATION AND COLLABORATION - Use technology to communicate ideas and information and understandings for a variety of purposes.

RESEARCH, CRITICAL THINKING AND DECISION MAKING - Use technology to develop a logical process for decision making and problem solving.

DESIGNING AND PRODUCING - Use technology to design and produce multimedia products to demonstrate their creative thinking.

DIGITAL CITIZENSHIP - Follow guidelines to promote healthy use of ICT tools

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Respond to questions on the human life cycle, e.g. infancy, childhood, adolescence, puberty and adulthood. Use pictures to create a poster depicting the stages in the human life cycle, in the correct sequence. Be provided with a series of statements about the human life cycle and asked to sort these in the correct stage of the human life cycle. Use the grouped statements to summarise what happens at each stage in the cycle.	Create, communicate, think critically - analyse, classify, summarise	Poster contains correct sequence of all stages in the human life cycle Statements correctly matched to stages in the life cycle Summary captures the main events at each stage
View videos/posters/charts on changes during puberty and adolescence. Guided by teacher led discussion, generate working definitions for the terms puberty and adolescence. List some of the main changes (physical and emotional) that occur during puberty and adolescence in males and females (e.g. mood swings, hair on pubic areas, widening of hips in females, deepening of voice and broadening chest in males), and name the hormones that initiate these changes.	Communicate, define operationally, collaborate, think critically - analyse	Acceptable definitions given for the terms puberty and adolescence Changes in males and females during adolescence correctly identified Male and female hormones correctly identified
Be asked to recall times when they grew rapidly in primary school and identify the main ways in which they changed. Use secondary data of height at different ages to plot growth charts and identify the main periods of time when rapid growth takes place. In groups, collect data on the heights (cm) of a sample of boys/girls aged 12 and another sample of boys/girls aged 16. Calculate the average height of the students of both age-groups and/or sexes. Record data in a table and construct a bar graph of the results. Write a report on the investigation paying special attention to height, gender and age. Participate in teacher led discussion of the findings.	Construct line graphs, think critically - analyse, interpret, communicate Collaborate, measure, collect and record data, communicate, think critically – analyse, draw conclusions, Investigate	Line graphs correctly plotted Main periods of growth correctly identified Acceptable presentation of data in table Bar graph correctly constructed Report findings supported by data
Examine models or view poster / chart/ video (online/offline) of human male and female reproductive systems. Identify specific parts of the male and female reproductive system [ovary, fallopian tube/oviduct, uterus/womb, vagina, testes, scrotum, penis], and relate these to their basic functions. Label diagrams of the reproductive system on prepared worksheets and include the basic functions of these reproductive structures.	Communicate, annotate diagrams	Parts and functions are correctly matched on completed worksheets

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Use pictures or video clips of sperm and egg cells to review cell specialisation. Compare them and suggest how they are specially adapted for their functions. Draw and describe, or annotate drawings, of egg and sperm cells identifying their main features.	Annotate drawings , think critically - analyse, compare,	Acceptable drawings of egg and sperm cells Annotations contain correct information about labelled structures.
In a teacher-led discussion, talk about what they know of human egg cells, e.g. where they are produced, how often they are produced, and how a woman might know if she is pregnant or not. (*Teacher should use students' suggestions and video or CD-ROM simulation to introduce the stages of the monthly cycle.*)	Communicate	
With the aid of the teacher, construct a diagram of the days in the cycle, marking when menstruation and ovulation might occur and when the lining of the uterus/womb is thickening.	Draw	Diagram correctly represents the events of the menstrual cycle
Use Menstrual Cycle Wheel, provided by the teacher, along with guided discussion to identify the main changes that occur and relate each stage of the cycle to its significance in sexual reproduction.	Communicate, collaborate, think critically – analyse, draw conclusions,	The role of each stage in sexual reproduction is correctly described
Complete worksheet on the phases of the Menstrual Cycle.	Think critically - analyse	Worksheet correctly completed
View video/charts outlining the process of sexual reproduction in humans. In a teacher-led discussion, establish that fertilisation involves the fusion of a male cell (sperm) with a female cell (egg). Recap that sperm are produced in testes and eggs in ovaries. Talk about sperm being deposited in the vagina and having to move to where the egg is, and the egg moving down the oviduct. (Teacher can illustrate, for example, with video and software simulations.)	Communicate, sequence, collaborate Create and format multi-media presentations	Correct sequence of stages of sexual reproduction
Draw, or label, and sequence pictures or diagrams illustrating ovulation, fertilisation, and implantation. OR In groups, sequence cards, or manipulate interactive tutorial, bearing pictures or words depicting the stages of sexual reproduction. Display cards for critique. OR Create multimedia presentation depicting the stages of reproduction	Draw/label diagrams, think critically – analyse, sequence Collaborate, communicate, think critically - sequence,	Sequence of pictures or diagrams or Cards correctly depicts the events of reproduction

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Create and perform songs/poems about hygiene. Discuss their creations and identify ways in which good personal hygiene is depicted or not depicted. As a class, discuss the importance of good personal hygiene during puberty/adolescence. Record the main points from the discussions in a variety of ways.	Think critically – analyse, justify, create, communicate, collaborate, record	Main points about personal hygiene practices captured Good hygiene practices reflected in creations
Individually create kits for personal hygiene (T*eacher should recognise that a variety of hygiene products are used in different cultures and parts of the country and these are acceptable*). Display and critique the kits using a checklist generated by the class.	Observe, think critically - critique, create, design	Kit contains appropriate products that address each area of personal hygiene
In groups, use the Engineering Design Process to create a product that can be used to improve personal hygiene (example: comb, soap, lotion, powder). Design a marketing campaign to advertise the product.	Create, manipulate, communicate, think critically – plan and design, solve problem, investigate,	Marketing campaign design reflects creative thinking and is effectively executed Plan follows the Engineering design process Product meets design requirement

Learning Outcomes

Students who demonstrate understanding can:

- Identify the phases of the human life cycle
- Name, locate and describe the functions of the reproductive structures
- Describe fertilisation in terms of the fusion of egg cells and sperm cells
- Describe the changes in the menstrual cycle
- Describe the observable changes that occur in males and females during puberty/adolescence
- Recognise that reproductive organs mature during puberty as a consequence of growth and circulating hormones
- Recognise that good personal hygiene is important for healthy living
- Navigate and manipulate online tutorials/simulations on the stages of sexual reproduction in humans
- Communicate and collaborate using wiki

Points to Note

Highlight that the menstrual cycle varies from person to person and may be shorter or longer than 28 days.

Teacher created class wiki may be used for communication and collaboration

Follow guidelines to promote healthy use of ICT tools

Extended Learning

Discuss factors that contribute to irregular menstrual cycles.

Research issues related to adolescence and puberty (e.g., religious, social and cultural).

RESOURCES

videos, pictures, songs, charts/ posters, presentation software, worksheets on structure of the male and female reproductive systems

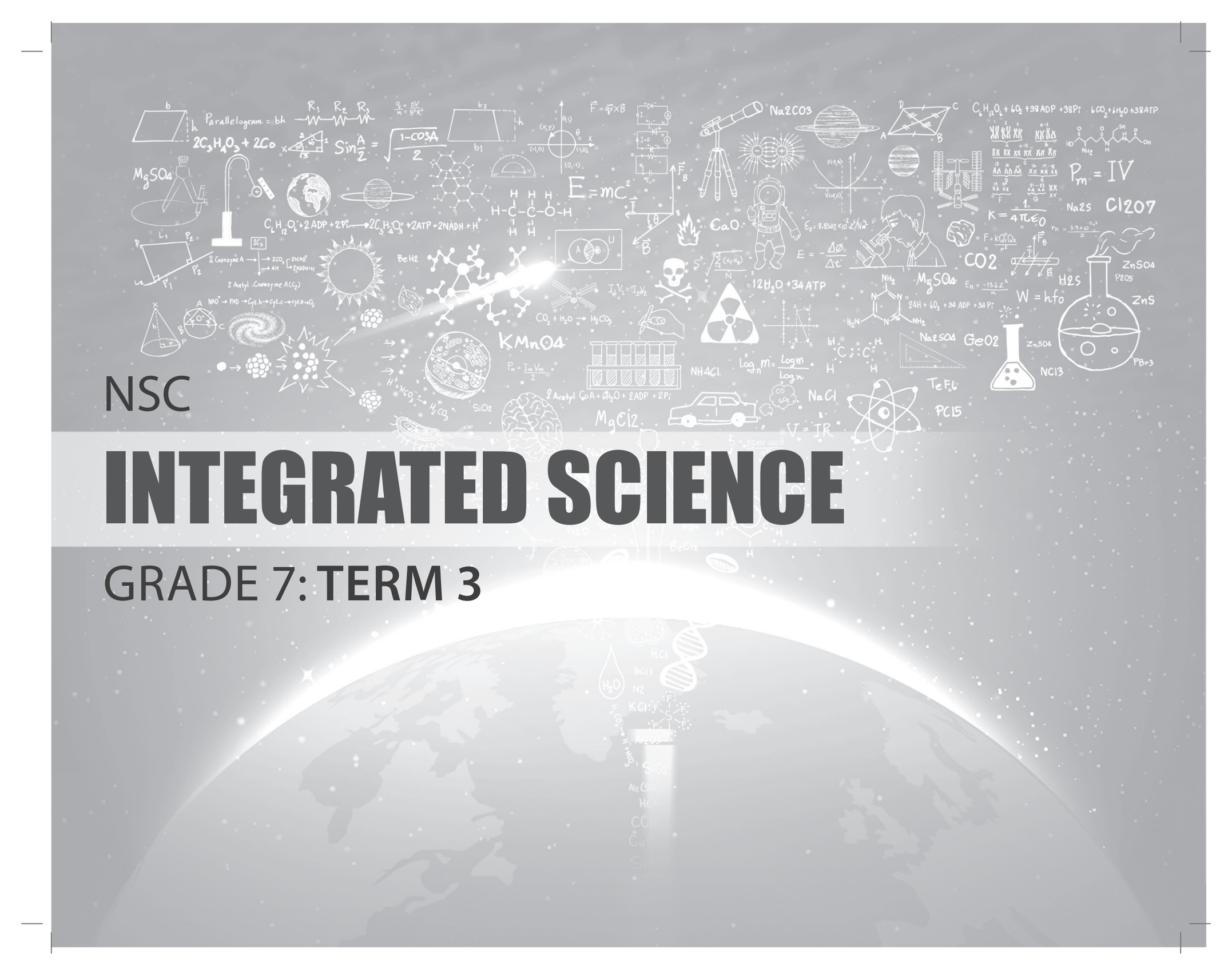
computer, Internet, multimedia projector, word processing and spreadsheet software, CDs/DVDs, class wiki site

KEY VOCABULARY

puberty, adolescence, menstrual cycle, oestrogen, testosterone, ovary, testis, fertilisation, sexual reproduction, hormone, hygiene, ovulation, fallopian tube/ oviduct, uterus/womb, vagina, testes, scrotum

LINKS TO OTHER SUBJECTS

Link with HFLE Grade 6 : Sexuality and Sexual Health, Religious Education



NSC

INTEGRATED SCIENCE

GRADE 7: TERM 3

About the Unit

In this Unit, students will learn about some common sexually transmitted infections, their causative agents, symptoms, modes of transmission and treatment. They will explore the dangers of drug misuse, abuse and addictions, through the study of some commonly abused drugs, and learn about the effects of these on the human body, mind and society at large.

Range of Content

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

- Sexually Transmitted Infections are caused by either bacteria, virus or parasite spread mainly through sexual contact, although some can be spread through non-sexual means such as blood or blood products
- Common STIs include syphilis, gonorrhoea, chlamydia, hepatitis B, herpes, HIV and HPV. The main symptoms usually associated with these are vaginal discharge, urethral discharge or burning in men, genital ulcers and abdominal pain.
- Some STIs can be cured while others cannot, hence, counselling to improve responsible sexual behaviour, vaccinations, condom use and abstinence are methods aimed at preventing them.
- Drug misuse refers to the use of a drug other than for its intended purpose (e.g. prescription drugs) while drug abuse is the repeated use of a drug in order to experience pleasure, relaxation or the feeling of 'getting high'.
- Drug abuse that leads to psychological and physiological dependence results in a chronic disease called drug addiction. Commonly abused drugs include alcohol, marijuana, stimulants, steroids, cocaine, heroin and prescription drugs.
- Drug abuse firstly alters the proper functioning of the brain which leads to changes in behaviour, attitudes, personality, and habits. Changes in physical appearance can also occur resulting in blood shot eyes, dilated/constricted pupils, sudden weight changes and bruises.
- Drug abuse eventually affects family and societal relationships as social behaviour changes, financial problems increase and involvement in criminal activity occurs to feed the habit.
- Drug addiction is not 'cured' but can be managed through intervention and rehabilitation programs that use addiction treatment medicine and behavioural therapy.

Guidance for the Teacher

Presentation methods include: PowerPoint, songs, poems, role play, panel discussions, interviews, editorial, video, brochures, posters, displays, picture story, etc.

Teachers should make reference to the Health and Family Life Education (HFLE) programme.

Always be aware of the need for sensitivity to the personal circumstances of students and their families.

UNIT TITLE: Sexually Transmitted Infections and Drug Abuse

Theme: Living Things, Life Processes and the Environment

Prior Learning

Check that students can:

- Explain the process of sexual reproduction in humans
- Identify the main reproductive organs and describe their functions

ATTAINMENT TARGET(S):

- Understand the importance of the life processes in plants and animals, their interdependence, their interaction with the environment, and how lifestyles determine health and well-being.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

BENCHMARK(S):

- Understand the importance of maintaining a healthy lifestyle.
- Apply scientific skills, processes and methods in everyday situations and be aware of safety precautions involved in scientific work.
- Use scientific principles in the design of solutions to a problem taking into account potential impacts on man and the natural environment.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: Sexually Transmitted Infections

Duration: 5 hours/2 weeks

OBJECTIVES

Students will:

- Explain the importance of responsible sexual behaviour
- Evaluate risks associated with irresponsible sexual behaviour
- Formulate a definition of the term sexually transmitted infection
- Identify common diseases that are transmitted sexually (E.g. gonorrhoea, syphilis, genital herpes, HIV/AIDS, chlamydia, yeast, Human Papilloma Virus (HPV)), and their effects on the body.
- Identify the causative agent (pathogen), main symptoms, treatment and methods of prevention of selected STIs
- Show respect for another person's idea.
- Present observations and data using appropriate methods, including tables and graphs
- Interpret observations and data
- Draw conclusions from observations, measurements and data

ICT ATTAINMENT TARGETS:

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

RESEARCH, CRITICAL THINKING AND DECISION MAKING - Students use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DESIGNING AND PRODUCING - Students use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems and make informed decisions.

DIGITAL CITIZENSHIP - Students 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: View a video or a chart that introduces the concept of sexually transmitted diseases. In groups, brainstorm and formulate a simple definition for the term 'Sexually Transmitted Infection'. List some common sexually transmitted infections.	Collaborate, communicate, think critically, define operationally	Acceptable definition given for STIs At least five STIs listed
As a class, view videos (online/offline) and/or listen to songs on responsible sexual behaviours. Discuss the importance of responsible sexual behaviour, and then write a letter to an imaginary friend who is sexually active telling them about the dangers of STIs and the consequences of irresponsible sexual activities. Create a class portfolio using the letters.	Collaborate, investigate, communicate, draw, observe, think critically - infer	Letter contains correct information about the dangers of STIs and the consequences of irresponsible sexual activities.
ICT Integration The letter may be done using word processing software and attached to the class email, if available. E-portfolios may be used to store the compiled letters.	Create and format word processing document Send email with attachment	
Conduct research in small groups to gather information on a specific or assigned STI. Include the name of the STI, its causative agent (pathogen), symptoms, treatment, preventative measures and statistics on the number of persons who are infected in Jamaica and the Caribbean. Use the information to launch an STI Awareness Day in which each group will display their research findings using various methods e.g. banners, posters, videos, songs and poems. Invite resource personnel to address the subject of STIs. Complete a worksheet on STIs.	Research, collaborate, create, communicate, think critically – analyse, evaluate, formulate, apply	Accurate information on STIs presented Awareness Day displays satisfy given criteria Worksheets completed correctly Group collaboration evident
Acquire data on incidence of STIs among different groups, e.g. age, gender etc., in Jamaica and the Caribbean. Examine the data for trends and patterns. Represent the data in tables and graphs. Summarise their findings and draw conclusions. Share and discuss their findings with the class.	Communicate, think critically - analyse, summarise, draw conclusions, interpret	Trends and pattern correctly identified Logical conclusions drawn Presentation of data is appropriate
As a class, develop a promotional activity (e.g. a STI exposition, a STI awareness day/hour, lunch-hour presentation) to sensitise the rest of the school to STIs and the importance of responsible sexual behaviours.	Collaborate, create, communicate, think critically – apply, formulate	Presentations are creative and contain accurate information on the dangers of STIs

ICT Integration
The promotional activity may include various electronic means of portraying the message, e.g. e-posters, PowerPoint presentations, audio/video messages.

Learning Outcomes

Students who demonstrate understanding can:

- Explain the term sexually transmitted infection
- Identify the causative agent (pathogen), main symptoms, treatment and methods of prevention of selected STIs
- Argue the importance of responsible sexual behaviour
- Analyse, interpret and present data.
- Organise and implement a promotional activity/marketing plan.
- Create and format word processing document
- Communicate and collaborate using class email with attachment

Points to Note

Clear up any misconceptions or superstitions that emerge from discussions or work presented by students. Refer to Guidance Department, if necessary.

STI data may be obtained from the websites of various government and non-governmental organisations, e.g. the World Health Organisation (WHO), ministries of health, the Centre for Disease Control (CDC) etc.

Recognise some of the dangers associated with internet use and demonstrate safe online behaviours.

Extended Learning

Research the incidence of STIs among school children in the Caribbean.

Interview members of the community to find out common myths relating to STIs (e.g., transmission, treatment, prevention and cure). Prepare a summary of the findings for class discussion.

Role-play the HIV epidemic – 'HIV Acting'.

Research policies that exist to prevent discrimination against HIV infected individuals.

RESOURCES

Video/chart on STIs, worksheet

Computers, Internet, speaker, multimedia projector,

interactive video tutorials, CDs/DVDs, class email account

KEY VOCABULARY

symptom, transmission, sexual transmitted infection, pathogen

LINKS TO OTHER SUBJECTS

Social Studies, Health and Family Life Education

UNIT TITLE: Sexually Transmitted Infections and Drug Abuse

Theme: Living Things, Life Processes and the Environment

Prior Learning

Check that students can:

- Differentiate between useful and harmful drugs
- Describe some of the harmful effects of drug use and misuse

ATTAINMENT TARGET(S):

- Understand the importance of the life processes in plants and animals, their interdependence, their interaction with the environment, and how lifestyles determine health and well-being.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

BENCHMARK(S):

- Understand the importance of maintaining a healthy lifestyle.
- Apply scientific skills, processes and methods in everyday situations and be aware of safety precautions involved in scientific work.
- Use scientific principles in the design of solutions to a problem taking into account potential impacts on man and the natural environment.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: Drug Abuse

Duration: 5 hours/2 weeks

OBJECTIVES

Students will:

- Distinguish between drug use, misuse and abuse
- Describe the dangers and effects of commonly abused and misused drugs (alcohol, nicotine, marijuana, cocaine, caffeine, aspirin, paracetamol, antibiotics etc.)
- Explain the term drug addiction.
- Evaluate the effects of drug abuse on the human body and society.
- Explain ways in which addicted persons can be rehabilitated
- Recognise that there are ethical issues involved in research and development of drugs
- Select and make effective use of secondary sources of information about health, indicating how strongly evidence supports or does not support a conclusion

ICT ATTAINMENT TARGETS:

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

RESEARCH, CRITICAL THINKING AND DECISION MAKING - Students use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DESIGNING AND PRODUCING - Students use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems and make informed decisions.

DIGITAL CITIZENSHIP - Students 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: View videos on drug use, misuse and abuse. In small groups, brainstorm and record what they think is meant by the terms drug abuse, use, misuse and addiction. Share the information with the class. Discuss and compare their definitions with that provided by the teacher.	Collaborate, communicate, define operationally, think critically - formulate	Acceptable explanations given for the terms drug abuse, misuse, use and addiction
Be provided with a list of well-known substances, e.g. paracetamol, cannabis, tobacco, penicillin, antiseptic. Sort the list into drugs and other substances, then categorise the drugs into different groups. Explain the criteria or reasons for their categories.	Think critically - analyse, classify, justify	Drugs and other substances correctly classified. Criteria or reasons justified
In groups, discuss their perceptions of the dangers of drugs (e.g. widely used, side effects, addictive, likely to cause death). Use secondary sources (e.g. magazines, internet, resource persons) to check the accuracy of their perceptions of drugs. With the aid of the teacher, present their findings in a variety of ways for use by students in other classes.	Collaborate, research, communicate, create, think critically - analyse,	Accurate information presented in research Rubric contains relevant criteria

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
In groups, conduct research on drugs and their use, misuse and abuse. Include the dangers and effects on the human body, the social and economic implications and methods and opportunities for rehabilitation of persons who are addicted. Present their findings using a variety of methods. Peer-assess the presentations using a rubric they developed. **ICT Integration** Presentations may include class Wiki and blogs	Collaborate and communicate using class Wiki	
Depict through role-play scenarios related to drug use and abuse. As a class discuss the issues raised.	Create, communicate, role play, think critically – formulate, apply	Role-play acceptably portrays drug use and abuse
Collect a variety of pictures from the internet, newspaper, magazines that depict drug abuse and arrange the pictures in a sequential order so that they tell a story about the effects of drug abuse. Display picture stories on school notice board. **ICT Integration** Digital story software may be used to create and display the picture stories.	Create, communicate, think critically - analyse Create, edit, format, display digital stories	Picture story acceptable and satisfies criteria given
Visit rehabilitation centres or listen to resource persons (e.g. speakers from the National Council of Drug Abuse, Public Health nurses or persons who have managed to give up drugs) on the types of rehabilitation services available in Jamaica. Summarise and display information gleaned from the presentation/visit.	Communicate, summarise	Summary includes a variety of rehabilitation options

Learning Outcomes

Students who demonstrate understanding can:

- Explain drug abuse, misuse and addiction
- Explain the effects of drugs on the human body and mind
- Describe some social and economic problems associated with drug abuse.
- Identify some methods used/are available to help rehabilitate persons addicted to drugs.
- Create and format, digital display using digital story software
- Collaborate and communicate information on drug abuse using class Wiki and blogs.

Points to Note

Students may hold ideas about the effects of the use of some drugs that may be erroneous. It is important that the teacher identify and address these "myths".

Sensitivity must be exercised when addressing the cultural or ritualistic use of certain drugs.

Emphasize the importance of making responsible choices in order to maintain a healthy lifestyle.

Pay attention to the effects of drug use, misuse and abuse on unborn babies.

Recognise some of the dangers associated with internet use and demonstrate safe online behaviours.

Extended Learning

Research and present information on the use of performance enhancing drugs in sports

Research the medical uses of marijuana and present findings in a variety of ways (flyer, poster, brochure, song, etc.)

Write a letter to a friend or family member who is a chronic cigarette smoker, advising him/her of the dangers of the habit to health

Read publicly available leaflets on drugs

RESOURCES

Computers, internet, magazines, newspapers, videos, resource personnel, charts, sample rubric for presentation, speaker, multimedia projector, interactive video tutorials, CDs/DVDs, concept mapping software, class Wiki and blog

KEY VOCABULARY

drug, drug abuse, drug misuse, addiction, rehabilitation, symptoms

LINKS TO OTHER SUBJECTS

Social studies, Health and Family Life Education

About the Unit

In this Unit, students will learn about climate change and global warming. Students will also learn about the impact human activities such as the burning of fossil fuels have on climate and how they can minimize the impact on their lives.

Range of Content

- Climate change refers to significant changes in climate (which is affected by temperature, precipitation, wind patterns etc.) over a long period.
- Human activities such as burning of fossil fuels, deforestation, gaseous emissions from industries and agricultural practices have contributed to climate change.
- Global warming refers to the steady increase in average surface temperatures of the Earth due to higher concentrations of greenhouse gases in the atmosphere.
- Greenhouse gases such as carbon dioxide, methane, nitrous oxide and water vapour trap heat in the atmosphere, like a greenhouse, causing it to become warm.
- Greenhouse effect is the trapping of heat in the atmosphere by greenhouse gases. This effect is made worse by manmade production of these gases.
- The natural greenhouse effect is important to keep the Earth's atmosphere warm enough to support life.
- Data on changing temperatures and concentrations of greenhouse gases can be analysed to determine cause and effect relationships with climate change.
- Reducing greenhouse gas emissions, using clean energy and promoting lifestyle changes are some initiatives that can mitigate the impact of climate change.

Guidance for the Teacher

The following greenhouse gases should be treated carbon dioxide, methane, nitrous oxide, fluorinated gases (e.g. chlorofluorocarbons, CFCs) and sulphur dioxide. In depth look at chemical reactions are not required at this level.

Efforts should be made to increase individual and collective ownership of the issue of climate change, so that each student will take personal responsibility for the introduction of initiatives that can reduce its effect.

Increased awareness of this issue should be promoted throughout the school with the help of environmental and science clubs.

UNIT 2: Climate Change

Theme: Living Things, Life Processes and the Environment

ATTAINMENT TARGET(S):

- Understand the importance of the life processes in plants and animals, their interdependence, their interaction with the environment, and how lifestyles determine health and well-being.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

BENCHMARK(S):

- Understand the impact of climate change on living things and on the environment.
- Apply scientific skills, processes and methods in everyday situations and be aware of safety precautions involved in scientific work.
- Use scientific principles in the design of solutions to a problem taking into account potential impacts on man and the natural environment.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate care and concern for living things and the environment
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate concern for the preservation of natural resources.
- Demonstrate concern for man's impact on the environment.
- Demonstrate sensitivity to others who are different.

Topic: Climate Change

Duration: 12.5 hours/5 weeks

Prior Learning

Check that students can:

- Identify climate change as an environmental problem

OBJECTIVES

Students will:

- Explain the meaning of the term 'greenhouse effect'
- Investigate the principles governing the 'greenhouse effect'
- Differentiate between the natural and manmade 'greenhouse effect'
- Recall what is meant by climate change
- Identify some effects of climate change in the Caribbean
- Identify selected greenhouse gases and their sources
- Deduce the relationship between the greenhouse effect and global warming
- Evaluate the impact of at least three effects of climate change on living organisms and the environment
- Explain ways in which human practices contribute to climate change
- Describe at least three ways in which people can reduce the impact of climate change on their lives
- Formulate plans to reduce the production of major greenhouse gases
- Critique initiatives developed by environmental protection agencies to reduce the harmful effects of climate change
- Interpret data which illustrates the impact of climate change

ICT ATTAINMENT TARGETS:

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

RESEARCH, CRITICAL THINKING AND DECISION MAKING - Students use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DESIGNING AND PRODUCING - Students use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems and make informed decisions.

DIGITAL CITIZENSHIP - Students 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: Carry out an investigation to show the greenhouse effect: Put 50 cm^3 of water into each of two identical transparent glass jars then measure and record the temperature of the water in each. Cover one jar ensuring that it is air-tight. Place both jars in a sunny location/under a light source so that they are equally exposed to the light source. After at least 15 minutes, check on the jars, measure and record the temperature of the water and include any other observations (*e.g. steam in jar*). Discuss and suggest explanations for observations made. Share observations and explanations with class. (*In class discussion teacher should introduce the term 'greenhouse effect' and relate it to the activity.*) In groups, based on the investigation and subsequent class discussions, formulate a definition for the term 'greenhouse effect'. Share definition with class.	Investigate, manipulate, observe, record, collaborate, define operationally, communicate, think critically – infer, draw conclusions	Observations appropriately recorded Logical explanations given for observations Acceptable definition of greenhouse effect formulated
ICT Integration Share observations and definitions using online posting to class wiki or through class email with attachments.	Collaborate and communicate electronically	
In groups, use research and investigative skills to design and build a model, drawing or simulation of the natural greenhouse effect. Share designs with the class to determine if any modifications are to be made. Test the model and redesign if necessary. Use the model to explain the principles governing the greenhouse effect.	Communicate, create, plan and design, collaborate, think critically – analyse, evaluate, apply	Simulation/ Model works as intended Drawing represents the greenhouse principle Use and transfer of knowledge evident
Visit an actual greenhouse or research offline/ online how a greenhouse operates. Make drawing of the greenhouse and identify the functions of each component. Make comparisons between the natural and manmade greenhouse effect. Present findings to the class in a variety of ways.	Observe, draw, gather evidence, communicate, think critically – analyse, draw conclusions	Accurate information presented Logical explanations and plausible comparisons made
View a video to recap the meaning of the term 'climate change'. In groups, explore the possible effects of the 'greenhouse effect' on climate. Produce a podcast on the relationship between the greenhouse effect and climate change. Conduct peer evaluations on the podcast, then share and discuss with the class. Based on the discussions, derive a simple explanation of the term 'global warming'.	Collaborate, communicate, create, think critically – evaluate, draw conclusions	Acceptable explanation given for global warming

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Conduct research on some greenhouse gases (carbon dioxide, methane, nitrous oxide, sulphur dioxide, and fluorinated gases such as chlorofluorocarbons - CFCs) and list some sources of each. Explain how the greenhouse gases are produced naturally and through human activity. Create a poster to depict the information and display in the science corner. **ICT Integration** Posters may be created using digital drawing tools	Research, create, communicate Create digital content	Poster depicts accurate information
In groups, carry out research to assess some effects of climate change on the Caribbean (eg. Extreme weather events, loss of habitat, animal and human effects) and explain ways in which human practices contribute to these effects (See resource package for Grace Kennedy Annual Lecture 2015 video). Describe at least three ways in which people can reduce the impact of the effects on their lives. Share information with the class/school in a variety of ways. **ICT Integration** Information sharing may be done through discussion forums on social networking sites.	Research, collaborate, communicate Collaborate and communicate information using social network	Descriptions of human practices to reduce climate change are correct
In groups, be assigned one major greenhouse gas for which they will plan ways of reducing emissions. Peer-assess the plans to arrive at a class consensus on the best emission reduction methods. As a class, use the consensus information to produce a proposal/booklet on how to reduce greenhouse gas emissions.	Collaborate, communicate, create, think critically – formulate, evaluate	Greenhouse gas emission reduction plan is applicable Group collaboration evident
In groups, be provided with data on changes in global temperature/ carbon dioxide levels for the last 5 or more decades. Analyze and interpret the data to identify trends/ patterns. Make associations (cause & effect relationships) between the data and current climate change indicators. Make predictions on the effects of current practices on temperature and carbon dioxide levels.	Collaborate, communicate, gather evidence, think critically – analyse, interpret, justify, predict	Interpretations supported by data Logical conclusions made Justifiable predictions given

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
In groups, review initiatives developed by environmental protection agencies – such as National Environmental Protection Agency (NEPA), Jamaica Environment Trust (JET), Meteorological Service of Jamaica (Met office) – to reduce the effects of climate change. Assess which initiatives they think are most effective, providing justification for their selection(s). Use the selected initiative(s) to develop a public service campaign.	Collaborate, think critically - analyse, evaluate, justify, apply, communicate, create	Justification for selected initiatives is logical Campaign satisfies the given criteria
In groups, formulate plans that can be implemented by School/ Environmental or Science clubs to reduce contributions to climate change (eg. Composting, recycling of plastic). Suggest lifestyle changes that individuals can practice to limit their carbon footprint (eg. Use of environmentally friendly products, less driving, more walking, using bicycles, alternative energy, cleaner forms of energy). Create drawings or cartoons with catchy slogans to encourage more environmentally friendly lifestyles or to show cause and effect relationships between lifestyle practices and climate change.	Collaborate, communicate, plan and design, create, think critically – analyse, apply, draw conclusions, justify	Plans are sound and contain accurate information Creative drawings/ cartoons with correct information Logical connections made

Learning Outcomes

Students who demonstrate understanding can:

- Illustrate the greenhouse effect
- Explain the concept of climate change in terms of global warming and the greenhouse effect
- Describe effects of climate change
- Analyse mitigation methods to deal with climate change
- Collaborate and communicate electronically using class wiki and/or class email with attachments.
- Communicate information and collaborate using discussion forums and social networks

Points to Note

Additional information on climate change may be obtained online.
Some Effects of Climate Change:

1. Rise of sea and atmospheric temperatures
2. Increase in number and intensity of storms
3. Sea level rise
4. Increased drought

Extended Learning

Research the importance of the ozone layer, the substances that affect it and its impact on organisms and the environment.

Investigate the use of environmentally-friendly products by noting labels of products in supermarkets etc. Collect data and make presentations of findings.

Points to Note	Extended Learning
5. Risk of significant loss of biodiversity through species extinction in many tropical areas Teacher created/directed class wiki site, email account and discussion forums through social networking sites.	

RESOURCES

videos, pictures, songs, charts/ posters, presentation software, worksheets on structure of the male and female reproductive systems

computer, Internet, multimedia projector, word processing and spreadsheet software, CDs/DVDs, class wiki site

KEY VOCABULARY

Global warming, greenhouse effect, greenhouse gases, carbon dioxide, methane, nitrous oxide, global warming, sulphur dioxide, fluorinated gases

LINKS TO OTHER SUBJECTS

Social studies: AT1, Climate, grades 8 and 9, Geography, Mathematics

NSC

INTEGRATED SCIENCE

GRADE 8 UNITS

TERM 1

Unit 1

Working Like a Scientist 2

Methods of presenting data
Construction of pie-charts
Presenting data in pie-charts
Converting data from pie-charts to graphs and tables
Rewriting an experimental method
Classifying and constructing variables
Identifying & interpreting trends/ patterns in data
Identifying anomalies in data
Creation of annotated drawings

Unit 2

Photosynthesis and Energy Relationships

Investigating conditions necessary for photosynthesis
Word equation for photosynthesis
External leaf adaptations for photosynthesis
Defining consumer, herbivore, carnivore, producer,
Creating food webs from food chains
Energy flow in food chains
Impact of human activities on food chains

TERM 2

Unit 1

Human Nutrition

Differentiating mechanical and chemical breakdown of food
Relating the structure of teeth to role in mechanical breakdown
Drawing and labelling the tooth
Caring for the teeth
Processes involved in human nutrition
Tests for protein, starch, fats and simple sugars in foods
Role of selected enzymes in digestion
Final products in digestion
Interpreting data on nutrition

Unit 2

Physical and Chemical Changes

Pure and impure matter
Comparing physical and chemical changes
Investigating physical and chemical changes
Comparing elements, mixtures and compounds
Common compounds found in the home
Investigating methods of separating mixtures
Predicting separating techniques based on properties

TERM 3

Unit 1

Respiration

Structure & function of the human respiratory system
Path oxygen travels from atmosphere to alveoli
Respiration as energy release
Requirements for aerobic respiration
Gaseous exchange across the alveoli
Word equation for aerobic respiration
Distinguishing between respiration and breathing
Investigating aerobic respiration products
Comparing photosynthesis and respiration

Unit 2

Space Science

Constructing models of space exploration devices
Connecting the terms universe, galaxy & star
Planetary systems associated with stars
Physical characteristics of selected components of the solar system
Using models/diagrams to represent lunar & solar eclipses
Influence of gravity on motion in space systems
Use concept of light year to solve problems

*Table continues on following page

TERM 1

Unit 3

More About Matter

Development of the Periodic Table

Common elements of the Periodic Table – symbols, appearance and properties

Evidence of particle movement – diffusion and osmosis

Definition of an element

Structure of an atom

Differentiating the sub-atomic particles

Calculating the number of sub-atomic particles

Arrangement of elements on the Periodic Table

Special groups of the Periodic Table

TERM 2

Unit 3

Forces and Motion

Distinguishing between vector and scalar quantities

Recognizing balanced and unbalanced forces

Effects of balanced and unbalanced forces

Investigating forces involved in floating and sinking

Use diagrams to show all forces acting on moving objects

Investigating effects of streamlined shapes on motion

Describing motion using position, direction and speed

Solve problems with displacement, distance, velocity, speed and acceleration

TERM 3

Unit 3

Water and the Earth's Atmosphere

Relating water properties to its uses

Investigating the properties of water

Chemical tests for water

Classifying water sources

Interpret data on water usage

Water conservation methods

Water purification methods

Designing water purification devices

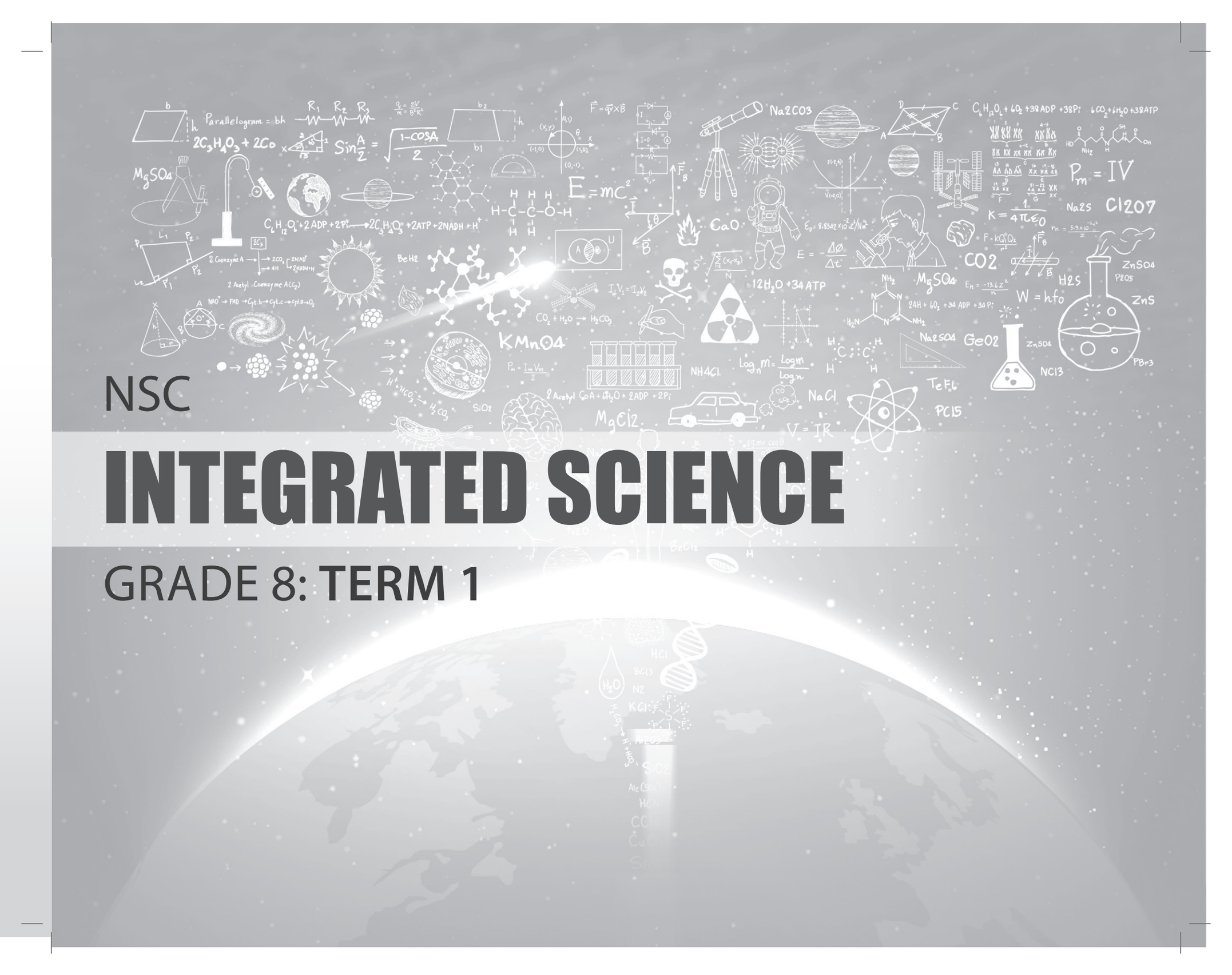
Composition of air

Investigating the composition of air

Properties and uses of gases in air

Chemical tests for oxygen and carbon dioxide

Modelling the carbon cycle



NSC

INTEGRATED SCIENCE

GRADE 8: TERM 1

About the Unit

In this Unit, students will through hands-on activities, learn how to represent experimental data in pie charts. They will identify and classify experimental variables. They will learn how to analyse and interpret data in order to arrive at meaningful conclusions. They will also learn how to annotate drawings.

Range of Content

- Data represent information collected from several sources and can be in numbers (quantitative) or in words (qualitative)
- Presenting data in different ways allows for better organization and understanding
- Tables are a good way to organize data while graphs and charts make the information more visual
- Pie charts are represented by circles, with the contribution of different items shown as part of the whole. Each part of the circle is calculated as a fraction of 360°
- A scientific experiment usually has three variables; independent, dependent and control
- The independent (manipulated) variable is the condition (factor) that is changed while the dependent (responding) variable is the condition that is measured or observed. The control (constant) variable is unchanged during an experiment
- Data analysis and interpretation identify trends (patterns) and anomalies and offer explanations for these
- Annotations provide additional information (concise and precise) on specific parts of a drawing

UNIT 1: Working like a scientist 2

Theme: Science Exploration, Application and Design Practice

Prior Learning

Check that students can:

- Construct tables, bar graphs and line graphs to required standards
- Make labelled drawings/diagrams to required standards

ATTAINMENT TARGET(S):

- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

BENCHMARK(S):

- Analyse and interpret experimental data to determine similarities and differences in findings
- Analyse several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate care and concern for living things and the environment.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: Data Presentation and Analysis

Duration: 7.5 hours/3 weeks

OBJECTIVES

Students will:

- Construct pie charts using findings from observations /data
- Classify variables as dependent, independent and control
- Analyse and interpret displayed data
- Annotate drawings
- Show honesty in sharing findings from investigations
- Demonstrate persistence in collecting and analysing data

ICT ATTAINMENT TARGETS:

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

RESEARCH, CRITICAL THINKING AND DECISION MAKING - Students use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DESIGNING AND PRODUCING - Students use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems and make informed decisions.

DIGITAL CITIZENSHIP - Students 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: As recap, use experimental data provided by the teacher to create a table, a line graph and a bar graph. As a class, review when it is most appropriate to use bar graphs/line graphs to represent data sets.	Communicate, think critically– analyse, apply	Table, bar graph and line graph reflects required standards.
In groups/as class, examine samples of pie charts provided by the teacher. List the common features observed in the samples. Share list with class. Observe as the teacher demonstrates how to construct a pie chart to illustrate data.	Collaborate, assess, observe, record, communicate	Common features reported
Create pie charts to represent data provided by the teacher. Convert the information/data from pie charts to bar graphs and tables.	Communicate Think critically - apply	Pie chart correctly constructed to required criteria Table and bar graph correctly Represent information in pie chart Bar graph reflects criteria provided
In groups, be given an experimental report to read, discuss and identify problems with the experimental method. Make suggestions on how the experiment could be improved. Share with the class problems identified and suggestions for improvements. As a class, with the aid of the teacher, identify the variables involved. In teacher led discussion, classify the variables as manipulating, responding and controlled. (*Teacher should introduce the terms independent and dependent variables as synonyms for the terms manipulating and responding variables respectively.*)	Communicate, collaborate, think critically– analyse, draw conclusions, justify, classify	Problems correctly identified Logical suggestions made on how to make improvements
In groups, view sample experimental procedures (*see points to note*) provided by the teacher. Identify and classify the variables in the procedures as manipulating, responding and controlled. Share classifications with class.	Communicate, collaborate, think critically– analyse, draw conclusions, justify, classify	Variables identified and correctly classified
In groups, be given data that is presented in a variety of ways (tables, bar graphs, line graphs, pie charts). Identify the trends/patterns/relationships where applicable and give simple explanations for these. Indicate any anomalies/irregularities in the data. Draw conclusions from these analyses. Report findings and conclusions to class.	Communicate, collaborate, think critically- analyse, draw conclusions, interpret	Trends and relationships identified and explained correctly Anomalies in data identified Conclusions supported by data and analysis
Individually, carry out analysis of data provided by the teacher.	Think critically - analyse, draw conclusions, interpret, report	Trends and relationships identified and explained correctly Anomalies in data identified Conclusions supported by data and Analysis

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
In groups/as class, examine samples of annotated drawings provided by the teacher. Discuss the usefulness of annotations on drawings.	Observe, collaborate, communicate	Drawing, labelling and annotations done according to required standards
Individually, make annotated drawings of familiar specimens provided by the teacher.	Draw, label, annotate	

Learning Outcomes

Students who demonstrate understanding can:

- Construct pie charts accurately
- Identify the different types of variables in an experiment
- Assess the meaning of experimental data

Points to Note

Students must be given as much opportunities as possible to practise the construction of pie charts, analyse data and annotate drawings.

Sample experimental reports.

Extended Learning

Use appropriate software to generate the various pie charts and graphs that were manually created throughout the unit. Then, evaluate the computer generated and manually created pie charts and graphs.

RESOURCES

Graph sheets, fictitious research report, sample experimental procedures, samples of annotated drawings , Computer, Internet, multimedia projector

KEY VOCABULARY

Pie chart, anomalies, annotation, variables, trend, pattern, relationship

LINKS TO OTHER SUBJECTS

Mathematics - statistics

About the Unit

In this Unit, students will learn that green plants are producers because they manufacture their own food during photosynthesis. Chloroplasts in leaf cells use the raw materials, carbon dioxide and water, in the presence of sunlight (light energy) and chlorophyll, to synthesize glucose/starch. Oxygen is released as a by-product of the process. Students will examine leaves to identify ways in which they are adapted for photosynthesis and investigate the presence of glucose and starch in leaves exposed to sunlight. They will learn that animals, as consumers, depend on green plants for their energy supply. They will explore ways in which energy is transferred from green plants directly or indirectly to animals, in food chains and webs. Students will construct food chains and webs using familiar organisms identified during their study of simple ecosystems and appreciate that humans can negatively affect terrestrial and aquatic ecosystems.

Range of Content

- During photosynthesis green plants use carbon dioxide and water, in the presence of sunlight and chlorophyll, to manufacture food.
- Photosynthesis takes place in chloroplasts and these are found in particular cells of the plant
- Leaves are specially adapted to carry out photosynthesis
- Energy is lost during transfer between trophic levels in food chains
- Human activities can have negative effects on food chains and webs.

Guidance for the Teacher

Only a simple explanation of the process of photosynthesis is required:

Carbon dioxide from the air enters the leaves through the stomata; water from the soil enters the roots through the root hairs and travels up the stem to the leaves; carbon dioxide and water are used to produce glucose within the chloroplasts; oxygen is released and diffuses out of the leaves via the stomata; glucose is converted to starch and stored.

All aspects of drawing must be done in pencil: clear, clean continuous lines of even thickness; labels to the right of the drawing, written in script and lower case; label lines drawn with ruler and do not overlap; title underlined, below drawing and in uppercase; correct magnification [calculated and written e.g. (Mag. X 100)].

UNIT 2: Photosynthesis and Energy Chains

Theme: Living Things, Life Processes and the Environment

ATTAINMENT TARGET(S):

- Understand the importance of the life processes in plants and animals, their interdependence, their interaction with the environment, and how lifestyles determine health and well-being.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

BENCHMARK(S):

- Understand how plants make their food, and how this forms the basis of energy chains and webs.
- Analyse and interpret experimental data to determine similarities and differences in findings.
- Analyse several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate care and concern for living things and the environment
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate concern for man's impact on the environment.
- Demonstrate sensitivity to others who are different.

Topic: Photosynthesis **Duration:** 12.5 hours/5 weeks

Prior Learning

Check that students can:

- Describe the basic structure of plants, e.g. leaf, root, stem, flower
- Recall that organisms depend on each other for survival.
- Know that green plants take in water through their roots and that the leaf plays a part in photosynthesis

OBJECTIVES

Students will:

- Recall that plants are producers and are the source of energy for animals
- Investigate the raw materials and conditions necessary for photosynthesis, controlling relevant variables
- Construct the word equation for photosynthesis
- Examine the external adaptations of the leaf for photosynthesis
- Formulate definitions of the terms producer, consumer, carnivore, herbivore, omnivore, food chain and habitat
- Construct terrestrial and aquatic food chains using familiar organisms
- Create food webs using the constructed food chains
- Explain energy flow in a food chain
- Assess the impact of human activities on food chains and webs

ICT ATTAINMENT TARGETS:

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

RESEARCH, CRITICAL THINKING AND DECISION MAKING - Students use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DESIGNING AND PRODUCING - Students use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems and make informed decisions.

DIGITAL CITIZENSHIP - Students 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, investigate the adaptations of the leaf to carry out photosynthesis. Examine the leaves as they are found attached to the plant. Make a list of the external adaptations and present to the class in a variety of ways.	Collaborate, communicate, think critically – analyse, infer, collaborate, investigate,	Acceptable list of external adaptations given
In groups, investigate: 1. the presence of starch in a green leaf which was previously exposed to sunlight. 2. that: i. carbon dioxide, ii. chlorophyll and iii. sunlight are necessary for photosynthesis. Place the freshly picked/treated leaf into the boiling water (provided by the teacher) for about three minutes. Transfer the leaf to a test/boiling tube containing ethanol or alcohol and then place the test/boiling tube in the hot water in the beaker for about five minutes to remove most of its green colour. (Turn off the flame before placing the test tube with the alcohol in the hot water.) Remove the leaf from the ethanol and dip it into the warm 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. **ICT Integration** View and manipulate interactive video tutorial on testing for starch in leaves.	Collaborate, communicate, manipulate, think critically - infer, draw conclusions, investigate,	Procedures carried out accurately and safely Experimental report done in acceptable format Suitable observations recorded and correctly explained Acceptable conclusions drawn and limitations noted
Predict what will happen if a variegated leaf which was exposed to sunlight was tested for starch. Make an annotated drawing of a freshly picked variegated leaf. Map the areas that are green and non-green. Indicate on the drawing the areas that should have and not have starch. Explain why chlorophyll is needed for photosynthesis. **ICT Integration** View and manipulate interactive video tutorial on the function of chlorophyll in photosynthesis.	Annotate, draw, communicate, think critically – analyse, predict	Plausible predictions made Drawing satisfies criteria Accurate annotations made Drawing of leaf shows correct outline of the distribution of chlorophyll Presence/absence of starch correctly matched to green/non-green parts of leaf Accurate conclusions given on requirements for photosynthesis

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
In groups, investigate the release of oxygen from actively photo-synthesising pondweed (Elodea). Measure the total volume of gas produced or count the number of bubbles released per minute. Discuss how they could identify the gas produced and share their suggestions with the class. (Teacher should help students to refine their suggestions and predict how the release of oxygen from pondweed varies with light intensity) **ICT Integration** View and manipulate interactive video tutorial on the production of oxygen during photosynthesis.	Collaborate, communicate, measure, communicate, think critically – analyse, predict, investigate	Accurate measurement of the volume of gas released Acceptable suggestions given for identification of the gas
View online/offline video/chart (or listen to a song/story or podcast) on photosynthesis. In groups, use information from the video/chart and the results of previous investigation to formulate a definition of the term photosynthesis. Identify the raw materials, conditions and products of the process. Present definitions to class and match with teacher prepared notecards.	Define operationally, collaborate, communicate, think critically – formulate,	Acceptable explanation of photosynthesis Raw materials, conditions and products correctly identified
In groups, use the information to construct a word equation for photosynthesis.	Think critically - formulate, collaborate,	Accurate word equation for photosynthesis
In groups, walk around the school yard or visit a garden, pond, or a tree and observe and record, in a suitable table, the organisms seen on their tour, where they are seen and what they are feeding on. (If the organisms are not feeding at the time of the trip or visit they must still be noted for later research; cameras/mobile phones can be used to capture images of organisms).	Observe, communicate, collaborate	Observations appropriately recorded in a table
Participate in a teacher-led discussion on food chains and define the terms food chain, food web, producer, consumer, carnivore, herbivore, omnivore, and habitat. Classify the organisms identified from the nature walk as producers, primary, secondary or tertiary consumers.	Collaborate, communicate, operationally define, think critically – analyse, classify	Acceptable definition of terms and classification of organisms
Construct food chains using the organisms identified. [Food chain should have at least three (3) organisms.] Create food webs using the food chains constructed. **ICT Integration** Use image capturing devices to capture the organisms in their habitats.	Create, think critically – analyse, formulate Capture and store digital images	Food chains and webs constructed accurately

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Brainstorm and suggest whether all the energy from one organism is transferred to the organism that consumes it and justify their suggestions. Share their suggestions with the class in a teacher led discussion.	Communicate, think critically – analyse, draw conclusions, justify,	Logical arguments given to justify suggestions
Use the food chains created from the field activity and a scenario depicting a human activity that disrupts the habitat (e.g. pollution, removal of species etc.) to predict the effects that the outlined human activity will have on the food chain. Give reasons to support their predictions. Share and discuss their predictions and justifications with the class.	Collaborate, communicate, Think critically - predict, analyse, justify	Logical justifications given for predictions
View video/PowerPoint presentation/posters summarizing the topic of food chains and webs. Complete worksheet on food chains and food webs.	Report, think critically – gather information, apply	Worksheet correctly completed

Learning Outcomes

Students who demonstrate understanding can:

- Explain the process of photosynthesis
- Write a word equation for photosynthesis
- Explain how the leaf is adapted for photosynthesis
- Explain the terms producer, consumer, omnivore, carnivore, herbivore, food chain, food web and habitat
- Describe energy transfer in terrestrial and aquatic food chains
- Describe how human activities affect food chains
- Understand, use and spell correctly specialised scientific terms
- Use image capturing devices to capture, format and store digital images
- Use word processing, multimedia and/or digital story tools to create and present digital content

Points to Note	Extended Learning
Simple explanation of the process of photosynthesis limited to word equation.	Explore the use of greenhouses to improve crop productivity.

RESOURCES

Videos/posters on food chains, computer, projector, camera, scissors, markers, masking tape, hand-outs, beaker, test tube, Bunsen burner, forceps, white tile, iodine solution dropper, alcohol/ethanol, variegated leaf, tripod stand, gauze, blank cards, food chain/web worksheet

KEY VOCABULARY

photosynthesis, producer, consumer, food chain, food web, chlorophyll, chloroplast, carbon dioxide, oxygen, glucose, terrestrial, aquatic, lamina, mid rib, petiole, vein, starch, primary consumer, secondary consumer, tertiary consumer, herbivore, carnivore, omnivore, habitat

LINKS TO OTHER SUBJECTS

Social Studies, Geography, Agriculture

About the Unit

In this Unit, students will use the Periodic Table as the means of classifying elements into metals and non-metals. Students will apply the Kinetic Theory of Matter to explain the movement of particles. In addition, students will perform experiments and account for their observations using the kinetic theory of matter. Students will learn additional information (building on grade 7) about atoms as the building blocks of elements. Students are introduced to the term subatomic particles and also the location, mass and charge of each subatomic particle.

Range of Content

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

- The atom is the smallest part of matter that can exist on its own.
- Evidence that matter is made up of tiny moving particles can be proven by using diffusion and osmosis experiments.
- During diffusion, particles move from an area of high concentration to an area of low concentration.
- Elements are made up of only one kind of atom.
- The atom consists of protons and neutrons (found in the nucleus) and electrons that orbit the nucleus.
- Protons, neutrons and electrons in terms of relative charge and mass.
- Atomic number refers to the number of protons in an atom. The elements in the Periodic Table are arranged in order of increasing atomic number.
- All known elements (whether solids, liquids or gases) can be found on the Periodic Table. They are usually represented by symbols.
- Alkali metals, alkaline earth metals, halogens and noble gases are special groups of elements found on the Periodic Table.
- The arrangement of elements on the Periodic Table (into groups and periods) was based on the works of scientists such as John Newlands and Dmitri Mendeleev.

Guidance for the Teacher

Chemical symbols are always written with capital letters if they are represented by a single letter and capital letter for the first and common letter for the second if represented by two letters.
It is sufficient to tell students that elements are grouped based on the number of outer shell electrons.

- **For diffusion activity:**
  1. Soak separate pieces of cotton wool in concentrated ammonia and hydrochloric acid and place each at opposite ends of a cylindrical glass tube and cork both ends)
  2. Place glass tube in clamp stand for students to observe
- If plasma comes up in discussion on states of matter indicate to students that it is outside the scope of the lesson.

UNIT 3: More About Matter

Theme: Energy, Forces and Matter

Prior Learning

Check that students can:

- Recall that matter exists as particles and exist in the states solid, liquid and gas. (plasma not considered)

ATTAINMENT TARGET(S):

- Understand the existence of materials such as solids, liquids and gases, the particulate nature of matter, and simple chemical reactions that change one material into another.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

OBJECTIVES

Students will:

- Describe briefly, the development of the Periodic Table
- Show that the Periodic Table is a collection of elements
- Collect and display common everyday elements on the Periodic Table
- Match elements to their respective symbols
- Classify elements as metals or non-metals
- Distinguish between some selected properties of metals and non-metals
- Summarize uses of selected metals and non-metals
- Categorize the groups and periods in the Periodic Table
- Investigate the building blocks of elements (matter).
- Cite evidence for the kinetic theory of matter
- Use appropriate scientific language
- Differentiate between the sub-atomic particles in terms of their position in atom, relative mass and charge.
- Create models to represent different atoms.
- Deduce the basis for arrangement of elements on the Periodic Table.
- Construct a board game using the first 20 elements on the Periodic table based on their symbols and atomic number.
- Identify by name, some special groups in the periodic table
- Find novels ways to state conclusions from observations
- Complete their own activity even if others have already finished theirs

BENCHMARK(S):

- Understand physical and chemical changes and know that chemical changes take place through the re-arrangement of atoms.
- Know that chemical symbols are used to represent elements on the periodic table, and how selected elements are grouped in the periodic table.
- Know the structure of an atom.
- Know how substances can be classified by their chemical nature and how this relates to the way they react.
- Analyse and interpret experimental data to determine similarities and differences in findings.
- Analyse several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: Elements and the Periodic Table

Duration: 15 hours/6 weeks

ICT ATTAINMENT TARGETS:

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

RESEARCH, CRITICAL THINKING AND DECISION MAKING - Students use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.ute to the learning of others.

DESIGNING AND PRODUCING - Students use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems and make informed decisions.

DIGITAL CITIZENSHIP - Students 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 internet/read literature on the contribution of specified scientists to the development of the periodic table. Create a montage/digital story to represent information. Display montage and present a 5 minutes playlet (dramatization, song etc) to the class.	Communicate, observe, classify, collaborate, create, think critically - synthesize	Montage correctly represents information Presentation creative and support information on montage
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 and identify existing patterns. (*Teacher will lead students to where solids/ gases or metals/non-metals are located*). Describe the appearance and properties of each element and compare them. Tabulate descriptions and share with class.	Communicate, collaborate, make observations, think critically – analyse, interpret,	Correct observations noted Elements correctly classified
Select an element of choice and research its uses and occurrence in nature. Write a poem or jingle on its everyday uses and create a poster displaying the information (*the poster should have a picture/drawing of the element*). **OR** Research the occurrence of elements in the body, historical use of some elements (e.g. iron) and elements dangerous to health. Present findings.	Research, communicate, create	Model and Poster Poster contains correct information on the element chosen. Poster is clean and neat, information well organized, colourful and creative.
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 (*students may respond that P is for potassium or that Na is not a symbol for any of the elements given*).	Communicate, collaborate	Symbols and names correctly matched
View Periodic Table with the names and symbols and revise their choices where necessary. In groups, list the first 20 elements and their associated symbols. (*Teacher should use Periodic Table with the elements in order of atomic number.*)	Communicate, collaborate	Correctly write the symbols for selected elements in periodic table

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
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, think critically, communicate	Atoms identified as building blocks for elements Particles identified as building blocks for matter
View video/read literature on the basic unit of matter and participate in group discussion on video content. (*Teacher should guide students to infer that the tiny particles that make up matter are called atoms, and an element contain atoms that are the same.*) Formulate a definition for elements and share definition with class.	Research, communicate, operationally define, collaborate	Correct definition of the term element
Examine structures/ materials 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	Argument supported by evidence
Investigate the evidence and movement of particles by the following: **Diffusion through a liquid** 1. Place a food colouring or a few crystals of potassium permanganate (VII) in a beaker with water 2. Observe for a few minutes and record 3. Provide explanations for observations **Diffusion of gases** 1. Place a cotton wool soaked with concentrated ammonia and another soaked in concentrated hydrochloric acid on opposite ends of a glass tube 2. Watch for the appearance of a white ring inside the tube 3. Observe and record 4. Note the exact position of the white ring 5. Provide explanations for observations *(Teacher should extend discussion to talk about the rate of diffusion of gases based on the position of the white ring).*	Make observations, communicate, manipulate, think critically – draw conclusions, investigate,	Correct observations noted Movement of particles from high to low concentration stated Lighter gas identified Correct observations noted Logical explanations given
Osmosis Experiment In groups, 1. Half-fill two beakers. One with water and the other with concentrated sugar solution. Measure mass of potato strips 2. Place one strip of potato in each solution and leave for at least 30 minutes	Manipulate, observe, measure, communicate, collaborate, think critically – analyse, predict and hypothesize, Investigate	Correct measurements made The direction of particle movement correctly traced

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
3. Make predictions and develop a hypothesis as to which strips would have the heavier mass 4. Measure the mass of the two potato strips 5. Observe and record 6. Share results with the class *(Emphasis should only be placed on the results in terms of particle movement and not on the concept of Osmosis)*		Hypothesis explains why the particle movement occurred Predictions correct
View animation on Kinetic Theory and the kinetic energy for the different states of matter. Summarize the Kinetic Theory of Matter on flashcards and submit for grading.	Record, think critically – analyse, summarize	Flash cards are creative with correct information States correctly differentiated
In groups, view video/ read literature/research internet and visit web quest on the structure of the atom and complete a teacher prepared question sheet. Discuss their answers with class. Create a table or chart, possibly using word processing/spreadsheet software, to summarize the properties of the subatomic particles.	Communicate, collaborate, Create Conduct electronic searches Create word processing/ spreadsheet table and chart Navigate and manipulate digital content	Table or chart correctly labelled/titled. Information contained in table or chart is correct
View a diagram of an atom (nucleus and shells only) and correctly position the sub-atomic particles. (*Guide students to appreciate that the electrons are not static but are constantly moving in energy levels/ shells*).	Observe, think critically - analyse	Sub-atomic particles correctly positioned
In groups, use modelling clay/play dough and wire to construct models of unknown atoms given the number of the sub-atomic particles and make presentation to class. Develop checklist criteria for peer evaluations. Participate in discussion on models presented by other groups, possibly using online discussion forums and class wiki. (*Students should keep models for future lesson.*)	Manipulate, make observations, create, collaborate, manipulate, communicate, think critically - synthesize Communicate information using discussion forums and social networks Manipulate digital content	Position of sub-atomic particles correctly located Model correctly done Number of sub-atomic particles correctly presented

Suggested Teaching and Learning Activities

View a copy of the periodic table of elements and participate in teacher facilitated discussion on how the elements are arranged (based on atomic number). Locate the atomic number of each element and account for any pattern seen (*Teacher should guide students to the recognition that the differences in elements are due to the number of protons that make them up.*)	Observe, communicate, think critically – analyse, draw conclusions, interpret	Correct observations noted Pattern of arrangement of elements deduced
Plan and design a game of BINGO using the first 20 elements of the Periodic Table. (To sensitize students to the concept of groups and periods). Choose appropriate materials to construct a prototype. Develop checklist criteria for peer evaluations. Present ideas to the class with supporting arguments to justify their designs. Modify design where necessary then construct prototype. Display models.	Plan and design, Create, communicate, think critically – analyse, formulate, justify, collaborate	Prototype contains groups, periods and elements correctly represented
Conduct research to identify special named groups (metals, non-metals, alkali metals, alkaline earth metal, halogens and noble gases) on the Periodic Table. Colour code and key these groups.	Research, communicate, classify, think critically – analyse	Accurately group elements into metals and non-metals Special groups correctly identified

Learning Outcomes

Students who demonstrate understanding can:

- Know that symbols are used to represent elements in the periodic table
- Recognize some familiar elements by their symbols.
- Classify elements as metals and non-metals
- Formulate a definition for diffusion
- Describe experiments which prove evidence of the kinetic theory of matter
- Describe the sub-atomic particles in terms of charge, mass and location
- Place elements in the Periodic Table according to periods and groups based on atomic number
- Apply the concept of atomic structure to identify special groups on the Periodic Table
- Create and format word processing and spreadsheet documents and tables
- Collaborate and communicate information using 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 – State only that elements are grouped based on outer shell electrons. Chemical properties should not be discussed.

Caution to be exercised when handling concentrated solutions. If possible make use of a fume cupboard when placing soaked cotton wool into the cylindrical tube.

Carefully add the potassium manganate (VII) crystals to the bottom of beaker using a tweezer.

Use the experiment on Osmosis to illustrate the movement of particles only, as the concept of Osmosis is not being taught.

Teacher created/supervised discussion forums and social network

Plan and conduct research, using a wide variety of electronic sources e.g. online periodicals, CDs/DVDs

Demonstrate safe, respectful, responsible and clear online communication

Extended Learning

Research how elements got their names and symbols.

Conduct further research on the relationship between the placement of elements in the Periodic Table and the number of electrons in their outer shell.

RESOURCES

Periodic table, worksheet on atoms, material for montage

Potassium permanganate, concentrated hydrochloric acid and ammonia, cylindrical tube, beaker, water, potato, ruler, sugar, ice, wax, Bunsen burner

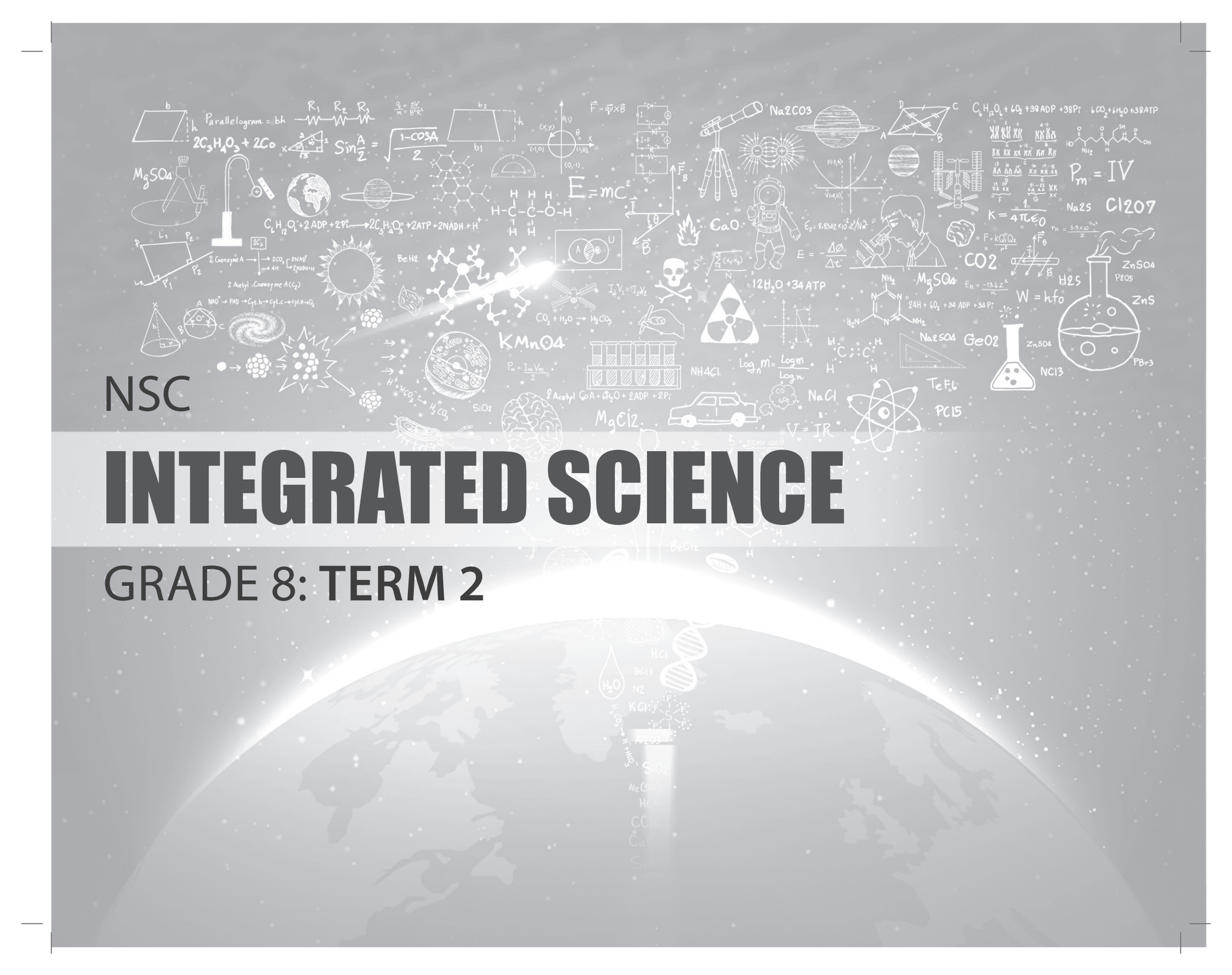
Computers, Internet, speaker, multimedia projector, interactive video tutorials, CDs/DVDs, concept mapping software, class Wiki and social network sites, Digital story tools

KEY VOCABULARY

Periodic table, atomic/proton number, nucleus, shells, energy levels, proton, neutron, electron, periods, groups, symbol, element, atom, metal, non-metal
Kinetic theory, diffusion, concentration

LINKS TO OTHER SUBJECTS

Grade 7 (Matter), Physics (Kinetic Energy), Biology



NSC

INTEGRATED SCIENCE

GRADE 8: TERM 2

About the Unit

In this Unit, students will learn how food is broken down mechanically by teeth and chemically by enzymes during digestion to form products that can be used by the cells of the body. They will investigate the structure of the teeth and relate this to their functions. They will also learn about selected digestive enzymes and where they are produced. Students will use models to explore the process of digestion and perform chemical tests to identify more food nutrients.

Range of Content

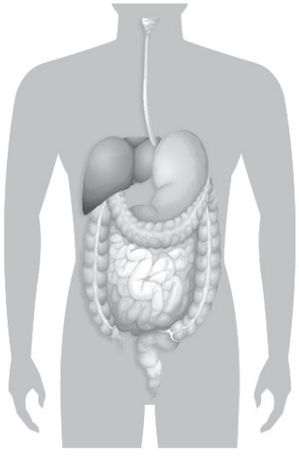
- Chewing or mastication of food by the teeth mechanically breaks down large particles into smaller ones to prepare them for digestion
- Teeth are specially adapted to cut, tear or grind/crush food.
- Some foods (protein, fat and some carbohydrates) have molecules that are too large to be absorbed by the cells/body
- Other foods (vitamins minerals water and some sugars) can be absorbed without digestion
- Large food molecules are broken down by enzymes in the alimentary canal to smaller molecules which are absorbed by the walls of the small intestine
- Digestion is the breakdown of food into simpler substances for absorption into the blood stream.
- Some food cannot be digested and is passed out of the body as faeces during defaecation/egestion.
- Our body uses digested food products for energy, growth and repair.

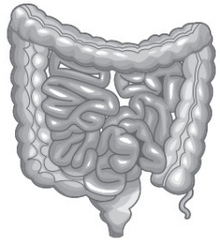
Guidance for the Teacher

Students should be guided in the correct use of terminologies especially for terms such as ingestion, egestion, absorption and digestion. This unit also provides an opportunity to show how nutritional choices become lifestyle practices, affecting health and well-being.

UNIT 1: Human Nutrition

Theme: Living Things, Life Processes and the Environment




Prior Learning

Check that students can:

- Identify the different nutrients in food
- Relate the main organs of the digestive system to their functions
- Recall that the digestive system is responsible for breakdown/ digestion of food for subsequent use by body cells

ATTAINMENT TARGET(S):

- Understand the importance of the life processes in plants and animals, their interdependence, their interaction with the environment, and how lifestyles determine health and well-being.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of express ing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

OBJECTIVES

Students will:

- Differentiate between mechanical and chemical breakdown of food
- Relate the structural adaptations of human teeth to their role in the mechanical breakdown of food (mastication)
- Draw and label a longitudinal section of a canine tooth
- Evaluate different ways of taking care of the teeth
- Describe the processes involved in human nutrition as ingestion, digestion, absorption, assimilation, and egestion
- Investigate the presence of protein, fat, starch and simple sugars in foods
- Explain the need for proteins, fats and some carbohydrates to be broken down during digestion
- Recognise the importance and the site of secretion of digestive juices in the alimentary canal
- Explain the role of selected enzymes (protease, lipase and amylase) in digestion
- Identify the final products of digestion of protein, fat and starch
- Present and interpret data in acceptable way
- Draw conclusions from observations and explain these using scientific knowledge
- Check for health and safety before and during practical work

BENCHMARK(S):

- Understand the intake, digestion and absorption of food in animals, and how energy is released through respiration.
- Understand the importance of nutrients, their functions and food tests.
- Analyse and interpret experimental data to determine similarities and differences in findings.
- Analyse several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate care and concern for living things and the environment.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: Human Nutrition

Duration: 7.5 Hours/3 weeks

ICT ATTAINMENT TARGETS:

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

RESEARCH, CRITICAL THINKING AND DECISION MAKING - Students use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.ute to the learning of others.

DESIGNING AND PRODUCING - Students use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems and make informed decisions.

DIGITAL CITIZENSHIP - Students 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, observe a chart of the digestive system with the names of the structures represented by numbers. Take turns to select a number from a bag which contains the numbers on the chart. Identify the structure that the number represents. Sequence the numbers to show the route food travels in the alimentary canal. Construct a table showing the identified parts of the digestive system and their function(s).	Communicate, summarize, collaborate, sequence	Number sequence accurately represents path food travels in the alimentary canal Correct structures and related functions in completed table Table constructed to acceptable standard
Watch a video/ teacher prepared power point presentation about the stages involved in the process of nutrition (ingestion, digestion, absorption, assimilation, and egestion). Write a simple summary of each stage and present to the class.	Think critically - formulate, summarise, define operationally	Acceptable summary of each stage
Eat a cracker. Note what happens. Explain to the class the process of mechanical breakdown of food in the mouth and its importance in digestion.	Communicate, observe, think critically - draw conclusions	Explanation is related to observation
Use a mirror to examine the teeth, describe each type and explain how they are adapted to perform their function. Make an annotated drawing of the longitudinal section of the canine.	Observe, draw, annotate, think critically – analyse, infer	Drawing done to acceptable standard Structures accurately labelled and correct adaptation to function given
Visit / invite/interview a dentist/dental technician to obtain information on dental care and oral hygiene. In groups use the information, to role-play different ways of caring for the teeth. Critique each other's presentation.	Communicate, role play, think critically - analyse, critique	Presentation is creative and contains accurate information
Complete a KWL chart based on the topic: digestive juices / enzymes. Write what they know and want to know about enzymes and share their ideas with the class or use class email and blogs to share or make comments on peer ideas/information on digestive juices/ enzymes. Read teacher created hand-out/web-post on enzymes, then complete the section on what they have learnt and share information with the class. Answer questions on teacher designed worksheet.	Communicate, collaborate, think critically - analyse	Correct responses to questions on worksheet
Perform tests to identify the presence of protein (Biuret), starch (Iodine), simple sugar (Benedict's) and fat (grease spot/ethanol) in common food substances. Make observations. Record results in a table and make inferences.	Manipulate, observe, tabulate, think critically - infer	Accurate inferences drawn from observations Table constructed to acceptable standard Procedures for conducting tests followed

Learning Outcomes

Students who demonstrate understanding can:

- Identify the main parts of the human digestive system and describe their functions.
- Differentiate between chemical and mechanical digestion
- Explain the role of selected enzymes in the process of digestion
- Identify the final products of digestion of protein as amino acids, starch as glucose (simple sugars) and fat as fatty acids and glycerol.
- Describe the stages involved in human nutrition
- Identify the types of teeth in an adult and explain how they are adapted for their function
- Describe different ways of caring for their teeth
- Use word processing software and other technology tools to create original work, to share information on digestion processes/concepts
- Conduct electronic search for different kinds of information

Points to Note

Distinguish between the digestive system (all the organs involved in digestion - mouth, oesophagus, stomach, small intestine, large intestine, pancreas and liver) and the alimentary canal (the long tube extending from mouth to anus)

Differentiate between egestion (removal of undigested food/ faeces from the alimentary canal) and excretion (removal of metabolic waste from the body)

Protein digesting enzymes are treated under the broad cover – protease. Proteases break down proteins to amino acids. The named examples of pepsin, trypsin etc. do not breakdown proteins directly to amino acids, this requires peptidases in the small intestine.

Extended Learning

Visit / invite a dentist or dental technician to speak and gather Information and resources about different types of dental prosthetics such as dentures, partials, crowns, bridges and implants

Research on selected diseases associated with the digestive system

Research insectivorous plants and describe how they digest captured insects

RESOURCES

Video/web-post/ chart on the Digestive system/digestion, worksheet/hand-out on enzymes, Benedict's Solution, Iodine, Biuret reagent (NaOH/KOH) and CuSO4), Ethanol, food materials for testing, crackers

KEY VOCABULARY

Protein, fat, starch, ingestion, digestion, absorption, assimilation, egestion enzymes, digestive system , alimentary canal, digestive juice, incisors, canines, premolars and molars, mastication

LINKS TO OTHER SUBJECTS

Home Economics, HFLE

About the Unit

In this Unit, students will group matter as pure and impure. Concepts of physical and chemical changes will be explored through experimentation and used to explain the formation of compounds and mixtures. 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

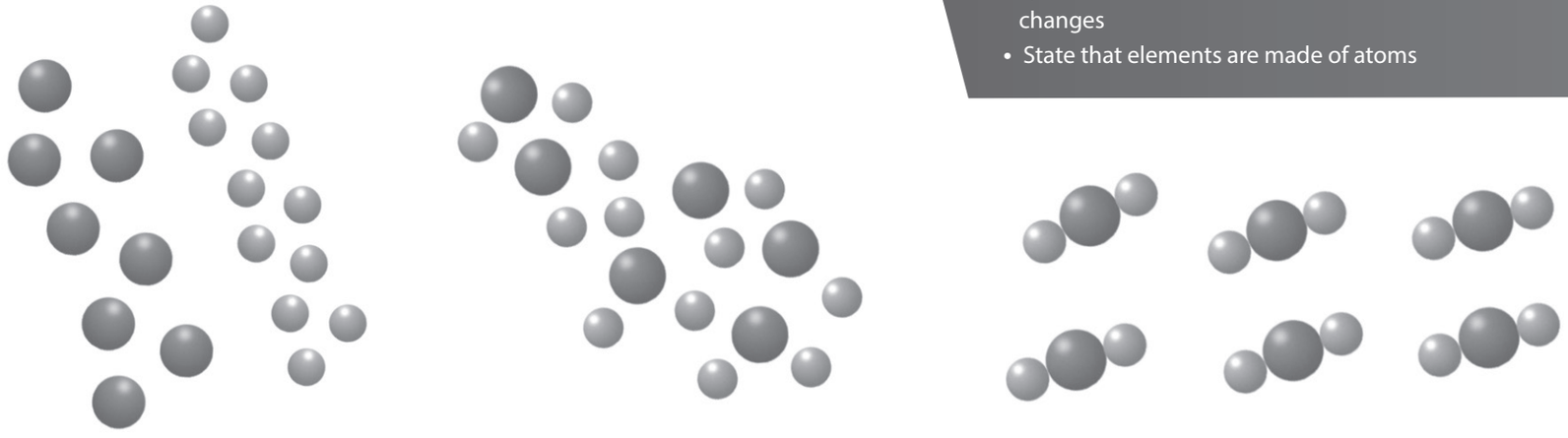
- Matter can be grouped into pure and impure substances.
- Pure matter contains only one kind of substance (eg. element and compound) while impure matter contains different kinds of substances (eg. mixtures).
- Compounds are formed when two or more atoms combine in a chemical reaction.
- Chemical change 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 when two or more elements and/ or compounds join physically.
- Mixtures are separated by physical means such as evaporation, sieving, filtering, sublimation, distillation and chromatography.
- The individual properties of components in a mixture are unchanged whereas the properties of a new substance formed in a chemical change differ from the individual components.
- Differences in properties such as solubility, particle size and boiling temperatures are the principles used to separate mixtures..

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.

UNIT 2: Physical and Chemical Changes

Theme: Living Things, Life Processes and the Environment



Prior Learning

Check that students can:

- Show that matter is made up of particles
- Explain the difference between reversible and irreversible changes
- State that elements are made of atoms

ATTAINMENT TARGET(S):

- Understand the existence of materials such as solids, liquids and gases, the particulate nature of matter, and simple chemical reactions that change one material into another.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

OBJECTIVES

Students will:

- Classify substances as pure and impure
- Explain the differences between physical and chemical changes in terms of composition, reversibility and properties
- Perform investigations to distinguish physical and chemical changes
- Infer that chemical changes lead to formation of compounds and physical changes lead to formation of mixtures
- Collect and display information on physical and chemical changes
- Set up simple comparative and fair tests on the separation methods
- Develop a logical argument for classifying substances
- Differentiate between elements, mixtures and compounds
- Investigate methods that can separate mixtures
- Predict how a given mixture can be separated based on solubility, particle size and structure
- Use appropriate scientific language
- Value individual effort and team work by completing investigations
- Identify industrial applications of separation techniques
- Evaluate the environmental impact of industrial separation methods

BENCHMARK(S):

- Understand physical and chemical changes and know that chemical changes take place through the re-arrangement of atoms..
- Know that chemical symbols are used to represent elements on the periodic table, and how selected elements are grouped in the periodic table.
- Know the structure of an atom.
- Know how substances can be classified by their chemical nature and how this relates to the way they react.
- Analyse and interpret experimental data to determine similarities and differences in findings.
- Analyse several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: Physical and Chemical Changes

Duration: 7.5 Hours/3 weeks

ICT ATTAINMENT TARGETS:

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

RESEARCH, CRITICAL THINKING AND DECISION MAKING - Students use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.ute to the learning of others.

DESIGNING AND PRODUCING - Students use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems and make informed decisions.

DIGITAL CITIZENSHIP - Students 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, recap that elements are made of the same atoms making them pure substances. Given samples of substances, identify the pure substances (elements) from the collection. Sort the remaining substances as impure substances. Formulate a definition for pure and impure substances based on the properties of the substances.	Observe, think critically– analyse, classify, define operationally, collaborate	Substances correctly classified as pure and impure. Elements correctly identified as pure substances.
In groups, view video/read literature online/offline /visit web quest outlining the differences between physical and chemical changes and formulate a definition for physical and chemical change. In groups, compose a jingle, possibly using audio recording software, to distinguish physical changes and chemical changes and record it on a CD-ROM.	Research, define operationally, collaborate, think critically, create, communicate	Correctly define physical and chemical change Differences between both changes correctly outlined. Jingle contains correct information, is easily remembered and shows clear understanding of the topic
In groups, perform the following investigations to determine which ones are chemical or physical changes. Tabulate observations and compare physical and chemical change based on composition, properties, reversibility, change in mass of substance. Draw conclusions as to which ones are physical and which are chemical. Give a reason in each case. **Investigation # 1 (Physical Change)** 1. Add one spatula of salt into a beaker. 2. Add 5ml of water into the beaker and stir. 3. Wait 15 seconds. Do not taste! 4. Record your observations. 5. Heat solution to dryness and record observations 6. Draw conclusions	Collaborate, think critically – analyse, classify, draw conclusions, observe, communicate, investigate Measure, manipulate, communicate, collaborate, think critically – analyse, draw conclusions, observe	Correctly identifies which changes are physical and which changes are chemical. Accurate explanation given for each change identified. Giving explanation for each choice. Accurate observations made Logical conclusions arrived at
Investigation # 2 (Chemical Change) 1. Add one spatula of baking soda into a beaker. 2. Add 5ml of vinegar into the beaker. 3. Wait 15 seconds. ***Do not taste!*** 4. Record your observations. 5. Draw conclusions	Measure, manipulate, communicate, collaborate, think critically – analyse, draw conclusions, observe	Accurate observations made Correct conclusions arrived at

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Investigation # 3 (Physical Change) Add 2 antacid tablets to a cup of water, followed by 3 or 4 raisins. Record your observation. Or Add 3 or 4 raisins to a cup of cream soda/ sprite. Record your observations. Draw conclusions	Measure, manipulate, communicate, collaborate, observe, think critically- investigate, draw conclusions	Accurate observations made Correct conclusions arrived at
Investigation # 4 ((Physical) Place four ice cubes in a dish and leave for five minutes. Record observations. Draw conclusions.	Measure, manipulate, communicate, collaborate, observe, think critically – draw conclusions	Accurate observations made Logical conclusions arrived at
Investigation # 5 (Chemical) Place four ice cubes in a dish and leave for five minutes. Record observations. Draw conclusions	Measure, manipulate, communicate, collaborate, observe , think critically – draw conclusions	Accurate observations made Logical conclusions arrived at
Investigation # 6 1. Place large crystals of ammonium dichromate on a sand tray and then on a tripod. 2. Heat with a Bunsen flame until crystals begin to change. 3. Record observations. 4. Draw conclusions 5. Draw conclusions	Measure, manipulate, communicate, collaborate, observe , think critically - analyse, draw conclusions	Accurate observations made Logical conclusions arrived at
Other investigations include heating wax or iodine, mixing vinegar and chalk, burning wood or paper and rusting of iron.		
Use digital drawing tools to create flow chart to show the various chemical and physical changes that occur when flour is sifted, made into dumplings and cooked.	Communicate, think critically – analyse, draw conclusions, justify	Flowchart correctly shows changes in the correct sequence. Depiction of changes justified

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
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*). 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, think critically – analyse, draw conclusions, interpret, communicate, collaborate, define operationally	Accurate information reported on the process observed. Correct definition of compound given.
View video/research on compounds and develop a graphic organizer showing information on: • how a compound is formed (definition) • examples of compounds • uses of selected compounds Present graphic organiser to class.	Research, communicate, create	Graphic organizer has an appropriate title and contains accurate information.
Research a list of common compounds and prepare a table with the following headings: common names, chemical names, chemical elements	Research, communicate, think critically - classify	Table contains correct information under appropriate headings.
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, create, communicate, think critically - classify	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, investigate, communicate, report, think critically - analyse, compare and contrast, draw conclusions, define operationally	Report contains accurate information on observations Correct definition for mixtures given Two correct differences between mixtures and compounds given

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Given picture/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.	Think critically - classify, justify, communicate, construct	Substances correctly classified as elements, mixtures and compounds Justifiable reasons given for grouping
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, students will 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	Properly labelled diagrams of separation techniques Techniques correctly predicted
Visit or view online/ offline, industries that use the different separation techniques in their operations e.g. sugar factories, oil refinery, flour mills, beverage companies etc. Identify and justify the specific methods used at different stages in the production process. Report findings (including pictures or drawings) in a variety of ways.	Observe, communicate, gather data, think critically – analyse, organize data, draw conclusions, justify	Report has accurate information and is presented creatively Observed separation methods are properly identified Correct justifications made
In groups, investigate how industries that apply the separation techniques impact society and the environment. Discuss the benefits gained by using the products and how these products (and the waste produced) affect the environment. Answer questions such as, "How are the products used?", "What happens to the waste that is separated?", "How is it disposed of?", "How does it affect the environment?", "What is the effect of the location?" Make class presentations on the results of their investigations including recommendations to protect the environment.	Collaborate, communicate, research, think critically – evaluate, make inferences, synthesize, apply	Presentation contains correct information Workable recommendations made

Learning Outcomes

Students who demonstrate understanding can:

- Recognize substances as pure and impure
- Distinguish between physical and chemical changes
- Explain the difference between elements, mixtures and compounds

- Carry out investigations to distinguish physical and chemical changes
- Deduce that chemical changes lead to formation of compounds and physical changes lead to formation of mixtures
- Carry out simple comparative and fair tests
- Explore methods that can separate mixtures
- Predict suitable separation techniques
- Work cooperatively in groups
- Discuss and question what they are learning and how it is relevant
- Capture, edit and record audio using audio editing software
- Collaborate and communicate ideas and information using class wiki/blogs and webquest
- Collaborate and communicate ideas and information using word processing and multimedia software

Points to Note

De-ionized 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.

Ensure that the room is well ventilated when sulphur is being burned.

Teachers should provide students with criteria for construction of display board, taking into account available space for displays.

Participate in online discussions using resources designed for student collaboration and knowledge building

Use word processing software and other technology tools to create original work for a specific purpose and audience.

Extended Learning

Research the separation of crude oil.
Investigate the melting and boiling points of pure and impure matter

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.

Samples of different mixtures, materials for making poster, multi-media material on mixtures, elements and compounds, video on the heating of the elements iron and sulphur to form the compound iron (II) sulphide.

KEY VOCABULARY

Pure substance, impure substance, physical change, chemical change, rusting, bonds, reactants, products, atoms, elements, mixtures and compounds, atom, miscible and immiscible, solvent and solute, solution, colloids, chromatography, filtration, evaporation, distillation, separating funnel, centrifuging, sublimation

RESOURCES

ICT

computer, speakers, Internet, multimedia projector, video CDs/DVDs, word processing, multimedia and graphic software tools, audio capturing software, web quest site

LINKS TO OTHER SUBJECTS

Grade 6 (Mixtures) **Grade 7**(Matter)

About the Unit

In this Unit, students will investigate motion and forces. They will describe motion in one dimension and perform simple calculations involving distance, displacement, speed, velocity and acceleration. They will be able to identify various forces. They will investigate the origin and behavior of common forces in everyday experience and explore how knowledge of these forces can be utilized.

Range of Content

- Physical quantities can be classified as either scalar (has size only e.g. distance, speed and volume) or vector (has both size and direction e.g. displacement, force and velocity).
- When two or more forces are acting on an object, and the object remains at rest or does not accelerate (change in speed/direction), the forces are said to be balanced. If the object's motion changes, then the forces acting on the object are unbalanced.
- Friction is the resistance to motion of one object/surface moving relative to another. Methods of reducing friction include:
  - Lubrication;
  - Making the surface(s) smoother;
  - Making objects streamlined shapes (which allow fluids to flow around them easily); and
  - Reducing the contact between the surfaces.
- Distance is a measure of the amount of ground an object has covered. Displacement is the distance travelled in a straight line from an object's original position.
- Speed refers to the distance covered in a particular time while velocity is the speed in a particular direction. The average speed of any object over a specified period of time can be calculated using the equation:

$$Speed = \frac{Distance\ travelled}{Time\ Taken}$$

- Acceleration is the rate at which an object's velocity changes. The average acceleration of any object over a specified period of time can be calculated using the equation:

$$Acceleration = \frac{Change\ in\ velocity}{Time\ Taken}$$

Guidance for the Teacher

Only simple calculation of speed and acceleration is required. DO NOT teach the equations of motion.

UNIT 3: Forces and Motion

Theme: Energy, Forces and Matter

Prior Learning

Check that students can:

- Identify some types of forces

ATTAINMENT TARGET(S):

- Understand natural laws as they apply to motion, forces, and energy transformations.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of express ing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

BENCHMARK(S):

- Explore the relationships between forces and motion, and illustrate these relationships in the environment and living things..
- Analyse and interpret experimental data to determine similarities and differences in findings.
- Analyse several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate care and concern for living things and the environment.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: Balanced and Unbalanced Forces

Duration: 5 hours/2 weeks

OBJECTIVES

Students will:

- Distinguish between vector and scalar quantities
- Investigate situations in which unbalanced/balanced forces act
- Draw conclusions about the effects of unbalanced forces
- Recall that friction is the force which opposes motion
- Explain why some things are able to float in water and air, identifying all the forces involved
- Construct diagrams to show all the forces acting on moving objects, in given situations
- Perform investigations to determine how streamlined shapes influence the degree of resistance to motion in water and air
- Show curiosity in investigating forces
- Suggest innovative and relevant ways to solve problems

ICT ATTAINMENT TARGETS:

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

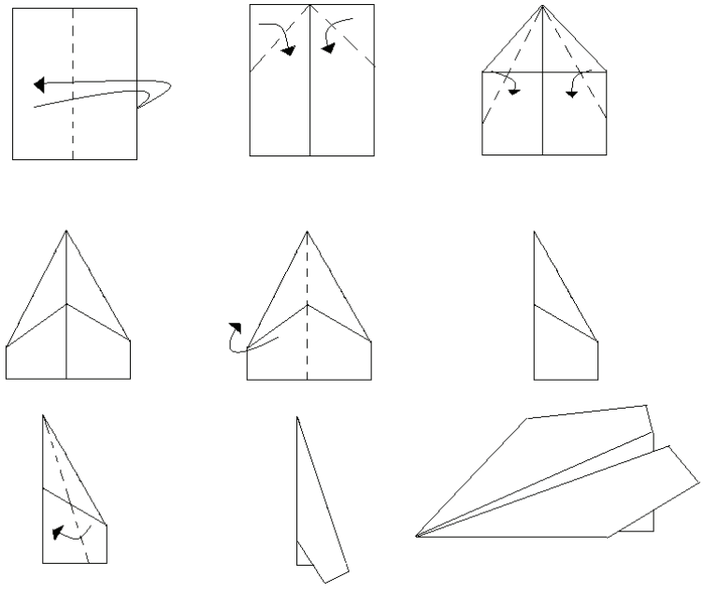
RESEARCH, CRITICAL THINKING AND DECISION MAKING - Students use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DESIGNING AND PRODUCING - Students use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems and make informed decisions.

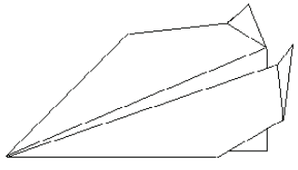
DIGITAL CITIZENSHIP - Students recognise the human, ethical, social, cultural and legal issues and implications surrounding the use of technology and practice online safety and ethical behaviour.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: In groups, be given a list quantities (time, temperature, force, mass) to sort under the headings "Quantities with Direction and Size" and "Quantities with Size Only", and share with the class. In a teacher-led discussion, connect the label 'Vector Quantities' to those quantities with direction and size, and the label with 'Scalar Quantities' to those quantities with size only.	Collaborate, think critically - classify, communicate	Quantities correctly classified
As a class, review forces. In groups examine a variety of situations in which forces act and identify the forces acting. Report findings to class in a variety of ways e.g., using multimedia presentations, digital story presentations.	Collaborate, communicate, record, think critically - classify, create, communicate using digital content	Forces correctly identified
Investigate the effects of balanced and unbalanced forces by engaging in a game of "tug of war" or "arm wrestling". Identify and record the stages where balanced and unbalanced forces are in operation. In groups discuss and Identify at least two other situations in which balanced/unbalanced forces act and report to class in a variety of ways, e.g., using multimedia presentations, using class blogs and email with attachment.	Observe, think critically - classify, record, communicate, collaborate	Correctly Identify at least two situations in which balanced forces act and two in which unbalanced forces act
Examine a variety of situations in which forces cause a change in direction, shape or motion (example: kicking a football, blowing a balloon and batting a cricket ball) and discuss the role of unbalanced forces in these situations.	Observe, record, communicate, think critically - classify	Illustrate two situations for each of the following in which forces causes a change in direction, shape or motion
In groups, carry out the following activities to investigate the balanced/unbalanced forces involved: 1. Place a tennis ball floating in a cup of water. Observe and record what happens to the ball when a pencil is used to submerge the ball and then release it. Discuss and suggest explanations for observations. 2. Toss a tennis ball vertically upwards and record observations. Discuss what might have caused the ball to stop moving upwards and return to the ground. 3. Drop a stone and a feather and compare their observations. Suggests reasons for differences observed. 4. Drop a stone and observe its fall. Attach a parachute the stone, allow it to fall again and record their observations.	Observe, communicate, manipulate, think critically - conduct fair test, investigate	Relationship between floating and upthrust correctly identified Correctly conclude that the falling motion of the ball was due gravitational force

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
to fall again and record their observations. Suggests reasons for differences observed. 5. Attach a rubber band/spring to a wooden block and place the block on a rough surface. Pull on the rubber band, gradually increasing the pull, until the block begins to move. Repeat the procedure for a smooth surface. Record, compare and suggest reasons for observations. 6. Release a small mass (e.g. a coin) from a specific height and record observations (including time to hit the ground). Attached the coin to a parachute and repeat the procedure. Compare and offer explanations for observations.		
Share and discuss their results and ideas with the class. This may be done using online journal sites.	Communicate, think critically Journalize observations	Acceptable explanations given for observations
Using diagrams illustrate the opposing forces acting in each case. Present findings to class in a variety of ways including using multi-media presentation and/or digital story tools. (*Teacher should guide students in identifying the balanced and unbalanced forces involved in the various activities: upthrust, gravity, friction, air resistance.*)	Construct diagrams, communicate Create, manipulate, communicate using digital content	Correctly draw use arrows on diagrams to indicate direction of forces experienced on the floating model and the parachute.
In groups, be given a container of water and two equal clumps of plasticine "play dough" investigate sinking and floating in the water. Design and construct a model that will sink and a model that will float. Discuss how the shape of the play dough affects floating and sinking. (Teacher should guide students to the inference that shape of the play dough changes the upthrust it experiences.)	Collaborate, observe, think critically, communicate, manipulate, investigate	Conclude that the depth at which a body floats in water is related to upthrust it experiences. Relate shape to upthrust and weight related to sinking.
Use plasticine to form balls. Add the balls one at a time to the floating model observing the change in depth at which it floats, until the model sinks. Discuss the relationships between the depth of floating and upthrust, and weight and sinking.	Observe, communicate, think critically, manipulate	
In groups, design and construct a paper plane (as outlined in the figure 1 on the following page) to investigate the effects of streamlining. Fly planes in groups and observe and record the horizontal distance of flight. Use word processing software/digital drawing tools for shape designs and documentation.	Observe, investigate, communicate, think critically, manipulate	Illustrates the effects of streamlining. Comparison of flight distances of both model designs correctly illustrates the effects of streamlining. Comparison of rate of descent of both situations correctly illustrates the effects of streamlining.



Fold back the tail of the airplane (as shown in figure 2 below) to create drag and repeat the flight process. Observe and record the horizontal distance of flight.



Compare the difference in distances of travel for the two flight processes.

(*Teacher should ensure that students realise that the paper plane with the flaps experiences more air resistance due to the fact that more surface area is exposed.*)

Explore further using planes of different designs.

Use a clump of plasticine "play dough" to design a solid cone. Drop the cone point first into a cylinder of water and note the rate of descent. Then drop the cone base first into a cylinder of water and note the rate of descent. Discuss and report on the observations.

Learning Outcomes

Students who demonstrate understanding can:

- Explain the action of balanced and unbalanced forces in various situations
- Demonstrate the effect of streamline shapes on resistance to motion in water and air
- Conduct electronic search for kinds of information e.g. text images and audio
- Collaborate and communicate online using class blog/social network sites.

Points to Note

Design and construction of model parachute should be done prior to class (at home)

Teacher should introduce and explain the term drag

Participate in online discussions using resources designed for studentcollaboration and knowledge building

Teacher created/supervised class blog/social network sites.

Demonstrate safe, respectful, responsible and clear online communication

Extended Learning

Research on ways of reducing friction. (include the invention of the wheel and axle and use of lubricants)

Research the purpose of Plimsoll Lines on ships

RESOURCES

Rope, football, balloon, cricket ball, tennis ball, rubber band, wooden block, water, cylinder, plasticine, paper

Computers, Internet, speaker, multimedia projector, interactive video tutorials, CDs/DVDs, word processing and multimedia software, class blog/social network sites

KEY VOCABULARY

Forces, upthrust, friction, drag, gravity, streamline, floating, sinking, stretching

LINKS TO OTHER SUBJECTS

Technical Vocational Education – apply solutions

Mathematics – measurement

UNIT 4: Forces and Motion

Theme: Energy, Forces and Matter

Prior Learning

Check that students can:

- Identify the fundamental of length and time and their units
- Correctly construct line graphs

ATTAINMENT TARGET(S):

- Understand natural laws as they apply to motion, forces, and energy transformations.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of express ing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

BENCHMARK(S):

- Explore the relationships between forces and motion, and illustrate these relationships in the environment and living things..
- Analyse and interpret experimental data to determine similarities and differences in findings.
- Analyse several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate care and concern for living things and the environment.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: One Dimensional Motion

Duration: 7.5 hours/3 weeks

OBJECTIVES

Students will:

- Describe the motion of an object by its position, direction, and speed
- Distinguish between displacement, distance, velocity, speed, and acceleration
- Solve problems involving displacement, distance, velocity, speed, and constant acceleration
- Work cooperatively in groups
- Value individual effort and team work by respecting different perspectives
- Show objectivity by using data and information to validate observations

ICT ATTAINMENT TARGETS:

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

RESEARCH, CRITICAL THINKING AND DECISION MAKING - Students use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

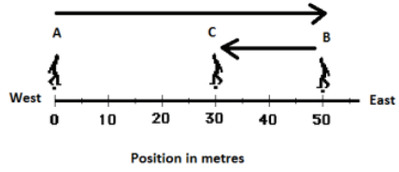
DESIGNING AND PRODUCING - Students use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems and make informed decisions.

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

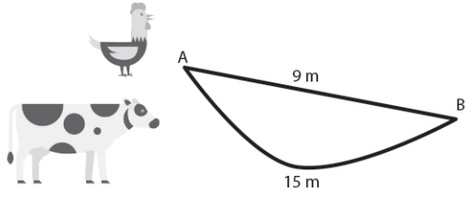
Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: In groups, push an object (ball/toy car) from a start/reference point and describe its motion with respect to its position and direction from the reference point, and its speed (e.g. the object moved slowly 5m west of the start point). Repeat the activity several times with varying sizes of push and in different directions. Share and discuss their descriptions of the object's motion with the class. As a class, discuss the importance of stating the direction and distance from the reference point when describing the motion of objects.	Collaborate, communicate, manipulate, investigate, think critically	Descriptions of positions sated giving distance and direction
In groups carry out the following: • Mark a reference point and place an object on it. Move the object in a straight line to a particular distance from the refer ence point, say 20 cm, in a particular direction, say East. Describe and record the new position of the object with regards to the reference point. Repeat several times, each time moving the object the same distance but in a different direction. • Move the object several distances in the same direction, in a straight line. Measure the distance from the reference point and describe and record the new position in each case. • Move the object along a looped path, starting and ending at the reference point. Measure the distance moved by the object and describe its new position. Answer and justify their responses to questions based on the activities. Example: 1. If the distance the object moves is the same, is its final position always the same? 2. If the object moves in the same direction, is its final position always the same? Share and discuss their results from the activities and answers to the questions with the class. (*Teacher should use relevant points raised by the students in the discussion to introduce the term displacement.*) Discuss the difference between distance and displacement. (*Note: Distance refers to how much ground an object has covered during its motion, whereas displacement refers to the distance covered in a particular direction.*)	Communicate, collaborate, think critically - Investigate, manipulate	Correct/acceptable answers and justifications given

Practise finding distance and displacement (see examples below).

- A man walks from point A to B to C. Determine the distance he travels and his final displacement.

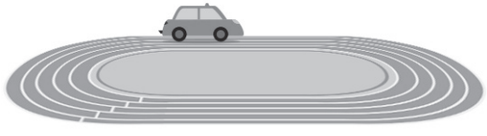


- A cow and a chicken take different routes in moving from Point A to Point B as shown below.



i. What distance does the cow travel?
ii. What distance does chicken travel?
iii. What is the cow's displacement?
iv. What is the chicken's displacement?

- A car travels around a 400 m track as shown below.



i. If the car travels once around the track, what distance does it travel?
ii. If the car travels twice around the track, what distance does it travel?
iii. If the car travels once around the track, what is its displacement

Calculate, think critically - analyse

Accurate distances and displacements given

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
View videos of situations where speed is measured, e.g. athletics events, racing car events, and discuss what they know about how speeds can be determined. In groups, be provided with times for a series of athletic events, e.g. men's/women's 100m, 200m, etc., and asked to deduce what they can about the speeds in the events, and to explain their answers (e.g. distance and time have to be measured). (Teacher should introduce the formal relationship, speed = distance ÷ time.) With the aid of teacher, use the relationship between speed, distance and time in a variety of contexts. As a class, compare speeds in different units of measurement. Carry out simple activities in which they predict the speeds of objects over a particular distance, then measure the time for the objects to travel that distance; for example, predict then determine the speed a ball travels with when dropped from a height of 2m to the ground. Calculate the speeds of the objects and compare their results to their predictions. (Teachers should ensure that students make repeated measurements and conduct fair tests.) In groups, be provided with descriptions of objects moving at various velocities (for example: a truck moving at 80kmhr-1 due East; a man running at 10 ms-1 due North) and asked to discuss, identify and record the similarities and differences between speed and velocity, including how they are calculated. Share and discuss their views with the class. (Teachers should use the discussions to clarify any misconceptions and elicit the relevant points from students.) As a class, summarise the similarities and differences between speed and velocity.	Collaborate, communicate, manipulate, think critically - investigate, conduct fair tests	Speeds correctly calculated. Correct similarities and differences between speed and velocity identified.
Observe two students in a short skit depicting a driving instructor and his student (see dialogue below). ***Student:*** *What do you use to make a car go faster?* ***Driving instructor:*** *The gas pedal or accelerator.* ***Student:*** *What causes the car's velocity to change from 40kmhr^{-1} to 80kmhr^{-1}?* ***Driving instructor:*** *The gas pedal or accelerator.* ***Student:*** *What do you use to go slower?* ***Driving instructor:*** *The brake.*	Collaborate, communicate, think critically	Correct answers to problems on acceleration.

Student: *What causes the odometer's needle to move from 80kmhr^{-1} to 40kmhr-1?*

Driving instructor: *The brake.*

The student: *What do you use to change the velocity of the car?*

Driving instructor: *The accelerator, which is the gas pedal, or the brake.*

In groups, answer questions based on the skit. For example:

- Does a car's velocity change when it speeds up?
- Does a car accelerate when it speeds up?
- Does a car's velocity change when it slows down?
- Does a car accelerate when it slows down?

Share and discuss their answers to the questions with the class and, as a class, formulate simple working definition for acceleration. Discuss the equation for calculating acceleration, provided by the teacher (Acceleration = $\frac{\text{change in velocity}}{\text{time taken}}$), and the unit of acceleration.

In groups, discuss scenarios in which objects move in a circular path and determine if the velocity and acceleration changes, providing justifications for their ideas.

Be given simple problems in which they determine change of velocity and acceleration. For example: A car moving at 40kmhr^{-1} changes its velocity to 80kmhr^{-1} in 10s. What is the change in the car's velocity? Find the acceleration of the car?

(Note: students are NOT required to perform unit conversions here, nor should the equations of motion be introduced.)

Learning Outcomes

SStudents who demonstrate understanding can:

- ✔ Differentiate among the basic terms used to describe motion
- ✔ Describe the motion of objects using words, diagrams, numbers, graphs, and equations
- ✔ Measure distance and time and calculate speed.

Points to Note

If there are pupils with physical disabilities in the class, ensure that examples are used which enable them to make a positive contribution, e.g. records from the Special Olympics for people with disabilities.

Extended Learning

Research suitable methods of measuring the speed of sound in air and, if possible, carry out this activity

RESOURCES

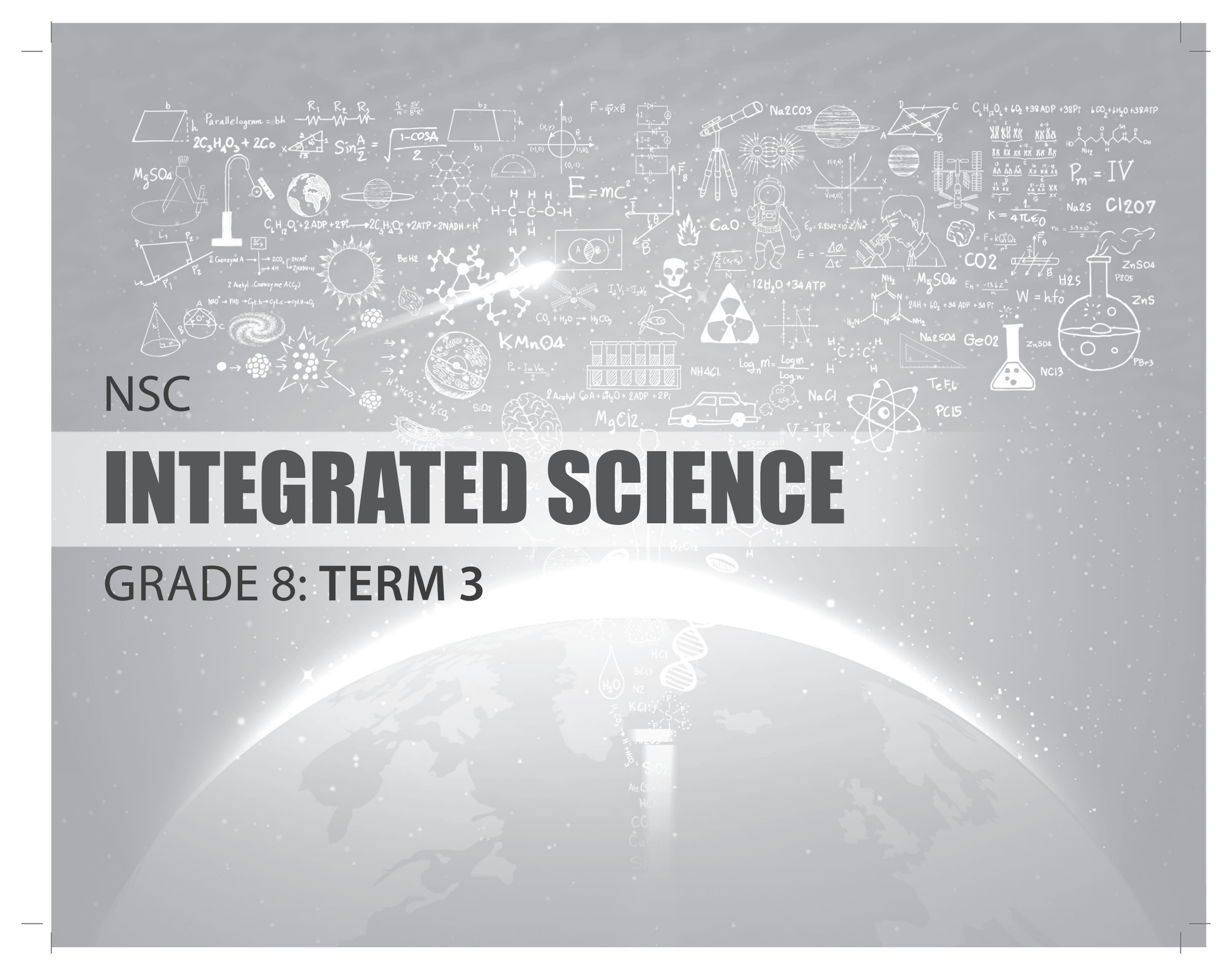
Instruments for measuring time and length, computer, internet

KEY VOCABULARY

displacement, distance, velocity, speed, acceleration

LINKS TO OTHER SUBJECTS

Mathematics – measurement, graphs



NSC

INTEGRATED SCIENCE

GRADE 8: 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. 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. In anaerobic respiration energy is released without oxygen.

Range of Content

- Breathing is the process of drawing air into and out of the lungs.
- During respiration energy is released from food for use by cells.
- There are two types of respiration, aerobic and anaerobic.
- In aerobic respiration oxygen is used to release energy from food.
- Carbon dioxide and water are by products of aerobic respiration.
- In anaerobic respiration energy is released in the absence of oxygen.
- Gaseous exchange is the process by which oxygen and carbon dioxide diffuse across the alveoli.

Guidance for the Teacher

- Students should consider the welfare of and demonstrate appropriate attitudes to the care of living organisms
- Pay attention to the ways in which human activities can affect breathing
- Wash hands and wipe the bench with disinfectant after handling live materials.

UNIT 1: Respiration

Theme: Living Things, Life Processes and the Environment

ATTAINMENT TARGET(S):

- Understand the importance of the life processes in plants and animals, their interdependence, their interaction with the environment, and how lifestyles determine health and well-being.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of express ing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

BENCHMARK(S):

- Understand the intake, digestion and absorption of food in animals, and how energy is released through respiration.
- Analyse and interpret experimental data to determine similarities and differences in findings.
- Analyse several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations..
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: Respiration

Duration: 7.5 Hours/3 weeks

Prior Learning

Check that students can:

- Recall the main organs of the human respiratory system and their basic functions
- Explain diffusion as the movement of particles of a substance from high to low concentration
- State the function of mitochondria
- Describe the nutrients in food
- Identify the final products of digestion

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 as the process in which energy is released from food either in the presence or absence of oxygen
- State that mitochondria are required for aerobic respiration
- Describe the exchange of oxygen and carbon dioxide across the alveoli
- Write a simple 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
- Compare photosynthesis and respiration and explain how they are linked
- Make observations and present these in a suitable format
- Account for factors that cannot be controlled when working with living materials
- Display safety consciousness for self and others
- Keep work area tidy during practical activities

ICT ATTAINMENT TARGETS:

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

RESEARCH, CRITICAL THINKING AND DECISION MAKING - Students use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

DESIGNING AND PRODUCING - Students use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems and make informed decisions.

DIGITAL CITIZENSHIP - Students 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: View a video/diagram/poster (online or offline) of the respiratory system and trace the pathway of air from the moment it enters the nostrils until it reaches the alveoli. Write down the structures involved in sequence and share with class.	Collaborate, communicate	Pathway of air correctly traced
View illustrations, models or digital/animated pictures of the fine structure of the lungs and suggest why the alveoli have so many blood vessels around them. Use the information provided by the teacher about carbon dioxide and oxygen concentrations in the atmosphere, blood and alveoli to predict what happens to the gases in the alveoli. Annotate given diagrams with arrows to show the direction of movement of oxygen and carbon dioxide and describe gas exchange in the alveoli.	Communicate, think critically – infer, predict, annotate,	Diagrams accurately annotated to show movement of oxygen from alveoli to the blood and removal of carbon dioxide from the blood into alveoli Predictions and inferences are sound
In groups, talk about their experiences and view video clips of athletic activities. Brainstorm the meaning of the term 'breathing' and explain why breathing is important for carrying out these activities. Share ideas with the class.	Collaborate, communicate, think critically – analyse, draw conclusions	Acceptable explanation and role of breathing
Sit quietly for 3 minutes. In pairs, take turns to count the number of breaths taken by each member in a minute by observing the movement of the chest. Repeat two more times and find the average number of breaths per minute. Take turns to run vigorously on the spot for 3 minutes then immediately count the number of breaths taken in a minute. Combine class results to construct a table to record the breathing rates before and after exercise. Plot a suitable graph using the data in the table. Explain the results. As a class, brainstorm how gender, state of health and different types of activity can affect breathing rate.	Calculate, tabulate, communicate, collaborate, measure, think critically – infer, investigate, draw conclusions, interpret	Acceptable record of data using table and graph Satisfactory summary of impact of selected factors on the rate of breathing
Test for the presence of carbon dioxide in exhaled air by using a straw to blow into a transparent container of lime water (Calcium Hydroxide solution). Record their observations and explain their findings.	Observe, manipulate, think critically - infer, investigate,	Cloudiness of lime water accurately linked to the presence of CO_2

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
In groups, half fill 3 boiling tubes with hydrogen carbonate (bicarbonate) indicator and record the colour. Immerse a pond snail/ guppy (small fish) into one, a piece of Elodea or other water plant in the second tube, and leave the third without any organism. Stopper each tube using a rubber bung and leave all three tubes in a dark place (cupboard) for half to one hour. Record and explain any colour changes observed.	Observe, manipulate, communicate, collaborate, think critially - analyse, infer, investigate, draw conclusions	Colour change from orange-red to yellow correctly linked to carbon dioxide produced in respiration The role of the control correctly identified.
In groups, investigate the release of energy from food material (e.g. a peanut). Pour 20 cm3 of water into a test tube and support it on a burette stand. Measure and record the initial temperature of the water. Find the mass of a peanut or cashew then stick it on the end of a pointed needle. Light the peanut/cashew and place below the test tube with the water. When the nut has completed burning, stir the water in the test tube then measure and record the final temperature. Calculate the energy released from the peanut/cashew using the following formula: *Energy released (J) = Mass of Water (g) x Rise in Temperature (^oC) x 4.2 J/g/^oC* (Note: 1cm^3 water = 1g)	Manipulate, communicate, collaborate, think critically – analyse, infer, investigate, interpret, draw conclusions	Accurate inference drawn from observation of rise in temperature of water. The energy released from the burning peanut/cashew is correctly linked to respiration. Accurate calculation of the energy released
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. Watch online/offline demonstration and interactive videos on the products respiration.	Manipulate, think critically – analyse, infer, investigate, draw conclusions	Acceptable inferences made
In groups, brainstorm to formulate a definition then construct a word equation for aerobic respiration. Share definitions and equations with the class and generate common definition.	Define operationally, communicate, collaborate, think critically - formulate	Acceptable definition and word equation given
Work in small groups to construct a table to compare photosynthesis and respiration.	Tabulate, collaborate, communicate, think critically - compare	Similarities and differences between photosynthesis and respiration correctly cited

Learning Outcomes

Students who demonstrate understanding can:

- Define aerobic respiration
- Trace the route taken by carbon dioxide and oxygen in the respiratory system
- Explain the importance of respiration to living organisms
- Describe the exchange of gases across the alveoli
- Summarise aerobic respiration using a simple word equation
- Perform simple experiments to identify products of aerobic respiration
- State similarities and differences between photosynthesis and respiration
- Distinguish between respiration and breathing
- Recognise the need for a control in an investigation
- Create and publish original documents using word processing software and other technology tools.

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 breathing and respiration, inspired and expired air.

Constituent	Inhaled air %	Exhaled air %
Oxygen	20	16
Carbon dioxide	about 0.0	4
Nitrogen and other gases	about 80	about 80
Heat	usually less	about 80
Water Vapour	usually less	saturated air

Table showing the comparison of inhaled/exhaled air

Extended Learning

Research and report on how human activities contribute to diseases of the human respiratory tract

Find out which respiratory diseases are more prevalent in Jamaica. (Relate to age, gender, occupation and lifestyle)

Design a leaflet/poster/advert for teenagers aimed at informing them of the benefits of aerobic exercise and encouraging them to get fit

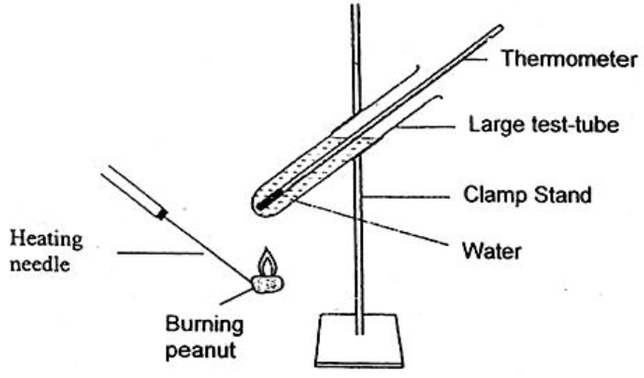
Research how aquatic organisms exchange gases

Points to Note

Establish that the hydrogen carbonate indicator changes colour from orange-red to yellow, and that lime water (Calcium Hydroxide solution) changes from colourless to milky in the presence of carbon dioxide.

Be aware of medical conditions that affect the ability of certain students to perform exercise (e.g. asthmatics, persons who suffer from sickle cell anaemia).

Include diagram of apparatus for energy release from food in instructions given to students.



RESOURCES

Videos, charts, hydrogen carbonate indicator, variety of invertebrates, Elodea, boiling tubes, drinking straws, disinfectant, rubber bungs, jars for collected specimens, lime water (Calcium hydroxide), peanuts/cashews, thermometers, cobalt chloride paper, transparent tape, mirror, timers, clamp and stands, water, plasticine, large pins, computer, speakers, Internet, multimedia projector, video CDs/ DVDs, multimedia, word processing and graphic software tools

KEY VOCABULARY

respiration, glucose, aerobic, anaerobic, energy, hydrogen carbonate indicator, lime water, lung, trachea, bronchi, bronchioles, alveoli, breathing, oxygen, nitrogen, carbon dioxide,

LINKS TO OTHER SUBJECTS

Physical Education

Home Economics

About the Unit

In this Unit, students will study outer space and some technologies that are used in space exploration. Through fun hands-on activities and simulations, they will explore planets, stars, and the solar system. They will become familiar with the light-year as a unit of astronomical distance, and discover the role of gravity in the solar system.

Range of Content

- Various tools and equipment are utilised in the exploration of space. For example, telescopes, gyroscopes, robots, cameras, rockets and various detectors
- The universe consists of billions of galaxies of varying sizes, and each galaxy consists of billions of stars. Many stars (e.g. the Sun) have planetary systems
- The solar system consists of: a star (the Sun); planets (e.g. the Earth), dwarf planets (e.g. Pluto), comets and asteroids in orbit around the Sun; and satellite moons in orbit around most of the planets
- A galaxy is held together by gravity. Gravity pulls on all masses in a galaxy influencing their orbits and speeds, and creating a spin of the entire galaxy. Gravity causes all galaxies in the universe to attract each other
- A light-year is a unit of distance; the distance that light can travel in one year. Light travels at approximately 300,000,000 metres per second (m/s).Therefore, one light-year is equal to 9,500,000,000,000,000 metres (9.5×10^{15} m). The light-year is very convenient to measure the very large distances in space.

Guidance for the Teacher

Unit is best taught using stimulus material from well documented sites and agencies such as NASA.
Encourage students to explore their universe through activities and simulations that are beyond earth.

UNIT 2: Space Science

Theme: Living Things, Life Processes and the Environment

Prior Learning

Check that students know:

- That the gravitational attraction of the Earth on a mass causes weight
- About the planets of the solar system and that they orbit the Sun

ATTAINMENT TARGET(S):

- Gain an understanding of the components and structure of the universe, and how advances in science and technology have enabled space exploration.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

BENCHMARK(S):

- Understand the physical characteristics of the universe and how technology has enabled its exploration.
- Analyse and interpret experimental data to determine similarities and differences in findings.
- Analyse several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: Beyond the Earth

Duration: 7.5 Hours/3 weeks

OBJECTIVES

Students will:

- Construct a model of a technological tool/device needed for space exploration
- Determine the connections between the concepts universe, galaxy, and star.
- Recognise that some stars have planetary systems
- Describe, in qualitative terms, the physical characteristics of selected components of the solar system (the sun, the planets, moons, comets, asteroids, and meteoroids)
- Construct simple models and diagrams to explain eclipses of the Sun and Moon
- Explain the role of gravity in determining the motions of the planets, stars, and solar system
- Use the light year, as a unit of astronomical distance, in solving simple problems
- Formulate relevant questions about the Universe and produce correct answers to them
- Work cooperatively in groups
- Show respect in responding to other persons' reports
- Communicate scientific information

ICT ATTAINMENT TARGETS:

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

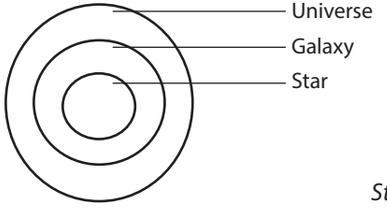
RESEARCH, CRITICAL THINKING AND DECISION MAKING - Students use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.

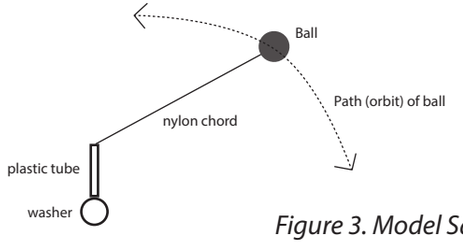
DESIGNING AND PRODUCING - Students use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems and make informed decisions.

DIGITAL CITIZENSHIP - Students 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: Recap the concepts of mass, weight, gravity and the solar system in a variety of ways, such as, crossword puzzles/worksheets/ videos/simulations/games/KWL strategy. Participate in teacher-led discussion to emphasise the concepts. (Teacher should emphasize the difference between mass and weight.)	Think critically – analyse, draw conclusions	Correct information provided for each concept
In groups, discuss and list tools/instruments they think would be needed to gather information about outer space. Research the instruments they have listed (online/offline). Create a mini booklet or scrapbook on 'Space Exploration Tools', including the names and pictures of instruments needed for space exploration, and a brief description of the purpose of each instrument. Share and critique booklets in a class discussion.	Collaborate, think critically, create, research, communicate	Mini booklet/scrapbook contains correct information on space exploration tool.
In groups, plan and design a simple model of any one of the technological tools discussed. Plans should include criteria for success and constraints, and scale diagrams. Present plans to class and make necessary adjustments to their design, if necessary, based on feedback. Make the model instrument based on revised plans, and display them in the science corner.	Collaborate, communicate, think critically - plan and design, manipulate, create	Plans reflect the Engineering Design Process Model of instrument constructed
In groups, be given pictures, or carry pictures, of the universe, a galaxy and stars, and separate labels with the names. Attach the labels to the pictures. Use the labelled pictures to create a flow chart showing the relationships among them (see example below).	Collaborate, think critically	Pictures correctly labelled. Flow chart reflects correct information.

Figure 1. Flow chart

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Use mathematical set notation to illustrate the relationship among the concepts universe, galaxy and star (see examples below).  *Figure 2. Set diagram* $Star \subset Galaxy \subset Universe$ *Expression 1: Set Notation*		Relationship among universe, galaxy and star correctly represented in set notation.
Visit a virtual observatory through the internet, or watch video, or read articles on the solar system. In groups, discuss the materials viewed/read and write a brief description of each of the following: the sun, the planets, moons, comets, asteroids, and meteoroids. As a class, share and refine descriptions, then create a poem/short story/poster (electronic/non-electronic) entitled "Components of Our Solar System". In a class discussion, suggest what bodies might be associated with other stars. Individually, write a fictional story about their journey to another planetary system, focusing on the types of bodies they saw.	Collaborate, communicate, create, think critically - investigate	Acceptable descriptions written for the sun, the planets, moons, comets, asteroids, and meteoroids. Poem/short story/poster contains correct information. Fictional story contains acceptable suggestions about other bodies that might be in another planetary system.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Recap the meaning of the terms luminous and non-luminous. Group the objects in space they have looked at as luminous or non-luminous. In groups, in a relatively dark area, place a flashlight directly in front of a large ball (e.g. a football), at a fixed distance from it. Turn on the flashlight and slowly move a small ball (e.g. a tennis ball) across and in front of the flashlight. Record their observations using simple scientific language and labelled diagrams. Repeat the movement of the small ball in front of the flashlight at varying distances, and record their observations using simple scientific language and labelled diagrams. Repeat the activity above with the small ball at the fixed distance from flashlight and the large ball being moved. Record their observations using simple scientific language and labelled diagrams. Share observations and discuss observations with the class. Participate in teacher-led discussion on solar and lunar eclipses, relating the concepts to the activities done. (Teacher should emphasize safety practices to be observed when viewing eclipses.)	Classify, collaborate, investigate, manipulate, communicate, observe, think critically	Objects correctly grouped as luminous or non-luminous Appropriately recorded observations: diagrams illustrate solar and lunar eclipses.
In groups, use a wooden or foam ball with a hole bored through its centre, a plastic tube, (e.g. a 1-inch PVC pipe) nylon cord and washer to construct a simple model of a satellite system. • Tie one end of the cord to the washer. • Pass the other end of the cord through the plastic tube and the ball, and then tie this end around the ball. • Hold the washer next to the bottom of the tube and rotate their fists so that the ball circles your fist, as shown in figure 3 below. • Take turns rotating the ball and record their observations.  *Figure 3. Model Satellite System*	Collaborate, observe, manipulate, investigate, infer, think critically	Summary includes all the main points from the class discussions.

Answer the following questions and share their responses in a class discussion.

- What keeps the ball from flying off when being spun around?
- Compare the model satellite to the motion of the Earth and the other planets around the Sun.
- What keeps Earth and the other planets from flying off into space away from the Sun?

As a class, watch a video or read an article on how gravity causes the motions of space bodies and discuss how gravity causes the following:

- The motions of planets and stars.
- The orbit of the solar system around the centre of the galaxy.

Individually, write a brief summary of the main points from the class discussions.

In groups, be given a timer and a metre rule/measuring tape/trundle wheel. Measure about 20 metres between two points, A and B, inside or outside the classroom. Starting from one of the points, have one member of the group walk heel-to- toe, back-and-forth between the two points for exactly one minute. Then stop and mark their position. Measure how far they walked to the nearest metre, and record this distance in the table below. Repeat the steps two more times, then calculate and record the mean average in the table.

Trials	Distance Walked/metres
1	
2	
3	
Average (Student-minute)	

(The average is the distance walked heel-to-toe in one minute, called a 'student-minute'.)

Collaborate, manipulate, think critically - investigate, summarize, measure, communicate

Measurements taken with due precaution to minimise errors

Mean average calculated correctly

Questions correctly answered
Table correctly completed

In groups, use their student-minute to solve various problems. For example: How many metres are in 5 student-minutes? How many of student-minutes are there in 8000 metres?

Share and compare their results with the other groups. As a class, discuss the advantages and disadvantages of representing distance (metre) using time (student-minute). Suggest student-time units that may better cover larger distances.

In groups, discuss and record what they think the term 'light-year' means. Discuss the similarities between student-minutes and light-year. Share their thoughts with the class. Be given the equivalent value of the light-year (1 light year ~ $9.5x10^{15}$ km) by the teacher and, as a class, discuss the importance of this unit. Use their knowledge of the light-year to complete the table below.)

Collaborate, communicate, calculate, compare, think critically

Distance to other stars in the Milky Way		
Star	Distance in Kilometres	Distance in Light years
Proxima Centauri	$4.3x10^{13}$	
Sirius	$9.0x10^{18}$	
Betelgeuse		500
Vegas	$2.6x10^{14}$	
Polaris		6800

Be asked to think of questions to answer about the Universe, e.g.

- Can any other planet support life?
- Why do we only see other stars at night?

Think critically

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Describe and build simple models of space exploration tools.
- ✔ Explain and represent the hierarchy of organisation of the Universe in graphical and mathematical forms.
- ✔ Describe, in qualitative terms, the physical characteristics of selected components of the solar system
- ✔ illustrate solar and lunar eclipses using models and diagrams

- ✔ Explain the movement of selected space bodies due to gravitational force
- ✔ Explain the significance of the light-year
- ✔ Convert the light-year to kilometres and vice-versa
- ✔ Generate questions about the Universe

Points to Note

Students should be encouraged to write their reports using ICT and to include images within it.
Many of the concepts in this unit may be abstract, so videos, animations and appropriate websites should be used as much as is possible.
Teacher could organise a viewing of stars, provided the school has a telescope.

Extended Learning

Research and describe some uses of artificial satellites, e.g. to assist weather forecasting, TV transmissions.

RESOURCES

Various stimulus materials on space science, electronic and non-electronic. Materials for building science exploration devices.
Materials for model satellite: nylon cord, plastic tube, washer
Telescope

KEY VOCABULARY

Light-year, universe, galaxy, star, satellite, moon, comet, asteroid, meteoroid, astronomy, telescope, solar eclipse, lunar eclipse

LINKS TO OTHER SUBJECTS

Mathematics – Sets
Geography/Social Studies – Solar System

About the Unit

In this Unit, students will explore the importance of water and air to survival. They will investigate some properties, sources, and uses of water and air. They will explore how water and carbon is cycled in the atmosphere. They will also examine the constituents of air and relate their properties to their uses. They will also explore methods of water conservation and purification.

Range of Content

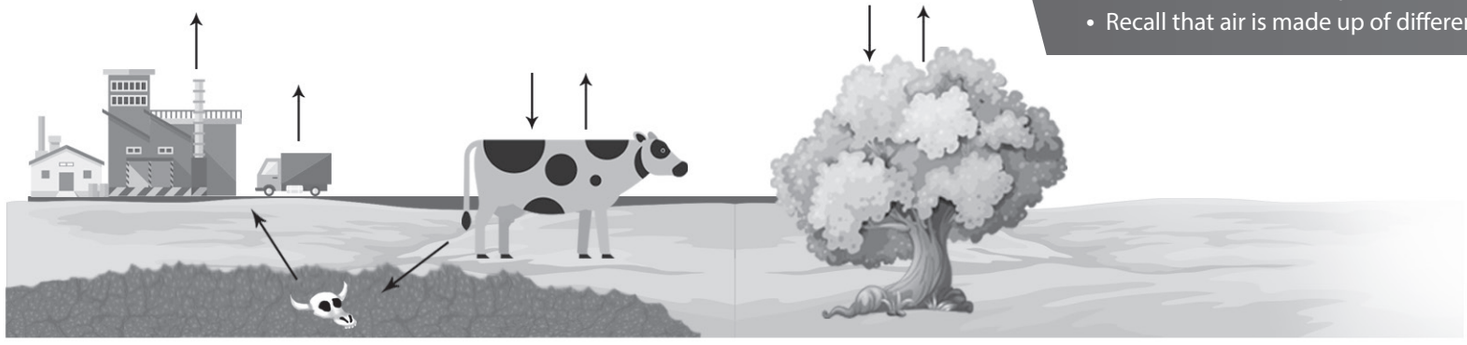
- Water is the most abundant liquid on earth, covering about 70% of the surface. Sources include surface water (e.g. lakes, rivers, seas) and groundwater (e.g. wells and aquifers).
- Properties of adhesion, capillarity, and surface tension allow water to drive reactions in living and non-living environments.
- Water is cycled in nature through the water (hydrologic) cycle which combines the processes of evaporation, transpiration, condensation and precipitation. Simple chemical tests for water include changing anhydrous copper sulphate to blue and cobalt chloride paper to pink.
- Water conservation refers to the 'wise use' of water resources and focuses on reduction, re-use and recycling of water.
- Human practices have resulted in pollution and contamination of water resources. Boiling, chlorination, filtration, aeration and desalination are some of the methods used to obtain clean water.
- Air is composed of approximately 78% nitrogen, 21% oxygen with traces of carbon dioxide, water vapour and argon.
- The properties of the gases in air are related to its uses: nitrogen is used in food packaging because it is unreactive; oxygen is used in burning fuels because it supports combustion; argon is unreactive hence used in light bulbs to produce an inert atmosphere; and carbon dioxide is used in fire extinguishers be cause it does not support combustion.
- Carbon is an important component of all living organisms and is cycled in nature as carbon dioxide in the carbon cycle. The carbon cycle maintains the amount of carbon dioxide in the air through the processes of photosynthesis, respiration and combustion.
- In chemical tests for atmospheric gases: oxygen relights a glowing splint (i.e. supports combustion) and carbon dioxide turns limewater (aqueous calcium hydroxide) cloudy..

Guidance for the Teacher

The wise use of Earth's resources is to be reinforced at every opportunity. Have students participate in activities/ projects that require the implementation of conservation ideas.

UNIT 3: Water and the Earth's Atmosphere

Theme: Living Things, Life Processes and the Environment



Prior Learning

Check that students can:

- State the chemical composition and formula of water
- Recall that air is made up of different types of gases

ATTAINMENT TARGET(S):

- Understand the importance of the life processes in plants and animals, their interdependence, their interaction with the environment, and how lifestyles determine health and well-being.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of express ing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

OBJECTIVES

Students will:

- Relate the properties of water to its uses
- Investigate selected properties of water
- Justify the need for water conservation
- Summarize various methods of water conservation
- Model how water is cycled in nature.
- Investigate common methods of water purification
- Create a simple water purification device
- State the composition of clean air
- Use appropriate statistical graphs to represent the percentage composition of gases in air
- Describe the chemical tests for oxygen and carbon dioxide
- Relate the properties of the gases in air to their uses
- Describe the carbon cycle in simple terms to include the processes of combustion, respiration and photosynthesis
- Make a model to illustrate the processes involved in the carbon cycle
- Value individual effort and team work through 'hands-on' activities
- Show interest in the outcomes of investigations on water and air
- Assess the impact of human activities on air and water quality
- Show interest in water conservation through personal conservation efforts
- Devise personal conservation plans

BENCHMARK(S):

- Know the properties, sources and uses of water.
- Know the percentage composition of air and understand how carbon is cycled in the atmosphere.
- Analyse and interpret experimental data to determine similarities and differences in findings.
- Analyse several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate concern for the preservation of natural resources.
- Demonstrate concern for man's impact on the environment.
- Demonstrate sensitivity to others who are different.

Topic: Water and the Earth's atmosphere

Duration: 12.5 Hours/5 weeks

ICT ATTAINMENT TARGETS:

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

RESEARCH, CRITICAL THINKING AND DECISION MAKING - Students use digital tools to design and develop creative products to demonstrate their learning and understanding of basic technology operations.ute to the learning of others.

DESIGNING AND PRODUCING - Students use appropriate digital tools and resources to plan and conduct research, aid critical thinking, manage projects, solve problems and make informed decisions.

DIGITAL CITIZENSHIP - Students 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: Participate in teacher led discussion to review the properties of water. Use the KWL chart to ascertain the chemical composition and formula of water.	Communicate, think critically - analyse	Correct formula given
View video / read literature /conduct online/offline research and participate in teacher led discussion to highlight the properties of water. Record findings in a variety of ways.	Research, communicate, think critically	Correctly state the properties of water
In groups, place a drop of water on a glass slide; place another slide on top of it and then try to separate the slides. Discuss the observations and suggest an explanation. Report findings using simple scientific language and use results to draw simple conclusions. Share with class. (*Teacher should introduce the term adhesion here*).	Manipulate, observe, think critically - analyse, draw conclusions, communicate, collaborate	Correct conclusions offered
In groups, pour coloured water into a beaker and place capillary tubes of different sizes in the water; record any observable change. Participate in teacher led discussion on observations made. Report findings using simple scientific language and use results to draw simple conclusions. Share with class. (*Teacher should introduce the term capillarity*).	Manipulate, observe, think critically - analyse, draw conclusions communicate, collaborate	Correct conclusions drawn
In groups, pour water into a beaker and gently place a paper clip or black pepper on the surface of the water; sprinkle soap powder in the beaker with the black pepper or paperclip. Record observations using simple scientific language, drawings or labelled diagrams. Use results to draw simple conclusions and share with class. (*Teacher should draw students attention to the concept of surface tension*)	Manipulate, observe, think critically - analyse, draw conclusions, communicate, collaborate	Correct conclusions drawn
In groups, place a strip of blue cobalt chloride paper and a small sample (about quarter spatula) of anhydrous copper sulphate salt on separate white tiles. Record initial colour of samples. Use a teat pipette to add a few drops of water to the cobalt chloride paper and the anhydrous copper sulphate salt until there is an observable change. Tabulate observations under the following headings: substances used to test water; colour before water added; colour after water added.	Manipulate, observe, communicate, collaborate,	Accurate observations of colour changes made

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will:		
Research the various sources of water and categorize them as groundwater or surface water. OR View videos on different water sources and classify them.	Communicate, think critically -classify	Correctly classify sources of water as groundwater and surface water.
In groups, state some uses of water in the home and industry. Develop a 24 hour 'Water Use' diary and present data as bar graphs, line graphs or pie charts. Analyse the data to indicate the area of maximum water usage. Discuss and record findings and suggest ways in which water can be conserved. Produce a poster, leaflet, or booklet on water conservation.	Communicate, colaborate, create, think critically – analyse, interpret, draw conclusions	Presentation and analysis of data acceptable and accurate Poster/leaflet/booklet contains correct information Creative presentations
Create a strategy to reduce water usage in the home, school, or community. Calculate how much water is used in the home daily (check meter readings). Formulate a personal conservation plan showing individual efforts to conserve water at home. Present plan to the class using multimedia or role play.	Create, calculate, communicate, think critically – analyse, synthesize, apply, justify	Workable strategy developed Plans show application and transfer of knowledge Presentations are creative and contain rational plans
As a class, identify areas of water wastage at school. Formulate plans to reduce, re-use or recycle water used in the school. Plan and design a public education campaign to increase awareness on water conservation options (e.g. using slogans, jingles etc.). Present to the school body in a variety of ways.	Observe, collaborate, communicate, create, think critically – evaluate, apply, justify, plan and design	Plans are sound and applicable Campaigns are creative and contain accurate information
In groups, research the water cycle and construct a model using indigenous materials. Make a presentation of the water cycle using the model. Display model in the science corner.	Manipulate, create, collaborate, think critically – analyse, apply	Correct representation of the processes in the water cycle. Model creative, to scale, correct facts represented
In groups, use research skills to investigate issues affecting water globally (e.g. scarcity, drought, contamination). Discuss the measures that are needed to make water safe. Investigate water purification methods used in water treatment systems (OR Visit a water treatment plant). Construct a model to represent each stage in the water treatment process. Present model with explanations of how the system works to the class	Research, communicate, create, collaborate, think critically – analyse, apply	Model correctly depicts stages in water treatment system Application and transfer of knowledge evident
In groups, be provided with (OR carry) 'dirty' water to class. Set up an experiment to use activated charcoal and/ or a filter and funnel to remove colour and solids from the water. Compare the water before and after the experiment. Explain how the treatment method works. Report findings to the class. Answer questions on the experiment.	Observe, report, communicate, collaborate, think critically – analyse, justify, investigate,	Report contains accurate information. Explanations match evidence Questions correctly answered

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
In groups, be provided with 'unclean' water. Use methods of boiling and chlorination to treat the water. Compare water samples before and after the experiment. Explain how the treatment method works. Report findings to the class. Answer questions on the experiment.	Observe, communicate, report, collaborate, think critically – analyse, justify, investigate	Report contains accurate information Questions correctly answered Logical explanations given
In groups, be provided with (OR carry) salt or sea water. Suggest how fresh water could be obtained from the salt water. Set up an experiment to achieve this. Compare the water samples before and after the experiment. Explain the processes involved. Report findings to class. Answer questions on the experiment.	Investigate, observe, report, communicate, collaborate, think critically – analyse, infer	Report contains accurate information Questions correctly answered Correct inferences made
In groups, research water purification methods that can be applied to communities with water problems. Compare the methods noting the advantages and disadvantages of each. Note the costs associated with different methods. Make presentations to the class, orally or in writing.	Research, report, communicate, think critically – analyse, infer, justify	Presentations are creative and contain accurate information Comparisons match evidence
In groups, plan and design a water purification device. Select appropriate materials. Plans should include costing and reasons for material selection. As a class, develop the criteria for the success of the device. Participate in a teacher led discussion to decide which design is the best solution for the water purification device. Implement where possible.	Communicate, plan and design, create, think critically - evaluate, justify, collaborate	Model correctly represents the process depicted
In groups, research online/offline the percentage composition of air and present data in a variety of ways (chart, pie chart, bar graph). Present information in a class display.	Research, communicate, collaborate, think critically - construct	Presentation contains correct information
In groups, investigate the percentage of oxygen in clean air by passing air repeatedly over heated copper to form copper oxide. Make observations and record findings.	Observe, collaborate, communicate,	Accurate calculations Correct conclusions drawn
In groups, research (online/offline) selected properties and uses of gases such as carbon dioxide, oxygen and nitrogen. Share views with class. Produce a leaflet, podcast or wiki to sensitize the school community about the gases in the air.	Collaborate, communicate, create	Correct information presented

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
In groups, investigate if water is present in air using the scientific method. Suggest how water in air can be tested. Identify the materials needed. Set up the investigation. Carry out tests. Record and explain observations. Write up and submit a laboratory report (include pictures)	Observe, communicate, collaborate, manipulate, think critically – analyse, apply, synthesize, make hypothesis, plan and design	Accurate observations noted Logical explanations given Steps in the scientific method clearly seen Report written properly and contains accurate information
In groups, investigate the chemical tests for oxygen and carbon dioxide. - Oxygen relights a glowing splint - Carbon dioxide turns calcium hydroxide (lime water) milky or cloudy.	Observe, collaborate, communicate, think critically - investigate	Accurate observations recorded
In groups, research and complete the activities in a web quest or computer simulation on the carbon cycle.	Research, collaborate	Accurate completed information
In groups, use information from discussion/internet/textbooks/ multimedia and/or graphic software to create a model of the carbon cycle, and present work to class. Display cycles in the science corner. Use research to investigate gases that contribute to poor air quality.	Collaborate, create, communicate	Model contains accurate information Creative model displays

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Show how the properties of water relate to its uses
- ✔ Classify various sources of water
- ✔ Cite evidence for the presence of water
- ✔ Suggest ways of conserving water
- ✔ Describe how water is cycled in nature
- ✔ Investigate common methods of water purification
- ✔ Represent the percentage composition of air using appropriate statistical graphs
- ✔ Show how the properties of the gases in air relate to its uses
- ✔ Cite evidence for the presence of oxygen and carbon dioxide
- ✔ Use context cues to construct the carbon cycle
- ✔ Work cooperatively in groups

- Use word processing, multimedia/digital story software to create digital content to communicate information
- Conduct electronic search to access navigate and manipulate digital content

Points to Note

Teacher must make connections with human activities and the impact these activities have on both cycles in order to sensitize on environmental concerns.

Use word processing software and other technology tools to create original work for a specific purpose and audience.

Locate relevant information on the Internet by using the successful search strategies

Follow guidelines to promote healthy use of ICT tools

Extended Learning

Research water pollution and water borne diseases

Research the fractional distillation of air

Research two human activities that contribute to an increase in carbon dioxide level and air pollution.

Find out how water is treated before it gets to homes.

Research artificial aquifer recharge.

RESOURCES

Capillary tube, beaker, paper clip, black pepper, soap powder, cobalt chloride paper, anhydrous copper sulphate salt, spatula, white tile, teat pipette, charts/multimedia materials on the carbon cycle

computer, speakers, Internet, multimedia projector, video CDs/ DVDs, word processing, multimedia and graphic software tools

KEY VOCABULARY

Adhesion, capillarity, surface tension, ground water, surface water, water purification, cycles, components, composition, carbon dioxide, oxygen, fossil fuel, photosynthesis, respiration, combustion, nitrogen

LINKS TO OTHER SUBJECTS

Social Studies (Climate)

NSC

INTEGRATED SCIENCE

GRADE 9 UNITS

TERM 1

Unit 1

Working Like a Scientist 3

Developing hypotheses
Planning & designing fair tests
Fundamental quantities and units
Derived units
Plotting graphs
Calculating gradients from graphs
Interpreting distance & velocity-time graphs
Determining significant figures
Writing numbers in standard form

Unit 2

Transport In Humans and Plants

Investigating Osmosis
Comparing Osmosis & Diffusion
Importance of transport system in multicellular organisms
Substances transported in animals
Annotate a diagram of the heart
Relate structure of the heart to its function
Tracing blood flow from heart to rest of the body
Relate structure of arteries, veins & capillaries to their functions
Main components of blood & their functions
Investigating rate of diffusion based on surface area
Substances transported in plants
Adaptations of roots for transport
Locating transport tissues in dicotyledons
Functions of xylem and phloem
Investigating movement of substances from soil to leaves

TERM 2

Unit 1

Electricity and Magnetism

Investigating static electricity
Applications and hazards of static electricity
Defining electric current
Classifying materials as conductors & insulators
Constructing simple circuits
Representing series and parallel circuits using diagrams
Preventing electrical hazards
Safety devices
Identify poles of a bar magnet
Demonstrating behaviour of like and unlike poles
Investigating relationship between voltage and current in simple series circuit
Constructing an electromagnet
Investigating properties of an induced current

Unit 2

Chemical Bonding, Formulae and Equations

Calculating number of sub-atomic particles in atoms and ions
Writing electronic configuration of 1st 20 elements
Defining ionic bonding
Forming ionic compounds
Physical properties of ionic compounds
Determining chemical formula of binary compounds
Writing word, symbol and ionic equations
Balancing equations
Investigating types of reactions
Identifying exothermic and endothermic reactions

TERM 3

Unit 1

Sensitivity and Coordination

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 & associated hormones
Comparing the nervous and endocrine system

Unit 2

Acids and Alkalis

Classifying substances as acids and alkalis
Interpreting the pH scale
Measuring the pH of substances
Using and creating acid-base indicators
Investigating reactions of acids and bases
Testing for hydrogen, carbon dioxide and ammonia
Classifying salts
Preparing insoluble salts
Applications of neutralization reactions in daily life

*Table continues on following page

TERM 1

Unit 3

TERM 2

Unit 3

TERM 3

Unit 3

Sexual Reproduction and Birth Control

Identifying key structures in a pregnant uterus & their functions

Determining how embryo gets food, oxygen and eliminates waste

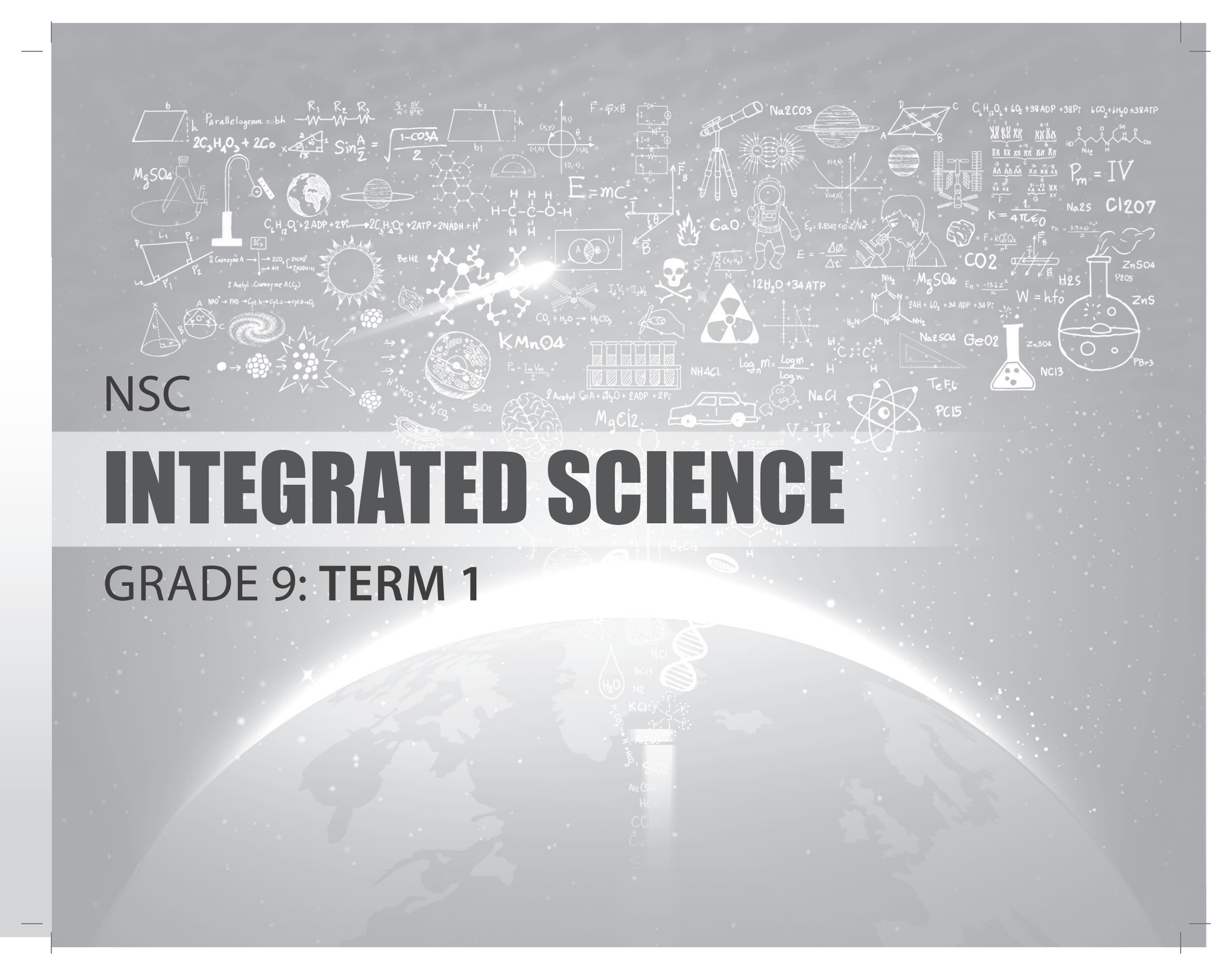
Effects of negative maternal behaviours on embryo development

Importance of prenatal care

Methods of birth control

Importance of family planning

Problems associated with teenage pregnancy



NSC

INTEGRATED SCIENCE

GRADE 9: TERM 1

About the Unit

In this Unit, students will learn about the processes involved in planning and designing fairs tests in order to solve problems. Emphasis is on the development of measurement skills through hands-on enquiry. The students will learn about the importance of physical quantities and units in measurement. They will learn the correct and appropriate use of various measuring instruments while determining physical quantities associated with objects and events. They will learn how to record measurements and the results of calculations in standard form and to give the appropriate number of significant figures. They will acquire the skills involved in the construction and interpretation of graphs.

Range of Content

- In developing hypotheses, previous knowledge or experience is used to put forward an idea of how or why something happens. Investigations of these hypotheses are then carried out using fair tests.
- The International System of Units (SI) or metric system is based on physical quantities that can be measured and expressed using specific units. These units are multiplied or divided by a set of prefixes representing a power of ten. Derived units such as area, volume and density are formed from the fundamental units.
- Line graphs describe the relationship between two quantities, with the independent variable on the horizontal (x) axis and the dependent variable on the vertical (y) axis. Best fit lines are drawn from scatter graphs and have approximately equal number of points on either side.
- In plotting distance-time and velocity-time graphs, the gradient (slope) of the line can be used to calculate velocity and acceleration which are affected by the steepness of the gradient.
- Significant figures represent the digits that carry meaning and contribute to the precision of a number. This can be determined by expressing the number in standard form (as a power of ten).

Guidance for the Teacher

In physical measurement, the number of significant figures is crucial in indicating precision. Students normally have difficulty with the concept of significant figures particularly when expressing the results of calculations. The following are some rules that should be emphasized in the determination of significant figures:

1. All non-zero digits are significant (e.g. *2856 g* has four significant figures);
2. Zeros that fall between significant digits are significant (e.g. *408 K* has three significant figures);
3. Trailing zeros are significant (e.g. *3.100 cm* has four significant figures).

Rules for determining significant figures in calculations:

1. **Addition or subtraction** – the result of the calculation should have the same precision of the least precise measurement (e.g. *45.24 g + 18.1 g = 63.3 g* and **not** *63.34 g*);
2. **Multiplication or division** – the result of the calculation should have the same number of significant figures as the measurement with the least number of significant figures (e.g. *40.96 kg ÷ 8.0 m^3 = 5.1 kgm^{-3}* and not *5.12 kgm^{-3}*).

UNIT 1: Working like a scientist 3

Theme: Science Exploration, Application and Design Practice

Prior Learning

Check that students can:

- Identify the steps in the scientific method
- Present data in a variety of scientifically acceptable ways
- Recall types of variables

ATTAINMENT TARGET(S):

- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

BENCHMARKS:

- Apply the principles of measurement in the solution of everyday problems.
- Use scientific knowledge to select appropriate experimental methods.
- Construct explanations, design and evaluate solutions to complex real-world problems, based on scientific knowledge.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: Experimenting

Duration: 5 hours/2 weeks

OBJECTIVES

Students will:

- Identify and state problems
- Formulate hypotheses
- Plan and design experiments (fair tests) to solve specific problems

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Create a flow diagram outlining the steps involved in the scientific method and then share and discuss their diagrams with the class. As a class discuss each step of the scientific method.	Communicate, collaborate	Flow diagram contains the steps of the scientific method in correct sequence.
As a class examine samples of scenarios, problem statements generated from them, and experiments which were carried out to solve the specific problems.Discuss the importance of controlling variables in the design and execution of fair tests.	Communicate, collaborate, think critically - analyse	Variables required for fair tests identified
In groups generate a problem statement from a scenario provided by the teacher. Develop a hypothesis then plan and design an experiment to test the hypothesis. Carry out the experiment then present a report to class in an exhibition format.	Collaborate, think critically – formulate, hypothesize, plan and design, investigate, record, communicate	Problem statement acceptable Expected results linked to hypothesis Experimental plan is plausible and follows expected steps Suitable methods indicated for presenting data Display meets agreed criteria
In groups, identify and specify a problem in their school/community. Discuss and formulate a hypothesis, then plan and design an investigation to test their hypothesis. Collect and record their observations/data and write a report on the investigation. Share and discuss findings and ideas with the class.	Writing problem statements, plan and design, observe, record, think critically – analyse, interpret, formulate hypotheses, draw conclusions, communicate	Report reflects the scientific method Problem statement acceptable Hypothesis acceptable Investigation reflects fair-testing Data/observations appropriately recorded Explanations/conclusions supported by data

Learning Outcomes

Students who demonstrate understanding can:

- Specify a problem
- Formulate hypotheses
- Design experiments (fair tests)
- Analyse data
- Draws conclusions that are supported by data

Points to Note

Use opportunities to reinforce the skills garnered in this unit, throughout the course.

Extended Learning

Identify an invention and research the processes that were involved in its development

RESOURCES

samples of scenarios and experiment reports, scenarios for the planning and designing activities, materials for creating science exhibition display boards

KEY VOCABULARY

hypothesis, problem statement, fair test, controlling variables

LINKS TO OTHER SUBJECTS

Biology and Chemistry

UNIT 1: Working like a scientist 3

Theme: Science Exploration, Application and Design Practice

Prior Learning

Check that students can:

- Recall the five fundamental quantities and their base units

ATTAINMENT TARGET(S):

- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

BENCHMARKS:

- Apply the principles of measurement in the solution of everyday problems.
- Use scientific knowledge to select appropriate experimental methods.
- Construct explanations, design and evaluate solutions to complex real-world problems, based on scientific knowledge.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: Quantities, Units and Graphs

Duration: 7.5 hours/3 weeks

OBJECTIVES

Students will:

- Formulate a definition for the term 'physical quantity'
- Recall five fundamental quantities and their base units
- Recognise a unit as a standard measure of a quantity
- Recognise that all other quantities and units are derived from fundamental quantities and base units
- Use prefixes micro, milli, centi, deci, kilo, and mega appropriately and be able to carry out relevant calculations
- Recognise that quantities have effects on each other and that a graph is a pictorial representation of their relationship
- Plot graphs according to accepted standards
- Calculate gradients of graphs and determine their units
- Create and interpret distance-time and velocity-time graphs for uniform motion

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: In groups, be given a glass of water and various measuring instruments (e.g. balance, ruler, thermometer, measuring cylinder, micrometer, vernier caliper, stopwatch). Use the instruments to measure and record the values of as many things as is possible regarding water. List some things about the water that could not be measured (e.g. colour, smell, shape). State, giving reasons, which of the set of things (measured/not measureable) are physical quantities. Suggest a simple working definition of the term *"physical quantity".* Share and discuss their definitions with class. (*A physical quantity is a measurable characteristic of anything.*)	Collaborate, communicate, record, report, manipulate, measure, think critically – analyse, draw conclusions, justify, operationally define	Measuring instruments used correctly Acceptable justifications made Acceptable definition of physical quantity
Recall five fundamental quantities of measurement and their base units. In groups, use a ruler to measure the length and width of a sheet of paper and calculate its surface area. Use a stopwatch to measure the time it takes for a small piece of tissue to fall from a height of 2 m to the ground and calculate speed (distance ÷ time). Identify the fundamental quantities in the calculation of the area and the speed. Share information with class. (*Teacher should use the ensuing discussions to introduce the term derived quantity*.) Answer the following question: 1. How are derived quantities formed? 2. How are the units of derived quantities found?	Collaborate, measure, manipulate, calculate, communicate, think critically – analyse, formulate	Fundamental units correctly identified Correct calculations made
In groups, have each group member measure and record the length across a desk top using their hand-span. Compare the measurements obtained. Use rulers (each group member) to measure the length across the desk and compare results. Discuss the differences in measurement obtained from using hand-span and the ruler and suggest advantages of using the ruler. Discuss the need for standardization in measurement and present a scenario to illustrate the need. Share information with class.	Observe, collaborate, measure, manipulate, create, communicate, think critically - compare and contrast,	Scenario illustrates the need for standard measurement
Determine the number of millimetre graduations on a metre rule and answer the following questions: 1. What fraction of a metre is a millimetre? 2. What does the prefix milli mean? Repeat the exercise to determine the meaning of centi and deci.	Observe, measure, think critically - formulate	Meanings of prefixes correctly determined Quantities correctly converted

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Complete the following for each of the prefixes: Micro = $\frac{1}{1000}$ milli; micro = Kilo = 100,000 centi; kilo = Mega = 10,000,000 deci; mega = Measure the mass of a stone in grams then convert the mass to (a) milligrams (b) kilograms. Read the frequency of a radio station on a radio dial then convert the frequency to (a) Hertz (b) kilo-Hertz.		
In groups, discuss and provide an answer for the questions, "What is a graph?" and "How are graphs useful?" Share information with class. (*Teacher should emphasize that quantities have effects on each other and that a graph pictorial representation it their relationship.*) Observe as teacher demonstrates the important steps involved in plotting a graph: 1. Formulating a title for the graph 2. Labelling axes of the graph with quantities and units 3. Creating scales to ensure that more than half of the grid is used in either direction 4. Plotting points accurately 5. Representing points using a small "x" (×) or a circled dot (⊙) 6. Drawing a thin line of best fit Use the guidelines to plot graphs from data provided by the teacher.	Construct graph, communicate, collaborate Construct graph	Graphs plotted according to the standards taught
As a class, brainstorm to determine the meaning of the term 'slope'. Discuss how slope relates to graphs and the usefulness of slopes in analysing data. (Teacher should introduce the term gradient as a synonym for slope.)	Communicate, define operationally, calculate gradient	Gradient determined using the standards outlined

Suggested Teaching and Learning Activities | Key Skills | Assessment Criteria

Observe as teacher demonstrates the important steps involved in calculating gradient/slope:

1. Selecting two points on the best fit line that would create a large triangle (do not use points in the table)
2. Reading off coordinates of selected points
3. Substituting coordinates of points in equation for gradient
4. Calculating the gradient with units

Use the guidelines for calculating gradient to determine the gradient of graphs plotted earlier.

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Determine derived units
- ✔ Convert from one unit to another
- ✔ Plot graphs
- ✔ Determine gradient
- ✔ Construct and use distance-time and velocity-time to determine speed, velocity and acceleration

Points to Note

The unit of frequency on the radio dial is MHz.

For graphs, require that each student has a 30 cm transparent ruler.

Extended Learning

Find out what are the fundamental quantities used to form the derived quantities density, acceleration and force. Determine the units for density, acceleration and force

RESOURCES

Metre rule, stopwatch, balance, radio, graph paper,
30 cm transparent rulers, computer, multimedia projector

KEY VOCABULARY

Quantity, derived quantity, fundamental quantities, units, micro, milli, centi, deci, kilo, mega, standardisation

LINKS TO OTHER SUBJECTS

Mathematics – measurement, numbers, relations, functions and graphs

UNIT 1: Working like a scientist 3

Theme: Science Exploration, Application and Design Practice

Prior Learning

Check that students:

- Understand decimals and place value

ATTAINMENT TARGET(S):

- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

BENCHMARKS:

- Apply the principles of measurement in the solution of everyday problems.
- Use scientific knowledge to select appropriate experimental methods.
- Construct explanations, design and evaluate solutions to complex real-world problems, based on scientific knowledge.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate concern for the preservation of natural resources.
- Demonstrate concern for man's impact on the environment.
- Demonstrate sensitivity to others who are different.

Topic: Significant Figures and Standard Form

Duration: 5 hours/2 weeks

OBJECTIVES

Students will:

- Determine the number of significant figures in the expressed value of a quantity
- Determine the number of significant figures in a calculated value
- Express measurements and calculated values to the correct number of significant figures
- Express measurements and calculated values in standard form ($a \times 10^n$)

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: In groups, be given a small object (e.g. a rectangular block, cylinder, sphere) for which they will measure and record the same dimension using a ruler, a vernier caliper and a micrometer screw gauge. Compare the measurements obtained, identify which measurement gives more information, and justify their selection. Share information with class. As a class, discuss the term 'precision' as it relates to measurement. Complete worksheet, provided by the teacher, on identifying the most precise value. Example of worksheet questions: *Identify the most precise value in each case:* *a. 0.2 g, 1.6 g, 8.24 g, 20 g* *b. 405 m, 879 m, 879.0 m, 870 m*	Collaborate, measure, record, manipulate, compare, communicate	Measurements correctly taken. Measurement that gives most information identified Correct answer provided on precision worksheet
As a class, discuss the meaning of the term 'significant figures'. (T*eacher should emphasize that the significant figures of a number are those digits that carry meaning contributing to its precision*.) Discuss the rules for *identifying significant figures in a given number*, as provided by the teacher, and observe the examples done by the teacher. Complete teacher provided worksheet on significant figures. As a class, discuss the rules for determining significant figures in numbers obtained from calculations, as provided by the teacher, and observe the examples done by the teacher. Complete teacher provided worksheet on significant figures, or the significant figures worksheet on the e-Learning website (*http://www.cremja.net/moodle*).	Communicate, calculate, think critically – analyse, summarize	Correct answer provided on significant figures worksheet
In groups, find out the distance of the sun from the earth, in metres. Given the speed of light (in m/s) and the formula for calculating speed, determine the time it takes for light to travel from the sun to the earth, in seconds. As a class, discuss the level of difficulty in carrying out the task. Discuss the rules for expressing numbers in standard form, as provided by the teacher, and observe the examples done by the teacher.	Research, calculate, communicate, observe, collaborate, think critically – analyse Communicate	Acceptable value for distance sun from the earth given Calculation of time for light to travel from sun to earth correct

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
In groups, carry out the same task using standard form. Discuss the advantages of this method (standard form) and share with class. Complete teacher provided worksheet on standard form. (T*eacher should point out that in expressing a number in standard form, the number of significant figures should be retained.*)	Collaborate, communicate, calculate, think critically – justify	Logical advantages given for using standard form. Correct answer provided on standard form work-sheets.
Carry out similar tasks, for example finding the time for a text message to travel from Jamaica to London, performing calculations using numbers in standard form. (*Teacher should include other tasks relevant to students' experiences*.)	Calculate, communicate, think critically - analyse	Correct answer provided in standard form

Learning Outcomes

Students who demonstrate understanding can:

- Give the results of calculations to the correct number of significant figures
- Record measurements to the correct number of significant figures
- Represent numbers in standard form

Points to Note

Opportunities for adequate practice must be provided for the students. In addition to worksheets, practical activities should be devised.

Extended Learning

Develop a podcast/digital story/photo story demonstrating how significant figures are determined, giving examples.

RESOURCES

Various small objects (e.g. a rectangular block, cylinder, sphere), worksheets on significant figures and standard form

KEY VOCABULARY

Significant figures, standard form, precision

LINKS TO OTHER SUBJECTS

Mathematics – measurement, numbers

About the Unit

In this Unit, students will learn that multicellular organisms require a transport system to move substances between the cells and the environment. They will learn that humans have an elaborate transport system consisting of a pump, the heart, and a system of blood vessels – arteries, veins and capillaries – that link all the tissues of the body. Students will demonstrate the double circulation of blood around the body and the impact of exercise on the rate of flow. They will learn that, compared to humans, there are two transport systems in plants – one that transports water and mineral salts and another for manufactured food. They will investigate the pathway of water and mineral salts up the plant using herbaceous plants.

Range of Content

- A transport system is needed by multicellular organisms to move substances between the cells and the environment.
- The transport system in humans consists of the heart, blood vessels and blood.
- The heart pumps the blood around the body.
- Blood is a tissue.
- The transport system in plants consists of xylem and phloem.
- Water and mineral salts are absorbed from the soil by root hairs/roots and passed from them into the xylem to be transported up the plant to the leaves.
- Manufactured food is transported by the phloem from the leaves to parts of the plant that use or store them.

Guidance for the Teacher

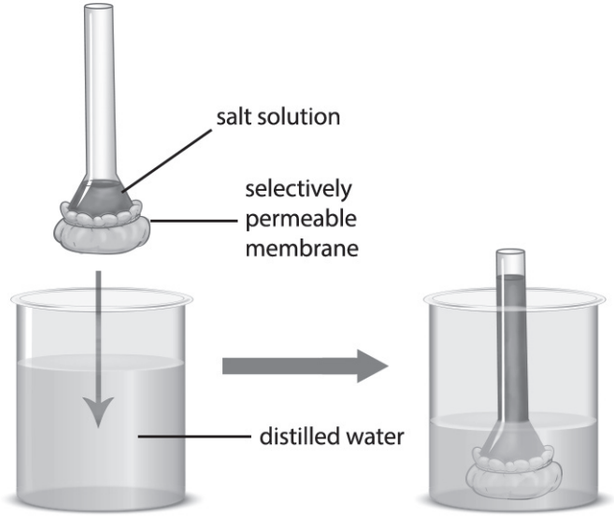
In preparing biological materials for investigation care should be exercised in the handling of knives or other cutting tools. Students should be reminded to handle eggs gently and carefully, not to eat or taste any biological sample and to wash hands immediately after handling samples. Take care to dispose of eggs and acid (HCl) safely.

Theme: Living Things, Life Processes and the Environment

Prior Learning

Check that students can:

- Recall the basic functions of the cell membrane, cytoplasm and vacuole
- Recall that the cell membrane is selectively permeable
- Explain diffusion



ATTAINMENT TARGET(S):

- Understand the importance of the life processes in plants and animals, their interdependence, their interaction with the environment, and how lifestyles determine health and well-being.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

OBJECTIVES

Students will:

- Investigate the process of osmosis
- Explain the process of osmosis
- Compare osmosis with diffusion
- Prepare biological materials for investigation
- Demonstrate interest in the outcomes of investigations
- Make predictions using scientific knowledge and understanding

BENCHMARKS:

- Demonstrate an understanding of transport systems in plants and animals.
- Apply the principles of measurement in the solution of everyday problems.
- Use scientific knowledge to select appropriate experimental methods.
- Construct explanations, design and evaluate solutions to complex real-world problems, based on scientific knowledge.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: Osmosis

Duration: 5 hours/2 weeks

ICT ATTAINMENT TARGETS:

COMMUNICATION AND COLLABORATION - Use technology to communicate ideas and information for a variety of purposes.

RESEARCH, CRITICAL THINKING, DECISION MAKING - use technology to develop a logical process for decision making and problem solving.

DESIGNING AND PRODUCING - Use technology to design and produce multimedia products to demonstrate their creative thinking.

DIGITAL CITIZENSHIP - Follow guidelines to promote healthy use of ICT tools

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: In groups, place one peg of grapefruit (or other citrus fruit) into a clean, dry, transparent plastic bag containing one tablespoon sugar or salt and shake. Place another peg of grapefruit into a similar plastic bag without sugar/salt. Leave the bags undisturbed for approximately ten (10) minutes. Observe and record what happens.	Manipulate, observe, communicate, collaborate, think critically - analyse, investigate, draw conclusions	Satisfactory handling of apparatus and materials Accurate record of observations
Share their observations with the class and suggest reasons for the changes. Guided by the teacher, relate their observations to the concept of osmosis and develop a simple definition of the process.	Define operationally	Acceptable definitions given Logical explanations given
OR		
In groups, cut a medium Irish potato in halves. Carve out a hollow in both halves of the potato. (Be careful when using sharp instruments). Cut the base of each potato cup so that it can stand on its own. Stand each potato cup in a separate dish containing the same volume of water. Place one teaspoon of brown sugar or salt into the hollow of one potato cup. Leave both potato cups for 30 minutes. Observe and record what happens.	Manipulate, observe, communicate, collaborate, think critically - investigate, analyse, draw conclusions	Satisfactory handling of apparatus and materials Accurate record of observations

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Share their observations with the class and suggest reasons for the changes. Guided by the teacher, relate their observations to the concept of osmosis and develop a simple definition of the process.	Define operationally	Acceptable definitions given Logical explanations given
Investigate the effects of pure water and strong sugar solution on raw, de-shelled chicken eggs. Make predictions about expected changes that will take place in the appearance of the eggs when submerged in pure water or in a strong sugar solution and left for some time. Take measurements of each egg – weight 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 weight and add the results to the table. Compare the eggs before and after placing in the liquids. Explain the changes observed in the eggs in terms of osmosis.	Investigate, manipulate, observe, communicate, measure, think critically – predict, analyse, interpret, draw conclusions	Accurate observations and measurements recorded in the table Results include reference to whether predictions are accepted or rejected Explanation of changes to the eggs accurately relates to process of osmosis
Construct a table to show the similarities and differences between osmosis and diffusion. Share information with the class and through a teacher led discussion, complete a combined table of these similarities and differences.	Tabulate, communicate, think critically - compare, summarise,	Table contains acceptable comparison of osmosis and diffusion Table constructed according to acceptable guidelines

Learning Outcomes

Students who demonstrate understanding can:

- Define and explain the processes of osmosis.
- Demonstrate osmosis using simple materials.
- Distinguish between osmosis and diffusion.

Points to Note

- To prepare de-shelled eggs
  The shell of the eggs can be removed by placing them in 300-500 cm^3 dilute hydrochloric acid (HCl) or vinegar (acetic acid) in a beaker/suitable container overnight or until the shell is fully dissolved. Ensure the eggs are fully submerged in the HCl or vinegar (acetic acid) (rest another small beaker of water over the eggs to prevent flotation). Carefully, using tongs/spoon, remove the eggs and rinse them several times in tap water. Dispose of the HCl safely. The eggs are now ready for use by students. Remind them to handle the eggs gently and carefully.
- Introduce the terms hypotonic, hypertonic and isotonic to explain osmosis.

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 effect of osmosis on red blood cells.

RESOURCES

Beakers or other suitable transparent plastic/glass containers, petri dishes, dilute Hydrochloric Acid, vinegar (acetic acid), eggs, Irish potato, salt, sugar, grapefruit or other citrus, plastic bags, ties

KEY VOCABULARY

Diffusion, concentration, concentration gradient, osmosis, dilute, selectively permeable, membrane, hypotonic, hypertonic, isotonic

LINKS TO OTHER SUBJECTS

Chemistry, Food and Nutrition

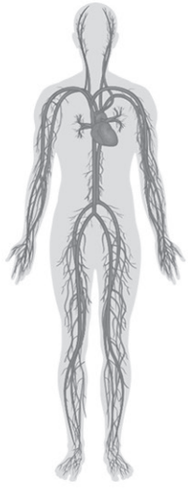
UNIT 2: Transport In Humans and Plants

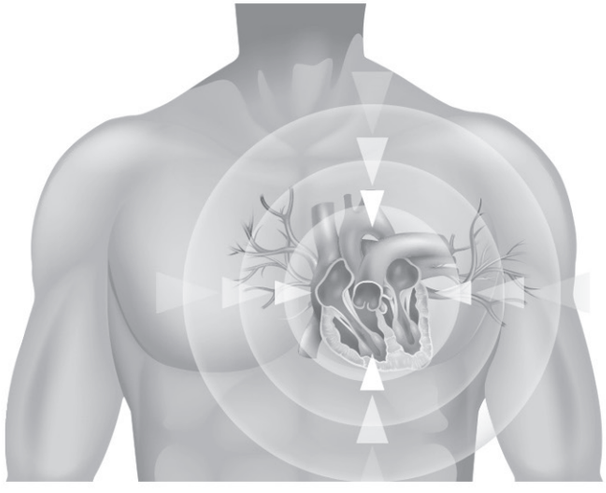
Theme: Living Things, Life Processes and the Environment

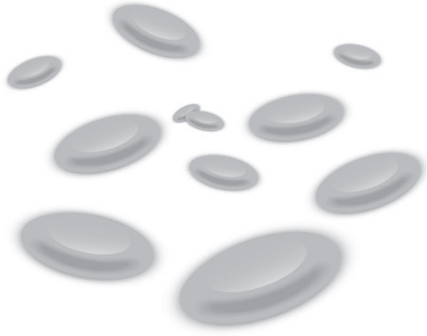
Prior Learning

Check that students can:

- Recall that the transport system is responsible for moving substances around the body of the organism
- Identify the main parts of the transport systems of humans
- Explain diffusion and osmosis







ATTAINMENT TARGET(S):

- Understand the importance of the life processes in plants and animals, their interdependence, their interaction with the environment, and how lifestyles determine health and well-being.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

OBJECTIVES

Students will:

- Investigate the need for a transport system in multicellular organisms
- Identify the types of substances which need to be transported in animals
- Annotate a simple diagram of the human heart
- Relate the basic structure of the human heart to its function
- Trace the flow of blood through the heart and around the body
- Relate the structure of arteries, veins and capillaries to their functions
- Identify the main components of blood and state their basic functions
- Use scientific vocabulary and/to articulate concepts clearly and precisely

BENCHMARKS:

- Demonstrate an understanding of transport systems in plants and animals.
- Apply the principles of measurement in the solution of everyday problems.
- Use scientific knowledge to select appropriate experimental methods.
- Construct explanations, design and evaluate solutions to complex real-world problems, based on scientific knowledge.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: Transport in Humans

Duration: 7.5 Hours/3 weeks

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, investigate how surface area influences the rate of diffusion in cubes of different sizes by carrying out the following activity. Measure the sides and calculate the surface area and volume of the cubes provided and record in a suitable table. Using forceps, place the coloured cubes into a 250 cm^3 beaker of dilute HCl and note the time. Record the time taken for each cube to become colourless. Determine the average time taken for each cube of a different size to lose its colour and plot a suitable graph of the results. As a class discuss the results and complete the lab report. (*Students are guided in identifying substances transported in animals and in inferring the need for a transport system in multicellular organisms*)	Communicate, measure, calculate, record, observe, think critically – analyse, infer, draw conclusions, construct graph,	Accurate measurements taken and recorded Correct calculations Correct relationship between surface area and rate of diffusion explained and supported by data Construction of graph adheres to principles taught Lab report adheres to the scientific method and uses scientific language to explain results
Peg or draw out a map of the human circulatory system on the school field or classroom floor. Label each area on the map. Take turns representing the blood, walk around the system explaining what happens at each point.	Collaborate, communicate, think critically – analyse, infer, draw conclusions,	Acceptable demonstration and explanation of blood flow

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Guided by the teacher, infer that the human circulatory system is a double circulation, explain why it is given this name and discuss the advantages of such a circulation. Demonstrate and explain what happens to the flow of blood if the rate of the heart beat increases.		
Annotate simple diagrams of the human heart [external features and longitudinal section (L/S)]. Examine, in groups, the external and internal features of a pig's/cow's heart and with reference to the diagrams identify the main parts.	Annotate, make observations, collaborate, think critically - compare	Appropriate labels and annotations
View a chart / video/ interactive animation on how the heart pumps blood around the body. Use arrows on their labelled diagrams (from previous activity) to indicate the flow of blood through the heart. Compare pig's/cow's and human heart.	Think critically - analyse, compare, illustrate	Arrows indicate correct flow of blood through the heart
In groups, research, plan and design models of the different types of blood vessels, using available materials. Plans should include constraints. Present designs to the class, explaining how they will represent the blood vessels. Then, refine designs based on feed-back. Construct the model using the modified designs and display in the science corner.	Collaborate, create, manipulate, communicate, think critically – analyse, evaluate, plan and design	Design plan reflects the engineering design process Constraints identified Models accurately depict blood vessels Group collaboration evident
View a prepared smear of human blood using a microscope, or a projected image or chart online/offline and, aided by the teacher, identify red and white blood cells and platelets. In groups, make models of red and white blood cells and platelets by cutting shapes from cardboard, paper, plastic, foam, modelling clay/plasticine or rubber. Develop criteria to peer assess the models. Display models in the science corner.	Observe, construct, collaborate, communicate, think critically - critique	Blood components and their functions correctly identified and represented by models Appropriate criteria developed for peer assessment

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Explain that multicellular organisms need a transport system.
- ✔ Describe the structure and functions of the human circulatory system
- ✔ Annotate a simple diagram of the human heart.
- ✔ Trace the flow of blood through the heart and around the body.

Points to Note

Teacher led discussion for activity 1 should focus on surface area: volume ratio and how this influences the rate of diffusion.

To make good solid agar, stir 2 g of plain agar powder into 100 cm^3 of water. Heat in a water bath filled with boiling water, while stirring, until the agar solution boils. Colour the agar with potassium permanganate (add a few crystals and stir until the desired colour is obtained). Pour the coloured agar into straight-sided dishes or ice cube trays then allow to cool. Cut the agar cubes for the students – 0.5 cm^3, 1.0 cm^3 and 1.5 cm^3. Provide each group with two cubes of each size.

Mammalian hearts (complete with fat and major blood vessels), obtained from freshly slaughtered pig, cattle or goat can be sourced from public health inspectors, abattoirs and markets.

Observe safety precautions when handling fresh specimens and sharp instruments. Students must wash hands using soap and water after the activity

Extended Learning

- Research selected diseases of the circulatory system and state the possible causes and preventive measures.
- Research issues relating to the use of blood transfusions in medicine (e.g. ethical, religious).
- Explore the benefits of exercise as it relates to the heart and circulatory system.
- Research legal and illegal methods of increasing red blood cell concentration to improve athletic performance.

RESOURCES

Videos, charts, posters, hearts (goat, cattle or pig), prepared blood smear slide, microscope, cardboard, foam, paper, plastic, modelling clay (e.g. Plasticine) or rubber, stop watch/clock, blunt needles (seekers), forceps, beakers, heating apparatus, agar, potassium permanganate, Hydrochloric acid, scalpel, straight sided containers or ice trays

Computers, Internet, speaker, multimedia projector, interactive video tutorials, CDs/DVDs

KEY VOCABULARY

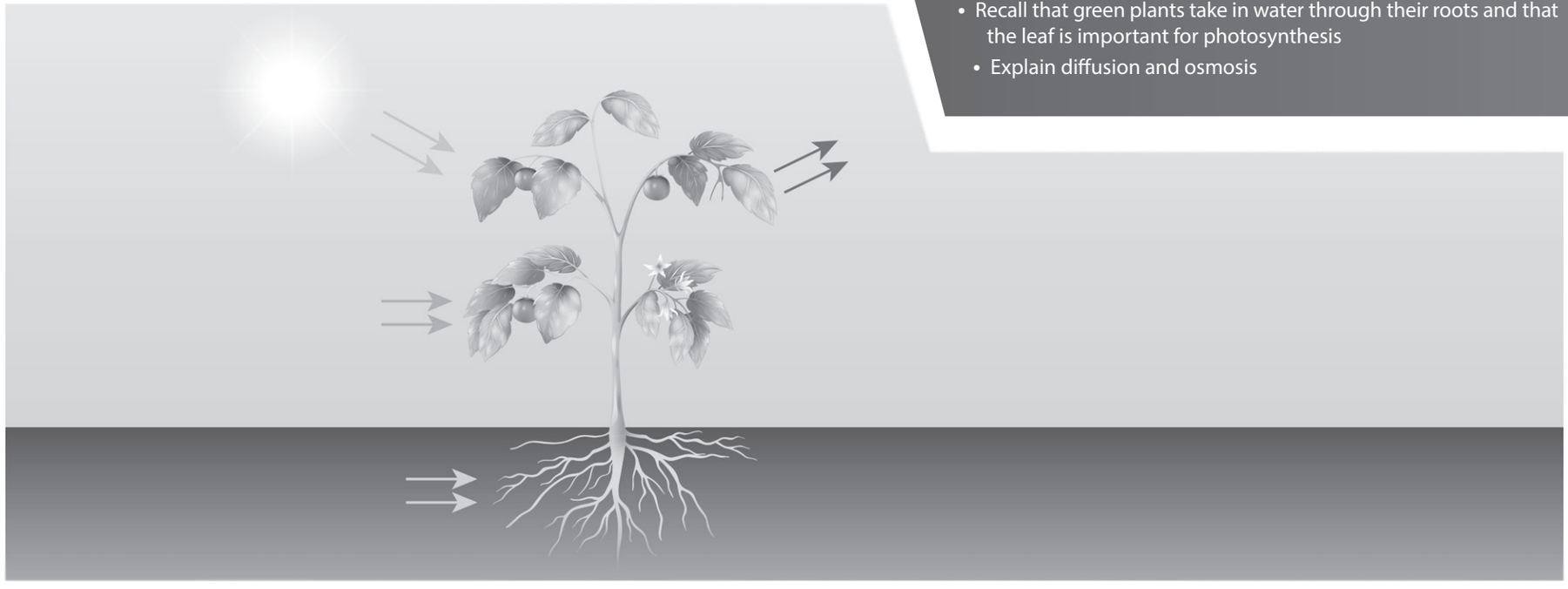
Arteries, veins, capillaries, valves, heart, lungs, blood, unicellular, multicellular, diffusion, osmosis, red blood cells, white blood cells, plasma, platelets, double circulation, transport system, haemoglobin, surface area, volume

LINKS TO OTHER SUBJECTS

Physical Education, HFLE, Mathematics (Volume and Surface area)

UNIT 2: Transport In Humans and Plants

Theme: Living Things, Life Processes and the Environment



Prior Learning

Check that students can:

- Describe the basic structure of plants, e.g. leaf, root, stem, flower
- Recall that green plants take in water through their roots and that the leaf is important for photosynthesis
- Explain diffusion and osmosis

ATTAINMENT TARGET(S):

- Understand the importance of the life processes in plants and animals, their interdependence, their interaction with the environment, and how lifestyles determine health and well-being.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

OBJECTIVES

Students will:

- Identify the substances that are transported in plants
- Describe how roots are adapted for taking in water
- Identify the location of transport tissues in a dicotyledonous plant stem and root sections
- Describe the basic functions of the xylem and phloem
- Investigate the movement of water from the soil to the leaves

BENCHMARKS:

- Demonstrate an understanding of transport systems in plants and animals.
- Apply the principles of measurement in the solution of everyday problems.
- Use scientific knowledge to select appropriate experimental methods.
- Construct explanations, design and evaluate solutions to complex real-world problems, based on scientific knowledge.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: Transport in Plants

Duration: 5 Hours/2 weeks

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, examine roots with root hairs, e.g. germinating peas or beans, or secondary sources such as prepared slides and animations, and brainstorm to identify the role of the root hairs. Share ideas with the class.	Collaborate, communicate	Acceptable role of root hairs identified
In groups, examine and record evidence of movement of a dye in plants using Balsam/'lady slipper' (*Impatiens*) plants which have been placed in the dye/food colouring for a few hours or over-night. Cut transverse sections from the stem and root of the plant and examine (using a hand lens) to show the location of the dye. View a prepared slide of the transverse section through a stem and root showing the vascular bundles and compare with the sections cut from the plant. Describe the movement of substances from the soil through the plant, and present their observations in a variety of ways. (*Teacher should emphasize that only the xylem will be stained by the dye and point out the association of the phloem with the xylem in the vascular bundle. Mention that food manufactured during photosynthesis is transported in the phloem. No further detail on the phloem is needed.*)	Observe, manipulate communicate, collaborate, think critically - investigate, analyse, draw conclusions	Accurate description of the movement of substances from the roots to the leaves Accurate record of observations

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
In groups, draw two circles on the floor or on a poster sheet (one representing the stem and the other the root). Cut 20 discs of two different colours and sizes from card or paper (10 representing xylem and 10, phloem). Arrange the discs to demonstrate how the vascular tissues in a dicotyledonous root and stem are arranged.	Think critically - create	Arrangement of vascular tissues in the dicotyledonous stem and root accurately depicted
Investigate the uptake of dye/coloured ink by white flowers by placing the freshly cut flower stalks into a beaker/glass containing the dye/ink solution. Leave for 1-2 hours and observe what happened to the white petals. Suggest an explanation for their results. Suggest how this practice could be used commercially.	Observe, communicate, collaborate, think critically - investigate, analyse, infer, draw conclusions	Accurate explanations of movement of substances

Learning Outcomes

Students who demonstrate understanding can:

- Describe the adaptations of roots for absorption of water.
- Describe the location and basic functions of the xylem and phloem.
- Describe the route taken by substances from the soil up the plant
- Communicate information using discussion forums or social network

Points to Note

Wash roots carefully before placing plant in the dye solution.

Sections of the parts of the plant may be projected for class viewing.

Extended Learning

Research the adaptations of roots and leaves of plants in different environments (aquatic– brackish/freshwater; terrestrial– typical/desert)

RESOURCES

Microscope, prepared slides/posters/ of T/S stem and root, live seedlings, video clips, measuring cylinders, beakers, paper/cards, balsam/lady slipper, dye

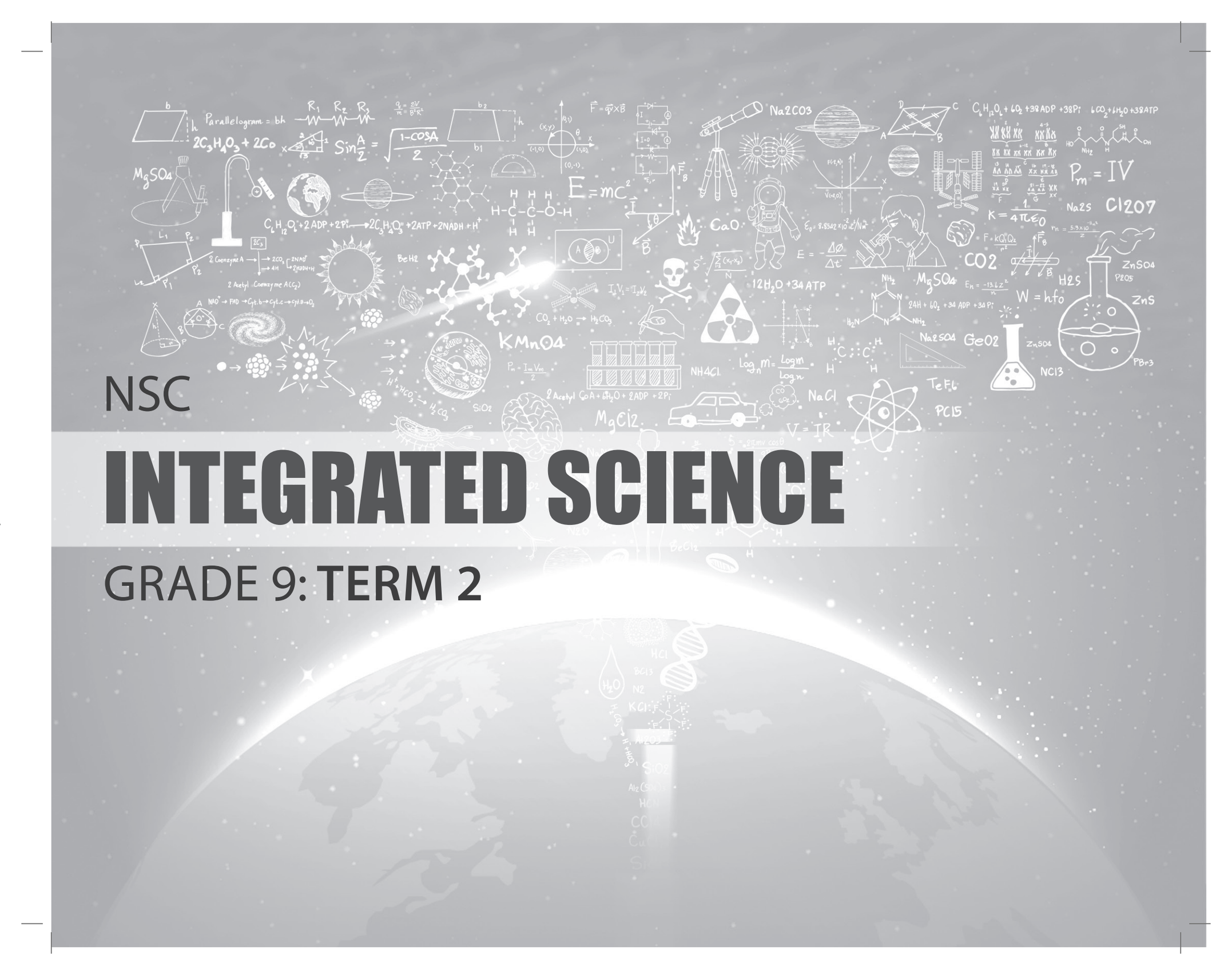
Computers, Internet, speaker, multimedia projector, interactive video

KEY VOCABULARY

xylem, phloem, vascular bundle, veins

LINKS TO OTHER SUBJECTS

Agriculture



NSC

INTEGRATED SCIENCE

GRADE 9: TERM 2

About the Unit

In this Unit, students will develop an understanding of static electricity, and the mechanism by which it is produced, through hands-on investigations. They will explore useful applications as well as dangers associated with static electricity. They will learn to construct and diagrammatically represent electric circuits. They will explore series and parallel circuits through inquiry based learning.

Students will become familiar with the properties of magnets through simple investigations, and explore the relationship between electricity and magnetism. Additionally they will investigate the relationship between voltage and current in a simple series circuit, and represent this relationship graphically.

Range of Content

- Objects can be positively charged, negatively charged or neutral (no charge).
- Matter is composed of atoms, and atoms consist of electrons (which are negatively charged), protons (which are positively charged), and neutrons (which are neutral). In their most stable state, atoms have equal numbers of electrons and protons and are therefore electrically neutral.
- Static electricity exists when there is a build-up of one type of charge on an object; i.e. there is an imbalance of positive and negative charge. A substance that gains electrons becomes negatively charged, while a substance that loses electrons becomes positively charged.
- One way of charging insulators electrostatically is by rubbing (friction). When some materials are rubbed, electrons are transferred causing a charge imbalance in both the material doing the rubbing and the material being rubbed.
- Static electricity can be very dangerous. For example, it can cause lightning, it can ignite the flammable gases thus causing explosions, and it cause electric shock to living organisms.
- Static electricity can also be very useful. For example, it is used in photocopiers and laser printers, in defibrillator machines, in electrostatic dust precipitators, in spray painting and insecticide sprays.
- An electric current is the flow of electric charge.
- Conductors are materials, e.g. metals, in which an electric current can flow freely. Insulators are materials, e.g. wood, that restrict the flow of an electric current.
- An electric circuit is a closed loop through which an electric current can continuously move. A simple circuit has conductors and a power source, however, other components such as a switch, a load (e.g. light bulb) are usually included. Circuit diagrams, or schematics, are line drawings that show how a circuit's components are connected together.
- There are two types of circuits: series and parallel. A series circuit is one that has only one path through which the electricity flows. In a parallel circuit there are more than two or more paths for electricity to travel.
- A magnet is any object that attracts iron, substances containing iron (e.g. steel), and some other metals such as nickel and cobalt.
- Magnets have north poles and south poles, which attract each other. However, two north poles will repel each other, as will two south poles. The poles of a magnet may be determined by suspending it or by using a plotting compass.
- Voltage is an electric force that causes an electric current to move around a circuit. When current flows through a conductor it creates heat because of resistance. Resistance measures how well a material or object conducts electricity. Low resistance means that an object conducts electricity well; high resistance means that an object does not conduct electricity well.
- If the voltage in a circuit is increased, then the current will increase. However, if the resistance is increased, then the current will decrease.
- When an electric current flows in a wire, it creates a magnetic field around the wire. This can be used to create an electromagnet. If the wire is wound into coils,

the electromagnet is stronger; the more turns on the coil, the stronger the electromagnet.

- An electric current is produced (induced) when a magnet is moved into a coil of wire in a circuit. The direction of the induced current is reversed when the magnet is moved out of the coil. The direction of the current will also be reversed if the other pole of the magnet is moved into the coil.

Guidance for the Teacher

Ensure that proper safety practices are followed in the use of electrical equipment and operation of electrical circuits.

UNIT 1: Electricity and Magnetism

Theme: Energy, Forces and Matter

Prior Learning

Check that students:

- Can identify electricity as a form of energy
- Know that attractive and repulsive forces occur between magnets

ATTAINMENT TARGET(S):

- Understand natural laws as they apply to motion, forces, and energy transformations.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

OBJECTIVES

Students will:

- Recall that atoms contain protons, neutrons and electrons and state their respective charges
- Investigate the production of static electricity
- Describe useful applications and hazards of static electricity
- Conduct investigations with due regard for safety
- Work cooperatively in groups

BENCHMARKS:

- Be familiar with the nature of electricity and understand the different types of electrical circuits.
- Apply the principles of measurement in the solution of everyday problems.
- Use scientific knowledge to select appropriate experimental methods.
- Construct explanations, design and evaluate solutions to complex real-world problems, based on scientific knowledge.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: Static Electricity

Duration: 5 Hours/2 weeks

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: Review the sub atomic particles and their respective charges (Protons – positive, and electrons – negative and neutrons – no charge).	Communicate	
Carry out simple static electricity activities: 1. Tear off several small bits of paper and place them on a table/ desk. Vigorously rub a dry plastic object (e.g. a pen, comb) with a dry piece of cloth/tissue paper/in hair, and then bring the plastic object near to the paper bits. Observe and record what happens. Discuss and suggest reasons for observations. Share explanations with class.	Communicate, observe, manipulate materals, record, think critically - investigate	Accurate record of observations. Suggestions logical and make reference to charges

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
2. Turn on the water so it is flowing from the tap in a narrow stream (just a few millimetres across but not droplets). Rub a plastic comb/balloon back and forth in their hair several times. Slowly move the comb or balloon towards the stream of water (without touching it) while watching closely to see what happens. Record and suggest reasons for observations. Share explanations with class.	Communicate, observe, manipulate materals, record, investigate, think critically	Accurate record of observations. Suggestions logical and make reference to charges
3. Blow up a balloon and tie it off. Rub it several times across their hair and then press it against a wall. Record what happens. Leave the balloon in place for a while. Record how long it stays when left undisturbed. Suggest reasons for observations and share explanations with class.	Communicate, observe, manipulate materals, record, investigate, think critically	Accurate record of observations. Suggestions logical and make reference to charges
After teacher guided class discussion, explain with the aid of diagrams **using multimedia presentations tool**, the charging of materials by rubbing, in terms of the transfer of charges.	Communicate, draw diagrams **Create and use multimedia to present information**	Diagrams meet criteria: neat, no shading, labels on one side Diagrams and annotations accurately depict process of charging by friction
Research/ **navigate digital content on websites and storage devices** and report on: 1. some useful applications of static electricity; 2. Some possible hazards of static electricity.	Research, report, record, interpret **Navigate and manipulate digital content**	Report reflects accurate knowledge of hazards and uses that can be applied
Research lightning and ways of reducing the dangers of lightning strikes. Create a poster/**digital story** etc. giving tips on safety practices that reduce the possibility of being struck by lightning.	Research, communicate **Create and present digital content**	

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Produce static electricity through charging by friction
- ✔ Explain how a body becomes electrostatically charged
- ✔ Cite evidence of the usefulness and dangers of static electricity
- ✔ **Plan and conduct research, using a wide variety of electronic sources e.g. Internet and storage devices e.g., CDs, DVDs, etc.**
- ✔ **Create multimedia presentations**

Points to Note	Extended Learning
Static electricity should be explained in terms of stationary charges useful application include: photocopier, dust extraction, painting car, crop spraying possible hazard include: lightning, **Create multimedia presentations which incorporate text, audio, images, videos and links to external resources to represent learning and original work** **Follow guidelines to promote healthy use of ICT tools**	Research animals that generate static electricity (e.g. Electric Eel, Electric Ray).

RESOURCES	KEY VOCABULARY
Plastic object, tissue paper, balloon, comb, computer, speakers, Internet, multimedia projector, video CDs/DVDs, multimedia and graphic software tools	static electricity, charge

LINKS TO OTHER SUBJECTS

Technical and Vocational Education

UNIT 1: Electricity and Magnetism

Theme: Energy, Forces and Matter

ATTAINMENT TARGET(S):

- Understand natural laws as they apply to motion, forces, and energy transformations.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

OBJECTIVES

Students will:

- Formulate a simple working definition for the term 'electric current'
- Classify materials/substances as insulators and conductors of electricity
- Construct simple circuits using lamps, insulated wires, dry cells, switches to distinguish between series and parallel circuits
- Draw diagrams to represent series and parallel circuits
- Conduct investigations with due regard for safety
- Work cooperatively in groups

BENCHMARKS:

- Be aware of the types of currents and understand the effects of resistance and voltage on current flow.
- Recognise the connection between electricity and magnetism.
- Be familiar with the nature of electricity and understand the different types of electrical circuits.
- Apply the principles of measurement in the solution of everyday problems.
- Use scientific knowledge to select appropriate experimental methods.
- Construct explanations, design and evaluate solutions to complex real-world problems, based on scientific knowledge.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: Current Electricity

Duration: 5 Hours/2 weeks

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 a teacher-led class discussion, review the phenomenon of lightning (Teacher should emphasize that a lightning strike is the movement of electric charges). With the aid of the teacher, derive a definition for an electric current (the movement of charges).	Communicate, operationally define, collaborate	
In groups, given each a box containing a D-cell battery, two 12-cm insulated wires, and a bulb, explore how the bulb can be made to light. Draw the setup used in their science notebook/journal. Share setup with class by drawing it on the board. Participate in teacher-led discussion to deduce the reason for the lamp lighting. Create a definition for the term circuit and discuss the connection between current and circuit.	Manipulate, draw diagrams, collaborate, communicate' think critically - investigate	The bulb is made to light. Students worked cooperatively
Brainstorm to identify switches as a means of controlling the flow of current in a circuit. Observe as teacher demonstrates how a switch is attached in a circuit. In groups, create simple circuits with switches. Demonstrate to class how the switch works in the circuit **and/or watch and manipulate online/offline interactive video tutorials on switches and circuits**. In groups, identify various devices/situations in which switches are involved in circuits. In class discussion identify/describe the use of switches in everyday electronic equipment.	Observe, manipulate, collaborate, communicate, think critically - investigate Navigate and manipulate digital content	Switch correctly attached in circuit. Switches used in everyday electronic devices correctly identified/described
In groups, investigate which material (paper, foil, cloth, aluminium, plastic, glass, water, salt water, etc.) will allow a lamp to light when used to complete a circuit. Observe and record result of the investigation in a variety of ways. Present findings to class using a multimedia presentation. Participate in teacher led discussion to deduce that some materials allow electric current to flow while others do not (here, teacher should introduce the terms conductors and insulators as relating to electrical conductivity) and/or watch and manipulate online/offline interactive video tutorials on electrical conductors and insulators	Manipulate, observe, record, draw diagrams, collaborate, communicate, think critically - classify, investigate Create multimedia presentation Conduct electronic search	Materials correctly classified as conductors and insulators

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Be given a D-cell battery, four 12-cm insulated wires, and two bulbs, explore different ways in which both bulbs can be made light and draw the arrangements, using digital drawing tool. Identify the arrangement in which one lamp will not light when the other is removed. Identify the arrangement in which one lamp will remain lit when the other is removed. In groups discuss and outline the physical differences between circuits, record and share with class . (*Here, teacher should introduce the terms series circuit – single pathway, and parallel circuit – multiple pathways.*)	Manipulate, collaborate, communicate, think critically - investigate Create digital drawings	Series arrangement constructed Parallel arrangement constructed Differences between series and parallel arrangements identified
In groups, research online/offline the circuit symbols for connecting wires, lamps, cell, battery and switch. Use the circuit symbols to represent the series and parallel circuits created in previous activity. Draw circuit diagrams using digital drawing tool with additional lamps/cells/switches (e.g. a parallel circuit with a switch in each branch). Construct the circuits drawn.	Research, collaborate, draw circuit diagrams, manipulate	Correct symbols identified for components. Circuit diagrams constructed correctly. Circuits correctly constructed based on circuit diagrams drawn
As a class, name electrical appliances that use varied electric current when operated. In groups create a simple circuit consisting of a battery and a 12 com bare wire. Place 5 ml of water in a container (e.g. a beaker) and record the temperature of the water. Place a section of the wire in the water for 10 minutes then record the temperature. Propose an explanation for observations and share with class (*teacher should emphasize that heat is a by-product of electric currents*). As a class, discuss the need for safety devices to protect humans and appliances from electrical hazards. In groups view safety devices, or online/offline videos of safety devices used to prevent/mitigate electrical hazards (e.g. fuses, insulated wires, three pin plugs and circuit breakers). Research and describe the use of fuses, insulated wires, three pin plugs and circuit breakers. Present information to the class in a variety of ways.	Communicate, manipulate, research, collaborate, think critically - investigate	Explanation of observations identify that heat is produced by electric currents Presentation contains correct information on safety devices
Examine electrical hazards and suggest ways of preventing them. In groups create multimedia presentations with a list of electrical safety rules to create awareness of need to avoid the hazards. Also use class email/wiki/blogs to collaborate and share ideas/information on how to prevent electrical hazards	Communicate, formulating models, collaborate Collaborate and communicate using class email/wiki and blogs	List comprises of at least six logical electrical safety rules

Learning Outcomes

Students who demonstrate understanding can:

- Construct and diagrammatically represent series and parallel circuits
- Explain the meaning of the terms circuit and current
- Differentiate between conductors and insulators
- Create and manipulate multimedia presentation to communicate information
- Manipulate digital content from a variety technological devices
- Collaborate and communicate ideas and information through file sharing using class email/wiki and blogs

Points to Note

Teacher should guide students in the construction of the series and parallel circuits and the differences between both series and parallel circuit connections in terms of current flow and pathway (series- all the current flows in the one path, parallel- current splits between the various paths)

Student would be guided to collaborate through file sharing (e.g., upload/download)

Extended Learning

Identify applications of series and parallel circuits in the home (e.g. Christmas lights, house wiring)

Research the operation and application of fuses

Identify and list safety devices and hazards in the home and suggest ways in which you can make your home safer.

Highlight the dangers involved in the practice of illegal electrical connections

RESOURCES

Paper, foil, cloth, aluminium, plastic, glass, water, salt water, bulb, socket, insulating wires, switch, textbook, fuses, insulated wires, three pin plug, circuit breaker

computer, speakers, Internet, multimedia projector, video CDs/ DVDs, multimedia and graphic software tools

KEY VOCABULARY

Insulator, conductor, current, circuit, series, parallel, battery, switch, cell, wire, fuses, insulated wires, three pin plug, circuit breaker, electrical hazards

LINKS TO OTHER SUBJECTS

Technical and Vocational Education

UNIT 1: Electricity and Magnetism

Theme: Energy, Forces and Matter

ATTAINMENT TARGET(S):

- Understand natural laws as they apply to motion, forces, and energy transformations.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

OBJECTIVES

Students will:

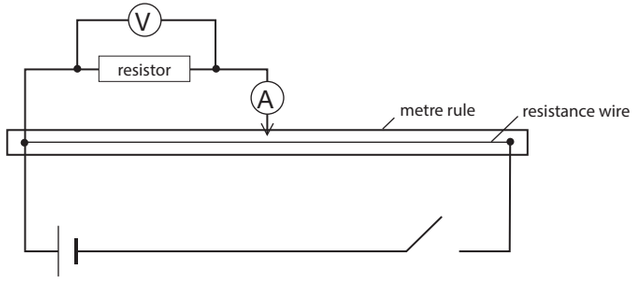
- Perform simple activities to identify the poles of a bar magnet
- Demonstrate that unlike poles attract and like poles repel
- Investigate the relationship between voltage (V) and current (I) in a simple series circuit
- Construct an electromagnet
- Investigate the properties of an induced current
- Conduct investigations with due regard for safety
- Work cooperatively in groups

BENCHMARKS:

- Be familiar with the nature of electricity and understand the different types of electrical circuits.
- Apply the principles of measurement in the solution of everyday problems.
- Use scientific knowledge to select appropriate experimental methods.
- Construct explanations, design and evaluate solutions to complex real-world problems, based on scientific knowledge.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: Electromagnets

Duration: 5 Hours/2 weeks

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Be provided with a magnet and various materials (including iron, iron alloys, non-magnetic materials etc.). In groups carry out an investigation to determine which of the materials are attracted by the magnet. Record results in a tabular form and share with class.	Observe, record, communicate, think critically - investigate	Materials correctly classified as magnetic and non-magnetic
In groups, use a string to suspend a bar magnet and allow it to swing freely until it comes to rest. Record the direction in which the magnet comes to rest and share with class. (*Based on discussions, teacher should introduce the concepts of magnetic North-pole and South-pole.*)	Observe, manipulate materials, think critically - investigate	North-South correctly identified as the direction which the magnets comes to rest
Place a magnet on a table and bring the like pole of another magnet towards it. Record observations. Repeat the process bringing the opposite pole towards the magnet on the table and record observations. Complete the following statements: 1. like poles of magnets _____ 2. unlike poles of magnets_____	Observe, manipulate materials, think critically - infer, investigate	Statements correctly completed
Be given a dry cell 1.5 V, a one metre long resistance wire (e.g. constantan), three connecting wires, two thumb tacks and a metre rule. In groups, attach the wire along the metre rule and secure its ends with the thumb tacks, leaving one centimetre at each end for connections. Use the components provided to connect the circuit in the diagram below. Use the voltmeter to measure the voltage (V) across various lengths in order to obtain at least six readings. Set the length of wire, close the switch, take voltmeter and ammeter readings. Tabulate the results. Individually, plot a graph of voltage against resistance and draw a line of best fit through the points. Based on the graph, identify the relationship between voltage and current.  	Manipulate materials, measure, think critically - investigate, interpret	Circuit correctly connected. Recorded values of voltages in table within reasonable limits of error from theoretical values Graph has title Axes of graph labelled with quantities and units Voltage (y-axis) and resistance (x-axis) Scales more than half length of grid Points plotted accurately Points represented using small "x" (×) or circled dot (⊙). Line of best fit drawn with thin line Large triangle for selecting points to calculate gradient Points on best fit line selected Read off coordinates of selected points correctly Relationship between voltage and current correctly identified

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
In groups, close wrap a 80 cm length connecting wire around a 8cm (3 inches) nail and try to take up small paper clip. Connect the ends of the wire to a 1.5V dry cell and try to take up the paper clip again. Record and explain observations.	Manipulate materials, measure, think critically - investigate, infer	Logical explanation proposed for observation
In groups, close wrap the 80 cm length connecting wire around a 2.5cm (1 inch) PVC pipe and slide the PVC pipe from between the wire so that the wire retains its helical form. Connect the ends of the wire to a voltmeter in the microvolt range or an ammeter in the microampere range. Insert one end of a strong bar magnet into the middle of the wire coil and rapidly withdraw it. Note what happens to the scale reading on the voltmeter/ammeter. Repeat the exercise with the other end of the bar magnet being inserted into the middle of the coil and withdrawn. State whether the voltmeter/ammeter showed a scale reading when the magnet was stationary in between the coil. State whether the voltmeter/ammeter showed a scale reading when the magnet was withdrawn from between the coil. Answer the following questions 1. What does a scale reading on the voltmeter/ammeter suggest? 2. What can you conclude from the results of the exercise?	Manipulate materials, measure, think critically - infer	Correct answers to questions

Learning Outcomes

Students who demonstrate understanding can:

- Locate the poles of a bar magnet
- use instruments to measure voltage and current accurately
- Demonstrate the relationship between electric current and magnetic effect
- Make an electromagnet
- Demonstrate some properties of an induced current

Points to Note	Extended Learning
Emphasize that magnets does not attract all metals Constantly remind student to open circuit when they are not in use.	Research on the uses of magnets in everyday activities and state how it affects our lives. Research on the effect of the speed at which the magnet is moved relative to the coil on the voltage/ current generated. Research on the current conducted with different soil types (clay, sand and loam) and different conditions (wet soil and dry soil). Design a simple device that uses an electromagnet

RESOURCES

Short pieces of connecting wire, 80 cm length connecting wire, resistors, voltmeter, ammeter, switch, cell, short length of one inch PVC pipe, strong bar magnet.

KEY VOCABULARY

Voltmeter, resistor, ammeter, voltage, ohms

LINKS TO OTHER SUBJECTS

Mathematics – measurement; relations, functions and graphs

Technical Vocational Education

About the Unit

In this Unit, students will explore the electronic configuration of the first twenty elements and use the need for stability to demonstrate the formation of ionic bonds. They will participate in various activities aimed at helping them understand how chemical formulae are written. Students will also learn how to write chemical equations through the use of innovative activities and laboratory investigations.

Range of Content

- In an atom, the mass (nucleon) number is the sum of protons and neutrons while the atomic number is the number of protons.
- Electronic configuration describes the arrangement of electrons in energy levels (shells). There are a maximum number of electrons that each energy level can hold.
- Atoms bond to achieve stability. In ionic bonding atoms transfer electrons: one atom loses and the other gains electrons.
- The number of protons and electrons are equal in a neutral atom. Ions are formed when an atom loses (cations) or gains (anions) electrons.
- Ionic compounds are soluble in water, conduct electricity (in aqueous or molten state) and have high melting points.
- A chemical formula shows the composition of atoms (elements) in a substance (compound). By using the charges (valencies) of ions, the chemical formulae of ionic compounds can be determined.
- A chemical equation shows the reactants and products in a chemical reaction. When an equation is balanced, equal numbers of each atom (element) appear on both sides of the equation along with the respective state symbols.
- The main types of chemical reactions are oxidation, combustion, synthesis, decomposition and displacement. In exothermic reactions heat is given off and heat is absorbed from the surroundings in endothermic reactions.

Guidance for the Teacher

- The Law of Conservation of mass/matter states that matter cannot be created or destroyed.
- In the activity relating to the Law of Conservation, avoid using chemical reagents that will react to produce a gas or gases. This is for two reasons, firstly, if students are working with sealed jars the pressure build-up from the gas can cause explosions and secondly, if the gas escapes the students' final reading could be affected.

UNIT 2: Chemical Bonding, Formulae and Equations

Theme: Energy, Forces and Matter

ATTAINMENT TARGET(S):

- Understand the existence of materials such as solids, liquids and gases, the particulate nature of matter, and simple chemical reactions that change one material into another.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

BENCHMARKS:

- Understand and apply the law of conservation of mass.
- Understand how substances can be classified by their chemical nature and how this relates to the way they react.
- Apply the principles of measurement in the solution of everyday problems.
- Use scientific knowledge to select appropriate experimental methods.
- Construct explanations, design and evaluate solutions to complex real-world problems, based on scientific knowledge.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: Formulae and Equations

Duration: 12.5 hours/5 weeks

Prior Learning

Check that students can:

- State the first 20 elements of the Periodic Table and their symbols
- State that compounds are formed from the combination of two or more different atoms
- Know the difference between atoms and ions

OBJECTIVES

Students will:

- Recall the symbols of the first twenty elements
- Calculate the number of each sub-atomic particle present in an atom/ ion
- Deduce the pattern for determining electronic configuration of first 20 elements
- Use the Octet Rule to explain why atoms bond
- Draw dot and cross diagrams to represent ionic bonding
- Formulate working definitions for ions, cation, anion and ionic bonding
- Investigate physical properties of ionic compounds
- Write the formulae of simple binary compounds using symbols and valencies
- Translate word equations for simple chemical reactions into symbol equation.
- Investigate main types of reactions
- Cite examples of exothermic and endothermic reactions
- State and apply the Law of Mass conservation to writing balanced equations
- Investigate the Law of Conservation of Mass using precipitation reactions
- Construct balanced symbol and ionic equations from given information
- Use appropriate scientific language
- Make sure they are working safely

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Students will: Read handout/textbooks (online/offline) on the atomic/proton number and mass number of an atom. Use the formula A = Z + N (where A – Mass number, Z – proton number and N – number of neutron) to calculate the number of sub-atomic particles in selected atoms. Use the idea of balancing charges to determine the number of electrons. Discuss and complete worksheet given.	Calculate, communicate, think critically – analyse, infer, draw conclusions	Sub-atomic particles correctly calculated Logical inference made about number of electrons Worksheet completed
Play online interactive games on electron configuration and deduce the trend in adding electrons to an atom. Or In groups, view completed electron shell diagrams of selected atoms and deduce the maximum number of electrons that can be added to each shell. Present deductions to the class.(Guide students to appreciate that the distribution of electrons in shells/energy level follows a pattern/rule).	Observe, communicate, collaborate, think critically – analyse, infer, draw conclusions	Electron configuration trend correctly deduced Logical conclusions made
View a diagram of an atom without any electrons (nucleus and shells only) and place electrons correctly in shells/energy levels. Complete electron shell diagrams for the first 20 elements.	Record, calculate, think critically - analyse	Electron shell diagrams for first 20 elements correctly done
Determine the electronic configuration of selected atoms. Place the element/ atom on the Periodic Table. Note the position and group number of the atom on the Periodic Table. Compare the number of outer shell electrons and the group number and determine the relationship between the two. Discuss with the class.	Calculate, classify, communicate, think critically – analyse, infer, formulate	Element/ atom correctly placed Accurate electronic configuration Relationship between outer shell electrons and group number correctly deduced
In groups, students will compare the electronic configuration of two metals, two non-metals and two noble gases (avoid the element H). Participate in a teacher- led discussion to infer that an octet of electrons (or duplet in Helium) implies stability.	Compare and contrast, communicate, collaborate, think critically – calculate, infer	Infer that stability is a function of the number of valence electrons in an atom.

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
In groups, discuss how they think given pairs of atoms may combine in order to attain stability and share their responses with class. Calculate the changes in the number of sub-atomic particles. Discuss what happens when the atoms gain or lose electrons. (The terms ions, cations, anions and ionic bonds should be introduced at this point). Formulate working definitions for ions, cations, anions and ionic bond. Complete worksheet to show the ions formed when selected atoms gain or lose electrons. Use dot and cross diagrams to show how atoms can combine in order to have a noble gas structure by transfer of electrons.	Draw, collaborate, communicate, calculate, create, think critically – analyse, infer, draw conclusions, define operationally	Diagrams correctly drawn to show transfer of electrons Changes in number of sub-atomic particles accurately calculated Logical conclusions drawn Working definitions are accurate Worksheet is completed with accurate information
Perform experimental activities to investigate the physical properties of ionic compounds with regards to melting, electrical conductivity and solubility (in water). 1. In groups collect materials for setting up a simple electrical circuit and assemble according to instructional sheet information. Test the conductivity of table salt and record information. Explain your observation. 2. In groups, add a few grams of table salt to a test tube of water. Note and explain observations. 3. In groups, place a few grams of table salt in a combustion spoon. Place in the hottest part of the flame. Record and explain observations.	Observe, record, manipulate, communicate, collaborate, think critically – analyse, draw conclusions	Successfully set up circuit Provide plausible explanations for their observations
In groups, select from a set of flash cards with the names of simple ionic compounds sodium chloride, calcium fluoride and magnesium oxide. Determine the ions (with charges) present in the compounds. Formulate the chemical formulae of these compounds by adding the integers (charges) to get zero, forming a neutral compound. Share their answers with the class and participate in discussion. Students will use the charges on the ions to assign the valency of the element.	Collaborate, communicate think critically – analyse, calculate, formulate, infer,	Correct formula given Correct valency given
In groups participate in teacher guided instructions on how to write the formula of simple binary compounds including the 'swap' method (which uses the valency or combination power). *Swap method should only be used to reinforce and not to teach the concept initially. (Teacher must guide students to the use of subscripts in formulae and that the overall charge on a compound is zero)*	Collaborate, communicate, think critically – analyse, formulate	Formulae correctly written with subscripts where necessary

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
In groups, view a chart/handout of common ions and engage in an activity to write the formulae of ionic compounds (using one-atom ions). Complete worksheet on formation of binary compounds	Collaborate, communicate, think critically– analyse, formulate,	Correct formula on completed worksheet
In groups, select two cards one from each colour and complete the following chart for the compound formed between the two ions selected. (Cards are pre-organised into two different colours, one with positive ions and the other with negative ions).	Collaborate, think critically– analyse, formulate	Table correctly completed, neatly drawn up
In groups, construct models of the substances for which the chemical formulae was determined previously and present to the class.	Collaborate, create, communicate, think critically - analyse, formulate	Model correctly represents the structure of the compound
In groups, given examples of common chemical reactions, students will make observations noting the reactants and products. Students will participate in teacher-led discussions to formulate word and symbol equations for the chosen reactions.	Make observations, communicate, collaborate, think critically – analyse, formulate	Accurate observations noted Correct word and symbol equations
Combustion Reaction View **online or** teacher demonstration of the reaction of burning magnesium in air or a pinhead portion of sodium metal in water and write the word equations for the reactions. (Concept of energy loss (heat) from exothermic reactions should be mentioned where applicable)	Make observations, collaborate, communicate, think critically– analyse, formulate,	Accurate observations noted Correct word and symbol equations
Participate in brief teacher-led discussion on how to represent chemical reactions with equations. Identify reagents, products and yield arrow in sample equations. Write chemical equation for the reaction.		

Positive ion	# of electrons lost	Negative ion	# of electrons gained	Formula of compound	Name of compound
Ca^{2+}	2	F-	1	CaF_2	Calcium fluoride

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
Oxidation View online or burn a piece of carbon over a Bunsen flame and write the word and symbol equations for this reaction.	Communicate, manipulate, make observations, collaborate, think critically – analyse, formulate ,	Accurate observations noted Correct word and symbol equations
Decomposition (thermal) View online or heat copper or calcium carbonate over a Bunsen flame. Test the gas produced. Determine the reactants and products and formulate word and symbol equations.	Communicate, manipulate, make observations, collaborate, think critically – analyse, formulate ,	Accurate observations noted Correct word and symbol equations
Displacement View online or add a small quantity of zinc (granulated) to copper sulphate solution in a test tube. Shake and observe after a few minutes. Formulate word and symbol equations for the reaction. (*Any loss of energy as heat should be noted and used to highlight exothermic reactions*) Or Add a few cm^3 of a soluble salt solution A (e.g. barium chloride) to a test tube containing a second soluble salt solution B (e.g. zinc sulphate). Record observations. Write word and symbol equations. *Activity can also be used to introduce writing of ionic equations.*	Communicate, manipulate, make observations, collaborate, think critically – analyse, formulate , Communicate, manipulate, make observations, collaborate, think critically – analyse, formulate ,	Accurate observations noted Correct word and symbol equations Accurate observations noted Correct word and symbol equations
Synthesis Recall the reaction of iron and sulphur heated to produce iron sulphide (Elements Mixtures and Compounds, Grade 8) or demonstrate the reaction again. Observe and formulate word and symbol equations. ***Concept of endothermic reactions (energy taken in from the surroundings resulting in reaction vessel becoming cold) can be introduced by dissolving a few grams of potassium nitrate or ammonium chloride in water.***	Communicate, manipulate, make observations, collaborate, think critically – analyse, formulate ,	Accurate observations noted Correct word and symbol equations

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
In groups carry out the following activity 1. Determine the mass of an empty measuring cylinder 2. Measure 10 cm^3 of soluble salt solution A (e.g. lead nitrate) and record the mass of the solution. 3. Measure 10 cm^3 of soluble salt solution B (e.g. potassium iodide) in a second measuring cylinder and record the mass. 4. Pour solution A into solution B. Observe and record the new mass. 5. Calculate the mass of reactants and products. 6. Write the equation for the reaction.	Make observations, collaborate, communicate, manipulate, think critically – analyse, formulate ,	Accurate observations noted Correct word and symbol equations
Discuss what information can be had by taking the mass before and after the mixing and share ideas with the class. (Teacher leads students to conclude that mass before reaction is the same as mass after – Law of conservation of mass). Balance the equation for the reaction with teachers' assistance.	Communicate, collaborate, think critically – analyse, formulate, infer,	Law of Conservation of Mass correctly stated Balanced equation given
In groups, collect a set of index cards with information for a given chemical reaction and complete the following activity. 1. Use the set of index cards to replicate the chemical equation onto work desk. 2. Label the reactant side and the product side. **Create an appropriately labelled table and record the following information:** 3. Identify the elements on the reactant side. 4. Count the number of atoms for each element. 5. Identify the elements on the product side. 6. Count the number of atoms for each element on the product side. 7. Are the 2 sides equal? If not, the equation is not balanced. 8. Insert the whole numbers (**coefficients**) before given chemical formulae. ***They can ONLY be placed in front of the elements. You cannot change the subscripts in any of the formulae.*** 9. Choose an element that is not balanced and add numbers before the formulae until the number of atoms of the element are equal on both sides of the equation.	Collaborate, communicate, think critically – analyse, formulate, calculate	Balanced equation given

Suggested Teaching and Learning Activities

10. Continue until you have worked through all the elements.
11. Once they are balanced, count the final number of Reactants and Products.
12. Write the balanced equation.
13. Can your equation be simplified?
14. Exchange their set of index cards with another group and repeat the activity

View video and engage in computer simulation/web quest on writing chemical formulae and balancing equations and complete the activities given.

Collaborate, communicate, think critically – analyse, formulate

Self-evaluate using computer program

Learning Outcomes

Students who demonstrate understanding can:

- ✔ Construct electron shell diagrams for the first 20 elements
- ✔ Show how ions are formed from loss or gain of electrons
- ✔ Use diagrams to represent ionic bonding
- ✔ Write the chemical formulae binary compounds using valencies
- ✔ Write word and chemical equations for simple reactions
- ✔ State the Law of Conservation of Mass
- ✔ Balance given chemical equations
- ✔ Work cooperatively in groups

Points to Note

- ✔ The focus is on writing the formula binary of compounds only. Compounds formed from polyatomic ions can be derived once formation of binary compounds is fully understood
- ✔ Teachers must use simple chemical equations such as reactions of metals with oxygen, acids; simple non-metals such as hydrogen and chlorine and oxygen.
- ✔ Preparation of index cards can be very tedious and hence students' assistance maybe secured in preparing cards well before time.

Extended Learning

Derive the formula of compounds from polyatomic ions or radicals.

Research other reaction types; redox and neutralization reactions

- The concepts of endothermic and exothermic reactions are only being introduced for reactions where there is a noted change in temperature.
- Teacher may treat the concept of exothermic and endothermic reactions, for all reactions.

RESOURCES

Periodic Table, sets of colour coded cards with anions and cations, flashcards with formulae of ionic and covalent compounds, cards with different parts of chemical equations (coefficient, formula of reagents and products etc), handouts with rules for writing formula and balancing equations, beakers, magnesium ribbon, sodium metal, barium chloride, zinc sulphate or other reagents that will react to form precipitates, potassium nitrate, ammonium chloride, iron, sulpur, copper carbonate, calcium carbonate, carbon, zinc, copper sulphate

KEY VOCABULARY

Symbols, chemical formulae, valency, chemical equations, reactants, products, coefficient, ionic equation, Law of conservation of mass, balanced, word equation, ions, cations, anions, ionic bonding, electronic configuration, mass number, atomic number, combustion, oxidation, decomposition, displacement

LINKS TO OTHER SUBJECTS

Mathematics (Equations)
Physics (Conservation of Energy)

NSC

INTEGRATED SCIENCE

GRADE 9: TERM 3

About the Unit

In this Unit, students will learn about the importance of the body's ability to respond to external and internal stimuli. They will investigate a range of stimuli to identify the specific receptors/sense organs which detect them. They will learn that the brain and spinal cord constitute the central nervous system which coordinates all responses to stimuli. They will learn about the main parts of the brain and their basic functions. They will also appreciate that many processes in the body are controlled by chemical regulators called hormones and identify the location and specific functions of selected endocrine glands.

Range of Content

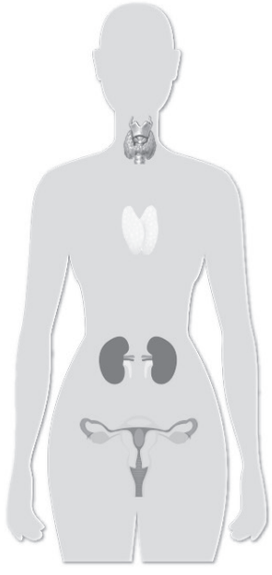
- The nervous and endocrine systems enable us to respond to changes in the external and internal environment
- A variety of specific receptor cells detect stimuli in the environment and pass the information to the Central Nervous System (CNS)
- The CNS receives and sends information via nerve cells/neurones as it coordinates all the body's responses to stimuli
- Reflex actions are rapid, automatic responses to stimuli
- Hormones are chemical substances secreted by endocrine/ductless glands and are transported in the blood to the parts of the body where they work
- Hormones regulate the functions of many organs and cells.

Guidance for the Teacher

Preview all videos to ensure they are appropriate in addressing the learning objectives.

UNIT 1: Sensitivity and Coordination

Theme: Living Things, Life Processes and the Environment



Prior Learning

Check that students can:

- Recall the definition of hormones
- Identify the sense organs of humans and the stimuli to which they respond

ATTAINMENT TARGET(S):

- Understand the importance of the life processes in plants and animals, their interdependence, their interaction with the environment, and how lifestyles determine health and well-being.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

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
- Name the main parts of the human brain and state their basic functions
- Differentiate between voluntary and involuntary /reflex actions
- Explain the importance of reflex actions using examples
- Describe the endocrine system as consisting of ductless glands that respond to internal stimuli by producing hormones
- Identify selected endocrine glands, their location, the hormones they produce and their importance in maintaining the internal environment
- Compare the nervous system with the endocrine system
- Use appropriate scientific language to describe features of the nervous and endocrine systems

BENCHMARKS:

- Understand the role of the key organs and systems in humans and animals in sensing and responding to the environment.
- Apply the principles of measurement in the solution of everyday problems.
- Use scientific knowledge to select appropriate experimental methods.
- Construct explanations, design and evaluate solutions to complex real-world problems, based on scientific knowledge.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate care and concern for living things and the environment.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate concern for the preservation of natural resources.
- Demonstrate concern for man's impact on the environment.
- Demonstrate sensitivity to others who are different.

Topic: Sensitivity and Coordination

Duration: 10 Hours/4 weeks

ICT ATTAINMENT TARGETS:

COMMUNICATION AND COLLABORATION - Students use technology to communicate ideas and information, and work collaboratively to support individual needs and contribute 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: View a video on the human nervous system. Participate in teacher led discussion to highlight the importance of responding to changes in the environment and identify the role the nervous system plays.	Communicate, collaborate, think critically - infer	Role of nervous system in responding to changes in environment identified
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.	Collaborate, define operationally, communicate, tabulate	Acceptable definitions given Accurate information linking sense organs to functions Acceptable presentation of table
View diagram / picture / video or examine a model of the human brain then label the main parts on a teacher prepared hand out. Construct a table to show the parts identified and their functions.	Label diagrams, tabulate	Diagram accurately labelled Acceptable presentation of table with accurate information
Participate in a teacher-led discussion then formulate a definition of involuntary /reflex actions. 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.	Define operationally, collaborate, communicate, think critically - infer, classify	Acceptable definition of reflex actions given Voluntary and involuntary actions correctly identified Acceptable benefits of reflex actions identified
Work in pairs to demonstrate some reflex actions identified in the previous activity (e.g. blinking, knee jerk, pupil reflex etc.) then in a teacher led discussion, identify the common features involved in the reflex actions and the role each plays.	Collaborate, communicate, think critically - analyse	Acceptable identification of common features involved in the selected reflex actions
Work in groups to compare their reaction times. Hold ruler with fore finger and thumb. On a signal given by group leader, release ruler and try to grasp it with fingers before it hits the surface. Record the time taken to catch the ruler. Perform the activity two more times. Tabulate the results and calculate the average reaction time. Repeat the activity to determine the average reaction time for each member of the group. Plot a suitable graph (reaction time/ students) using the group results. Share data with the class and compare reaction times of the students and discuss reasons for any differences. Use interactive online reaction time monitor and compare values. *https://faculty.washington.edu/chudler/java/redgreen.html*	Collaborate, manipulate, communicate, tabulate, construct graph, think critically - analyse and interpret data, draw conclusions	Accurate presentation of data in table and graph Acceptable comparisons of response times Acceptable interpretation of the variation in reaction times Graph constructed according to guidelines

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
View video/power point presentation/poster or chart of the human endocrine system showing selected glands (pituitary, thyroid, adrenal, pancreas, ovaries, and testes) and in teacher led discussion identify the glands, their location, the hormones that they produce and their effects on the body. Record the information in a suitable table. Annotate a blank diagram prepared by the teacher.	Collaborate, communicate, tabulate, annotate	Acceptable presentation of table with accurate information Accurate annotation of diagram
In groups, compare the nervous and endocrine systems and share findings with the class. Summarise the information presented.	Collaborate, communicate, think critically - analyse, compare, draw conclusions	Accurate information presented in summary Comparisons are supported by accurate information

Learning Outcomes

Students who demonstrate understanding can:

- Explain the role of sense organs in providing information on the external environment.
- Describe the central nervous system as comprising the brain and spinal cord.
- Identify the main parts of the brain and state their functions.
- Distinguish between voluntary and involuntary/reflex actions.
- Explain the importance of reflex actions using examples.
- Describe the endocrine system as consisting of ductless glands that respond to internal stimuli by producing hormones.
- Identify selected endocrine glands, their location, secretions and roles.
- Use appropriate scientific language to describe features of the nervous and endocrine systems

Points to Note

Components of reflex action to include – parts that detect stimuli and parts that carry out responses. Details of components of reflex arc not required.

Parts of the brain to include (cerebrum, cerebellum, medulla oblongata, pituitary gland)

Endocrine glands to include (pituitary, pancreas, ovaries, testes, thyroid, and adrenal)

Extended Learning

Research and report on the effects of the malfunction of selected endocrine glands (e.g. thyroids, pancreas), the diseases which may develop and the methods of treatment available.

Research the work of Pavlov and his dogs in the context of the reflex action.

RESOURCES

Charts, posters, videos, PowerPoint presentations on the nervous and endocrine systems; hand-outs and worksheets; stop watch, rulers

KEY VOCABULARY

Hormones, receptor, stimulus, spinal cord, brain, medulla oblongata, cerebrum, cerebellum, sense organ, pancreas, insulin, thyroid, pituitary, adrenal, adrenaline, thyroxin(e), voluntary , involuntary , reflex action , reflex arc, response, nerves, nervous system, central nervous system, endocrine, ductless gland.

LINKS TO OTHER SUBJECTS

Physical Education

About the Unit

In this Unit, students will engage in activities to classify substances in their environment as acids and alkalis using different indicators and the pH scale. They will investigate reactions of acids and alkalis and represent these in balanced equations. Students will also investigate salts; their classification and preparation and note examples of neutralization reactions in daily life.

Range of Content

- Acids have a sour taste and turn blue litmus red.
- Alkalis are soluble bases, have a soapy feel and turn red litmus blue.
- During neutralization reactions, acids and bases completely react to form neutral solutions.
- Indicators (e.g. litmus and universal indicator) are substances which change colour in acids and alkalis.
- The pH scale measures the acidity and alkalinity of a substance and runs from 0 to 14 - with acids less than 7, alkalis greater than 7 and neutral solutions at 7.
- Acids react with bases, metals and carbonates to produce salts. Bases react with ammonium salts to produce ammonia, an alkaline gas.
- Gases produced during acid reactions include hydrogen (which burns with a 'pop') and carbon dioxide (which turns lime water cloudy)
- Salts can be classified as soluble or insoluble. Insoluble salts can be prepared by precipitation – mixing two soluble salts.
- Neutralization reactions in daily life include using bicarbonate of soda toothpaste, antacids and baking power in cake making.

Guidance for the Teacher

- Proper laboratory safety procedures should be stressed at all times.
- The tasting of all chemicals is prohibited, especially some household chemicals which can be corrosive.
- The unit should be used to reinforce concepts of writing and balancing equations for all reactions of acids and bases that are demonstrated.

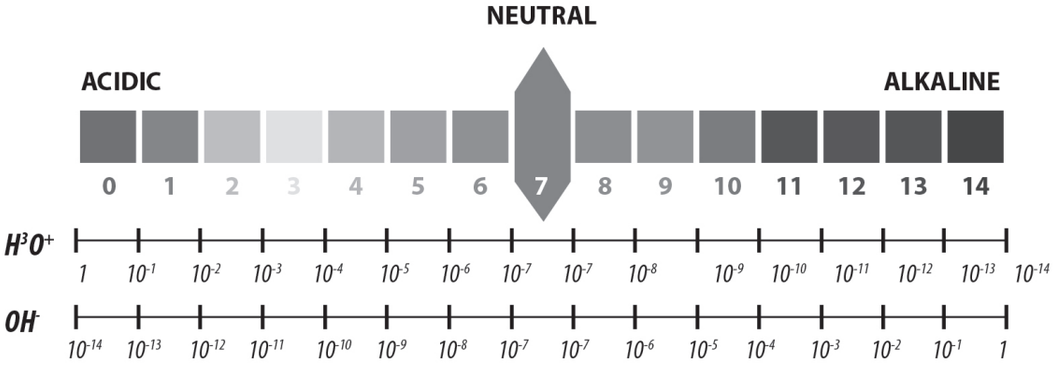
UNIT 2: Acids and Alkalis

Theme: Energy, Forces and Matter

Prior Learning

Check that students can:

- Classify materials based on identified properties



ATTAINMENT TARGET(S):

- Apply scientific knowledge and processes to the solution of real world problems.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

OBJECTIVES

Students will:

- State that compounds can be classified as acids and alkalis
- Identify common acids, alkalis and salts
- Interpret the pH scale
- Use pH paper and universal indicator solutions to determine pH of different substances
- Show that acid-base indicators change colour in acids and alkalis.
- Analyze and synthesize information from multiple sources
- Synthesize homemade indicators using materials found in the kitchen and garden
- Investigate household chemicals using acid-base indicators
- Create individual pH scale from household substances`
- Investigate selected reactions of acids and alkalis
- Create a safety booklet dealing with the handling of acids and alkali.
- Distinguish between soluble and insoluble salts
- Prepare an insoluble salt
- Cite practical examples of neutralization in daily life
- Base conclusions and suggestions on evidence
- Show interest in the outcomes of experiments and investigations

BENCHMARKS:

- Understand and apply the law of conservation of mass.
- Understand how substances can be classified by their chemical nature and how this relates to the way they react.
- Apply the principles of measurement in the solution of everyday problems.
- Use scientific knowledge to select appropriate experimental methods.
- Construct explanations, design and evaluate solutions to complex real-world problems, based on scientific knowledge.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations..
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: Acids and Alkalis

Duration: 7.5 hours/3 weeks

ICT ATTAINMENT TARGETS:

COMMUNICATION AND COLLABORATION - Students use technology to communicate ideas and information, and work collaboratively to support individual needs and contribute 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, use KWL chart to say what they know and what they want to know about acids and alkalis. Participate in teacher led discussion and complete the KWL chart. (Teacher must clarify any misconceptions about acids e.g. all acids are dangerous substances that must be avoided). Discuss the physical properties of acids and alkalis (e.g. acids have sour taste, alkalis have soapy feel etc.). (Teacher could take the opportunity to define alkalis as soluble bases). Produce a presentation or class wiki/poster on the physical properties of acids and alkalis.	Communicate, think critically- analyze, collaborate, create	Correctly completed chart Creative presentation contains accurate information on acids and alkalis
In groups, bring labels and samples of substances from the home that they think are acids and alkalis. Sort the samples as acids and alkalis based on the physical properties and the information presented on the labels. Report on their findings (using simple scientific language, drawings, labelled diagrams, bar charts or tables). Discuss the need for a more scientific method of determining acidity and alkalinity such as the pH scale and acid-base indicators. Students are guided to interpret the pH scale and use it to determine the pH of the household substances. Say what they think the function of an acid-base indicator is. Tabulate the results and make comparisons with initial classification made to draw simple conclusions.	Make observations, communicate, think critically – analyse, interpret, draw conclusions, collaborate, classify	Data presentation contains accurate information Substances correctly sorted Accurate observations noted Comparison of initial classification and pH readings tabulated Function of acid-base indicator formulated
In groups, use universal indicator (pH paper and solution) to determine the pH of different household substances. Construct individual pH scales based on the pH of the household chemicals measured (write the name of the chemicals instead of the numbers on the scale). Represent findings on an enlarged diagram of the pH scale posted on whiteboard or any suitable display surface.	Collaborate, create, manipulate, communicate, think critically - analyse, draw conclusions, make observations	Accurate pH and colour changes noted pH scale displayed and labelled appropriately
In groups, perform a lab activity to determine the colour changes of litmus paper and methyl orange in different acid and alkali solutions and record their observations in a variety of ways (teacher provide instructions) Add their results to class data table for display.	Collaborate, communicate, think critically - analyse, manipulate, make observations	Accurate observations noted Data suitably displayed

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
In groups, conduct research on homemade acid-base indicators. Plan and design a method of preparing an acid-base indicator from materials of their choice. Carry out procedures outlined for the preparation of the indicator. Use it on common household substances to sort them as acids and alkalis based on the colour changes observed. Use their results to suggest improvements and predictions for setting up further tests.	Manipulate, collaborate, create, plan and design, communicate, think critically - analyze, classify, predict, infer, make observations	Scientific method used Hypothesis clearly stated and testable Consideration for safety included Acid-base indicator is functional Substances correctly sorted using homemade indicator
In groups, investigate the properties of acids using simple test tube reactions of acids and metals (e.g. magnesium), alkalis (e.g. sodium hydroxide), bases (e.g. copper II oxide) and carbonates (e.g. calcium carbonate) and litmus. Test the gases (hydrogen and carbon dioxide) produced. Use the term neutralization to describe simple acid/base reactions. (Link – show that neutralization reactions are exothermic in nature). Write word and symbol equations for all reactions.	Collaborate, communicate, manipulate, think critically - analyse, make inferences, formulate, make observations	Accurate observations noted Balanced equations given Neutralization reactions identified
In groups, conduct research on the application of neutralization reactions to everyday life (e.g. indigestion tablets, treatment of bee and wasp stings). Perform laboratory investigations of common neutralization reactions in the home (e.g. reacting baking powder and lemon juice). Report findings (using simple scientific language, drawings, labelled diagrams, bar charts or tables).	Collaborate, communicate, manipulate, think critically - investigate, analyse, infer, draw conclusions, make observations	Accurate observations noted Neutralization reactions identified Suitable data presentation
In groups, investigate the properties of alkalis using test tube reactions of alkalis with acids, ammonium salts (e.g. ammonium chloride), and litmus. Test the ammonia gas produced with damp red litmus. (Students guided to identify ammonia as the only alkaline gas). Write word and symbol equations for all reactions.	Collaborate, manipulate, communicate, think critically - analyse, infer, draw conclusions, formulate, make observations,	Accurate observations noted Balanced equations given Presence of ammonia linked to observations
In groups, view video and engage in computer simulation and web quest on acids and alkalis and their everyday uses. Complete the activities assigned.	Collaborate, communicate, think critically - analyse	Completed Web Quest contains accurate information
In groups, conduct online/offline research and develop a safety booklet (electronic/non-electronic) on the correct ways of handling acids and alkalis.	Research, communicate, collaborate, create, think critically - analyse, draw conclusions,	Safety booklet is creative and contains accurate information Safety symbols used are correct and relevant

Learning Outcomes

Students who demonstrate understanding can:

- Classify substances as acids and alkalis
- Cite evidence to determine acidity or alkalinity of a substance
- Research for specific pieces of information
- Create homemade acid-base indicators
- Conduct investigations on acids and alkalis
- Work cooperatively in groups
- Navigate and manipulate digital content on websites and storage devices
- Use word processing and presentation software to collaborate and communicate information
- Collaborate and communicate by posting ideas/comments to, and responding to peers' posts in class wiki and blogs

Points to Note

1. Teacher should warn students against tasting anything in the process
2. Teacher can make this a competition in which the winning chart can be selected for display
3. Navigate digital content on websites and storage devices, e.g., CDs, DVDs, etc (Examples of digital content, games, quizzes, simulation exercises, story, encyclopedias, etc)
4. Demonstrate safe, respectful, responsible and clear online communication when using class wiki and blog sites.
5. Participate in online discussions using resources designed for student collaboration and knowledge building

Extended Learning

Research how soil pH affects its ability to support plant growth and the use of substances (e.g. Lime) to counteract soil acidity

Plan and design an experiment to determine the pH of a sample of soil collected from either school or home garden.

Research different types of acids

RESOURCES

Solutions of acids and alkalis, pH paper, red and blue litmus paper, universal indicator, magnesium, copper oxide, sodium hydroxide, ammonium chloride, aqueous ammonia, various household chemicals to include salts such as lead nitrate, potassium iodide, potassium nitrate, calcium sulphate, calcium carbonate, NaCl, Na_2CO_3, ammonia (cleaning solutions), bleach, vinegar, citrus fruits (juices) etc.

KEY VOCABULARY

Acid, alkali, indicator, pH, neutralization, carbon dioxide, hydrogen, ammonia, pH scale, base,

RESOURCES

Computer, Speakers, Internet, Multimedia projector, video CDs/DVDs,
Class wiki site, Class blog site(s)

LINKS TO OTHER SUBJECTS

Grade 7 Science – Matter, Elements, Mixtures & Compounds**, Grade 9 –** Formulae & Equations

About the Unit

In this Unit, students will learn about the changes that occur during pregnancy as the human zygote develops into an embryo, and then a foetus until it is born. During pregnancy the developing baby is supported by the placenta – all its oxygen and nutrient needs and all wastes are exchanged there. Students will appreciate that disease microorganisms and some drugs can also pass across the placenta and cause harm to the baby. It is therefore very important that the mother gets prenatal care and avoids practices such as smoking and drinking alcohol, which can harm the baby. They will learn about the importance of planning the family and explore the variety of methods of birth control used to prevent pregnancy. Students will debate issues related to teenage pregnancy.

Range of Content

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

- The human zygote undergoes repeated cell divisions to produce an embryo.
- The embryo becomes implanted in the wall of the uterus and develops into a foetus/baby during the period of gestation.
- The placenta is the point of contact between mother and foetus.
- Nutrients, oxygen and wastes are exchanged across the placenta.
- Disease organisms and drugs can pass across the placenta.
- Maternal habits such as smoking, drinking alcohol, use of drugs and inadequate diets can have significant negative effects on the developing embryo/foetus.
- Prenatal care is vital for the health of mother and baby.
- Birth control methods prevent pregnancy in a variety of ways.

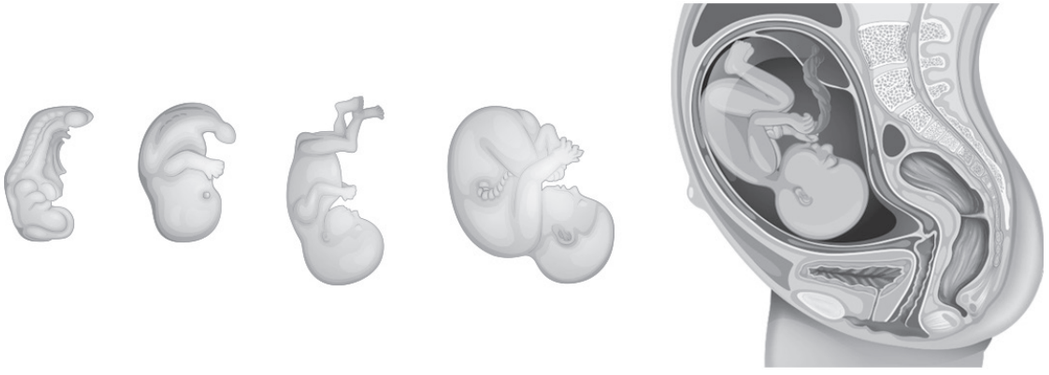
Guidance for the Teacher

Preview all videos to ensure they are appropriate in addressing the learning objectives.

Be aware of students' religious and cultural backgrounds, and also their attitudes to sexual development and conception.

UNIT 3: Human Sexual Reproduction and Birth Control

Theme: Living Things, Life Processes and the Environment



Prior Learning

Check that students can:

- Identify the structure and basic function of the human reproductive system
- Define puberty and adolescence
- Explain the stages of the menstrual cycle
- Define ovulation and fertilization
- Recall that fertilisation involves the fusion of the nuclei of sperm and egg/ovum

ATTAINMENT TARGET(S):

- Understand the importance of the life processes in plants and animals, their interdependence, their interaction with the environment, and how lifestyles determine health and well-being.
- Apply scientific knowledge and processes to the solution of real world problems.
- Use mathematics as a tool for problem-solving, and as a means of expressing and/or modelling scientific concepts.
- Appreciate the influence and limitations of science with consideration for ethical issues.
- Demonstrate a positive attitude towards the use of scientific language.
- Demonstrate positive interpersonal skills in order to foster good working relationships.

OBJECTIVES

Students will:

- State that the fertilised egg (zygote) undergoes repeated cell divisions to produce an embryo which becomes implanted in the uterus
- 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
- Describe how the embryo obtains nutrients and oxygen and eliminates waste
- Describe the effects of negative maternal behaviour during pregnancy on the development of the embryo/foetus
- Explain the importance of prenatal care during pregnancy
- Critique methods of birth control
- Assess the importance of family planning
- Evaluate problems associated with teenage pregnancy
- Show respect for each other's views

BENCHMARKS:

- Understand the role of the key organs and systems in humans and animals in sensing and responding to the environment.
- Understand embryo development and birth, appreciate the importance of maintaining a healthy lifestyle during pregnancy, and be aware of birth control methods.
- Apply the principles of measurement in the solution of everyday problems.
- Use scientific knowledge to select appropriate experimental methods.
- Construct explanations, design and evaluate solutions to complex real-world problems, based on scientific knowledge.
- Appreciate the importance of scientific methods.
- Demonstrate objectivity by seeking data and information to validate observations and explanations.
- Demonstrate care and concern for living things and the environment.
- Demonstrate concern for safety of self and others.
- Demonstrate curiosity, objectivity and perseverance in their approach to scientific activities.
- Demonstrate sensitivity to others who are different.

Topic: Embryo development and birth control

Duration: 10 Hours/4 weeks

ICT ATTAINMENT TARGETS:

COMMUNICATION AND COLLABORATION - Students use technology to communicate ideas and information, and work collaboratively to support individual needs and contribute 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: View chart/ model/ video (online or offline) showing the development of the human embryo in the uterus. Annotate a given diagram of the longitudinal section of the pregnant uterus.	Annotate	Correct annotation of diagram
Sequence prepared statements about the human life cycle (e.g. on cell specialisation, fertilisation, embryo development, birth etc.).	Sequencing	Acceptable sequence of stages of life cycle
In groups, create and annotate an album or a booklet to show the stages of growth of the foetus using pictures collected from the internet/posters/magazines. Display albums/booklets in the science corner.	Design, create, collaborate, annotate, sequence	Pictures accurately sequenced and annotated
Use suitable software (e.g., presentation or moviemaking) to create digital version of the album.	Navigate digital content Use search engines safely	
In groups, research (online/offline) the effects of negative maternal behaviours (e.g., diet, drugs, alcohol and smoking) on the developing embryo/foetus. Discuss information and prepare related questions that could be used during a panel discussion/ press conference. Enact the panel discussion or press conference.	Research, collaborate, communicate, think critically - research, critique, create	Questions adequately address the negative maternal behaviours Authentic enactment
OR In groups, design and make a poster or movie/digital story to persuade pregnant mothers to give up negative behaviours during pregnancy. Display posters on the classroom, school's notice board or present movie to class, invited teachers, parents, other guests or post movie on class page.	Create, collaborate, communicate, think critically - develop arguments, apply Create and format document and multi-media presentation	Poster/movie/digital story adequately address the negative maternal behaviours Accurate content, logical arguments, images convey message
Role play two pregnant women visiting a prenatal clinic, one who is taking good advice on prenatal care and the other who is disregarding it.	Think critically - critique, create, communicate	Role-play accurately depicts good prenatal care

Suggested Teaching and Learning Activities	Key Skills	Assessment Criteria
In groups, investigate the views/opinions of a nurse, doctor, teacher, parent (single and/ married) and teenager on the importance of family planning, the effects of teenage pregnancy and the different methods of birth control/contraception, the use of technology in improving birth control methods in the twenty-first century. Present information in form of a project, scrapbook, journal or portfolio.	Communicate, research, collaborate, think critically – create, analyse,	Presentation captures the variety, nature and importance of contraception Includes a variety of methods for capturing and reporting data Is attractively presented and reflects creativity Evidence of thorough research
In groups, go on a field trip to the maternity ward of a hospital or children's home and complete survey checklist provided by teacher and, participate in a teacher led discussion.	Communicate, collaborate	
Debate on the moot "Be it resolved that condoms should be distributed in secondary schools."	Communicate, collaborate, think critically - critique, analyse, develop logical arguments	Arguments reflect understanding of teenage sexuality and the effects of teenage pregnancy Group collaboration evident

Learning Outcomes

Students who demonstrate understanding can:

- Explain that the fertilised egg (zygote) develops into an embryo which becomes implanted in the uterus.
- Describe the basic structure and function of a pregnant uterus.
- Describe the exchange of substances across the placenta.
- Explain the effects of negative maternal behaviours on the developing embryo/foetus.
- Value the importance of prenatal care.
- Evaluate methods of birth control in preventing pregnancy.
- Appreciate the problems associated with teenage pregnancy.
- Use digital story/movie to communicate information.

Points to Note

Maternal behaviours to include diet, drugs, alcohol and smoking, responsible sexual habits.

Prenatal care to include maternal nutrition, exercise and immunisation.

Remind students of the following when using technology:

- Recognise and acknowledge the owners or creators of digital materials and encourage their peers to do so.

Extended Learning

Collect and sequence ultra-sound pictures showing the stages of the developing foetus.

Visit the National Family Planning Agency or online, collect data from the different parishes in Jamaica and plot graphs to illustrate the incidence of teenage pregnancy.

Points to Note	Extended Learning
• Follow guidelines to promote healthy use of ICT tools	Research in vitro fertilization (test-tube babies), fertility drugs and surrogate motherhood. Explain how identical, non-identical and Siamese twins occur. Research the rate of 'infant mortality' (death of new-born babies) in Jamaica. Find out how different animals e.g., developing bird or reptile, meet their needs inside the egg.

RESOURCES

Charts, models, videos and movies of various aspects of human reproduction and family planning, resource personnel , samples of birth control methods, cartridge paper, markers, tape, glue

Computers, Internet, multimedia projector, speakers

KEY VOCABULARY

zygote, cell division, embryo, foetus, uterus, placenta, amniotic fluid, amniotic sac, umbilical cord, conception, implantation, gestation, labour, delivery, birth, family planning, contraceptives, pre-natal care

LINKS TO OTHER SUBJECTS

Social studies, Religious Education, HFLE

NSC

INTEGRATED SCIENCE

GRADES 7-9: APPENDICES

GLOSSARY OF SCIENCE TERMS

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
Constraints	conditions that limit or restrict
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

TERMS	DEFINITIONS/MEANINGS
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
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
KWL approach/ chart	determines what I **Know**, what I **Want** to learn and what I did **Learn**
Laboratory report	a record of the steps in an experiment
Line of best fit	a straight line that describes the general trend from a scatter of points on a graph. It is usually drawn through the middle of the points
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

TERMS	DEFINITIONS/MEANINGS
Operationally define	use a given scenario (what is observed or measured) to derive the meaning of a term
Plot	to mark a point on a chart or graph to show the relationship between two variables
Predict	suggest a possible outcome based on information given
Problem statement	the statement that outlines the problem to be investigated
Prototype	a small-scale model or example of the object to be built
Prove	to show using evidence or arguments
Responding variable	the 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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ALTERNATIVE PATHWAYS TO SECONDARY EDUCATION (ASPE)

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 Objectives 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.

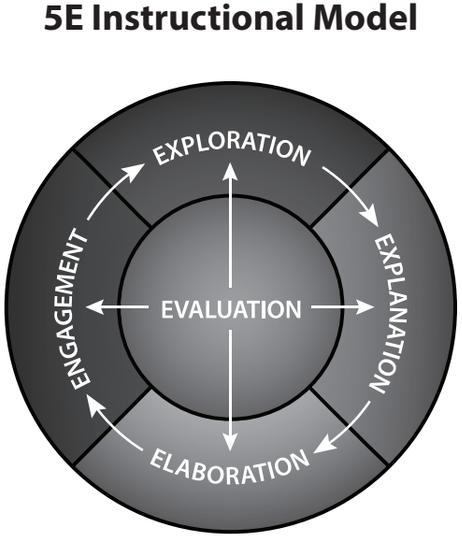

Figure 1. Illustrating one version of the 5E model that conveys the role of valuation as an interconnecting process that is at the core of the learning experience.

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

Duration: 60 minutes

Resources: Videos, pictures, textbooks, 2 L plastic bottles, heat source, thermometer, vinegar, chalk, gas tube, internet

Topic: Climate Change (Term 1, Unit 2)

Sub-Topic: Climate change causes and effects

Attainment Target(s)

- Recognise the variety of living things, their interdependence and their inter-relationship with the environment
- Gain an understanding of and apply aspects of the scientific method
- Demonstrate positive interpersonal skills in order to foster good working relationships

Benchmarks

- Be aware of some environmental problems and how to mitigate against them
- Make a series of measurements of quantities and make inferences from observations in order to draw conclusions
- Display curiosity, objectivity and perseverance in their approach to activities

Objectives

By the end of the lesson students should be able to:

- Define climate change
- Cite evidence of climate change
- Show the relationship between causes and effects of climate change
- Investigate gases that contribute to global warming
- Analyse and interpret results from investigations

Key Skills

Gather data, observe, record, collaborate, create, investigate, predict, analyse

Key Vocabulary

climate change, global warming, carbon dioxide, factors, reduce, reuse and recycle

Content Outline [*Brief notes on main points/concepts*]

Human activities can affect the environment positively and negatively. One example of a negative impact is Climate Change, which refers to a change in Earth's overall average weather. An increase in the average temperature of the Earth's atmosphere has led to harsher weather conditions such as increased droughts, flooding, hurricanes and distortion of natural habitats. Through principles of conservation, recycling and reuse some of these effects can be mitigated. An increase in carbon dioxide levels (from burning fossil fuels) is mainly responsible for the rise in global warming.

Prior Learning

Check that students can:

- Identify human activities that affect the environment
- Relate increase in average atmospheric temperatures to global warming

Learning Outcome

Students who demonstrate understanding can:

- Identify effects of climate change
- Show the relationship between human activities and climate change
- Identify and interpret data patterns
- Show good stewardship in their efforts to preserve the environment

Assessment Criteria:

- Workable definition of climate change
- Creative presentations/ reports with accurate information about the effects of climate change and the relationship between human activities and climate change
- Table/Graph captures relevant data and accurate results recorded and analysed
- Logical conclusions drawn on the main gas responsible for global warming
- Environmental project focuses on issues in their immediate environs and details the expected benefits to the environment.

Teaching Procedure/Activities

ENGAGE

How can I get students interested in this? Use of an interesting picture. (8 minutes)

- Students will be placed in groups and shown some images of the Earth and asked to discuss what the images represent. Students will then complete a pre-assessment quiz on Climate Change (effects, causes and ways to reduce its impact). Mixed ability groups will be formed based on the results. Students will discuss the ideas presented on the videos OR view pictures depicting different effects of climate change.

EXPLORE

What tasks/questions can I offer to help students puzzle through this? Use of a simple investigation. (10 minutes)

- Students will view a video on global warming/ Climate Change *(https://youtu.be/0F3QPY83NZQ or https://www.youtube.com/watch?v=Id2maUitnTg)*..
- In groups, students will formulate a simple definition of climate change. Students will use the videos to answer the following questions:

1. What is climate change?
2. Identify some effects of climate change on the environment?
3. What are the factors (human activities) that are thought to cause climate change?

Students will then identify the Climate Change effects using pictures.

EXPLAIN

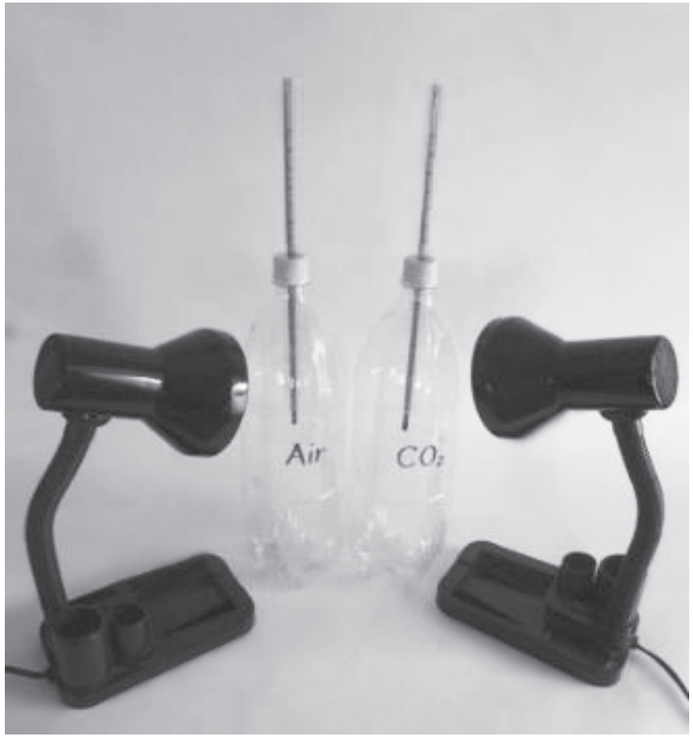
How can I help students make sense of their observations? Class presentation and discussions. (15 minutes)

- Students will present the answers to the questions on the causes and effects of climate change. A chart or poster depicting the appropriate information using cartoons or other art forms will be created and presented by each group. Students can also use other means to present their findings. Students and teacher will assess the presentations. Students will use an illustration on Global Warming to explain what happens during this process. The difference between Global Warming and Climate Change will be suggested by students.

ELABORATE

How can my students apply their new knowledge to other situations? Application of what was learned. (17 minutes)

- Students will suggest how humans can help to reduce the effects of Climate Change through different activities (e.g. awareness campaign) OR
- Students will investigate how climate change is influenced by global warming through an experiment. Two small plastic bottles containing air and carbon dioxide will be used. The carbon dioxide will be generated from a reaction between chalk and vinegar in a separate reaction and passed into the plastic bottle through a delivery tube. Each bottle will be corked with a thermometer placed in the cork (see diagram). The initial temperatures will be noted. A heat source (e.g. desk lamp or flashlight) will then be placed near the bottles and the temperatures recorded every minute over a 6-minute period. Results will be recorded and analysed.



Students will analyse results by answering the following questions?

- What trends did you observe?
- Which bottle had the highest temperatures?

- Which gas caused an increase in temperature?
- How does this gas affect global warming?
- How does global warming influence climate change?

A report summarizing the results and the role that carbon dioxide plays in global warming will be written and shared by students.

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. Assessment (10 minutes)

1. Students will complete the Pre-assessment activity sheet to ascertain prior knowledge and understanding of the topic. Brief class discussion will assess understanding.
2. Tables/graphs that were constructed to capture data and, the reports/presentations will be collected and scored using a rubric.
3. The Awareness Campaign will be assessed using a teacher-prepared rubric.
4. An Exit Card with the question, “Show what you understand by climate change?” will be given to each student at the end of class.
5. A checklist will be used over several weeks to assess students’ skills/commitment in supervising or taking care of garden or separation of solid waste initiatives.

EXTEND

As a class, students will design an environmental project to care for their immediate school environment such as the reuse/ recycling of plastics; separation of solid waste on school compound; planting and/maintaining a class /school garden.

LINKS TO OTHER SUBJECTS

Geography, Social Studies, Mathematics

POST-LESSON REFLECTION