KENYA INSTITUTE OF CURRICULUM DEVELOPMENT

A Skilled and Ethical Society

JUNIOR SCHOOL CURRICULUM DESIGN

INTEGRATED SCIENCE

GRADE 9

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FOREWORD

The Government of Kenya is committed to ensuring that policy objectives for Education, Training, and Research meet the aspirations of the Constitution of Kenya 2010, the Kenya Vision 2030, the National Curriculum Policy 2019, the United Nations Sustainable Development Goals (SDGs), and the regional and global conventions to which Kenya is a signatory. Towards achieving the mission of basic education, the Ministry of Education (MoE) has successfully and progressively rolled out the implementation of the Competency Based Curriculum (CBC) at Pre-Primary, Primary and Junior School levels.

The implementation of Competency Based Curriculum involves monitoring and evaluation to determine its success. After the five-year implementation cycle, a summative evaluation of the primary education cycle was undertaken to establish the achievement of learning outcomes as envisaged in the Basic Education Curriculum Framework. The Government of Kenya constituted a Presidential Working Party on Education Reforms (PWPER) in 2022 to address salient issues affecting the education sector. PWPER made far-reaching recommendations for basic education that necessitated curriculum review. The recommendations of the PWPER, monitoring reports, summative evaluation of the primary education cycle, and feedback from curriculum implementers and other stakeholders led to rationalisation and review of the basic education curriculum.

The reviewed Grade 9 curriculum designs build on competencies attained by learners at the end of Grade 8. Further, they provide opportunities for learners to continue exploring and nurturing their potentials as they prepare to transit to Senior School.

The curriculum designs present National Goals of Education, essence statements, general and specific expected learning outcomes for the subjects as well as strands and sub-strands. The designs also outline suggested learning experiences, key inquiry questions, core competencies, Pertinent and Contemporary Issues (PCIs), values, and assessment rubric. It is my hope that all Government agencies and other stakeholders in Education will use the designs to plan for effective and efficient implementation of the CBC.

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PREFACE

The Ministry of Education (MoE) nationally implemented Competency Based Curriculum (CBC) in 2019. Grade 9 is the final grade in Junior School in the reformed education structure.

The reviewed Grade 9 curriculum furthers implementation of the CBC from Grade 8 in Junior School. Grade 9 curriculum furthers implementation of the CBC from Grade 7. The main feature of this level is a broad curriculum for the learner to explore talents, interests and abilities before selection of pathways and tracks at the Senior Secondary education level. This is very critical in the realisation of the Vision and Mission of the on-going curriculum reforms as enshrined in the Sessional Paper No. I of 2019 whose title is: *Towards Realizing Quality, Relevant and Inclusive Education and Training for Sustainable Development* in Kenya. The Sessional Paper explains the shift from a Content-focused Curriculum to a focus on **Nurturing every Learner's potential.**

Therefore, the Grade 9 curriculum designs are intended to enhance the learners' development in the CBC core competencies, namely: Communication and Collaboration, Critical Thinking and Problem-solving, Creativity and Imagination, Citizenship, Digital Literacy, Learning to Learn, and Self-efficacy.

The curriculum designs provide suggestions for interactive and differentiated learning experiences linked to the various sub-strands and the other aspects of the CBC. They also offer several suggested learning resources and a variety of assessment techniques. It is expected that the designs will guide teachers to effectively facilitate learners to attain the expected learning outcomes for Grade 9 and prepare them for a smooth transition to Senior School. Furthermore, it is my hope that teachers will use the designs to make learning interesting, exciting, and enjoyable.

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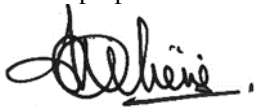
ACKNOWLEDGEMENT

The Kenya Institute of Curriculum Development (KICD) Act Number 4 of 2013 (Revised 2019) mandates the Institute to develop and review curricula and curriculum support materials for basic and tertiary education and training. The curriculum development process for any level of education involves thorough research, international benchmarking and robust stakeholder engagement. Through a systematic and consultative process, the KICD conceptualised the Competency Based Curriculum (CBC) as captured in the Basic Education Curriculum Framework (BECF) 2017, which responds to the demands of the 21st Century and the aspirations captured in the Constitution of Kenya 2010, the Kenya Vision 2030, East African Community Protocol, International Bureau of Education Guidelines and the United Nations Sustainable Development Goals (SDGs).

KICD receives its funding from the Government of Kenya to facilitate the successful achievement of the stipulated mandate and implementation of the Government and Sector (Ministry of Education (MoE) plans. The Institute also receives support from development partners targeting specific programmes. The revised Grade 9 curriculum designs were developed with the support of the World Bank through the Kenya Primary Education Equity in Learning Programme (KPEELP); a project coordinated by MoE. Therefore, the Institute is very grateful for the support of the Government of Kenya, through the MoE and the development partners for policy, resource and logistical support. Specifically, special thanks to the Cabinet Secretary-MoE and the Principal Secretary-State Department of Basic Education.

We also wish to acknowledge the KICD curriculum developers and other staff, all teachers, educators who took part as panelists; the Semi-Autonomous Government Agencies (SAGAs), and representatives of various stakeholders for their roles in the development of the Grade 9 curriculum designs. In relation to this, we acknowledge the support of the Chief Executive Officers of the Teachers Service Commission (TSC) and the Kenya National Examinations Council (KNEC) for their support in the process of developing these designs. Finally, we are very grateful to the KICD Council Chairperson and other members of the Council for very consistent guidance in the process.

We assure all teachers, parents and other stakeholders that this curriculum design will effectively guide the implementation of the CBC in Grade 9 and the preparation of learners for transition to Senior School.



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NATIONAL GOALS OF EDUCATION

Education in Kenya should:

1. **Foster nationalism and patriotism and promote national unity.**
   Kenya's people belong to different communities, races and religions, but these differences need not divide them. They must be able to live and interact as Kenyans. Education's paramount duty is to help young people acquire this sense of nationhood by removing conflicts and promoting positive attitudes of mutual respect that enable them to live together in harmony and foster patriotism in order to make a positive contribution to the life of the nation.

2. **Promote the social, economic, technological, and industrial needs for national development.**
   Education should prepare the youth of the country to play an effective and productive role in the life of the nation.
   a) **Social Needs**
      Education in Kenya must prepare children for changes in attitudes and relationships necessary for the smooth progress of a rapidly developing modern economy. There is bound to be a silent social revolution following in the wake of rapid modernisation. Education should assist our youth in adapting to this change.
   b) **Economic Needs**
      Education in Kenya should produce citizens with the skills, knowledge, expertise, and personal qualities required to support a growing economy. Kenya is building up a modern and independent economy that needs an adequate and relevant domestic workforce.
   c) **Technological and Industrial Needs**
      Education in Kenya should provide learners with the necessary skills and attitudes for industrial development. Kenya recognises the rapid industrial and technological changes, especially in the developed world. We can only be part of this development if our education system focuses on the knowledge, skills, and attitudes that will prepare our young people for these changing global trends.

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3. **Promote individual development and self-fulfillment**
   Education should provide opportunities for the fullest development of individual talents and personalities. It should help children to develop their potential interests and abilities. A vital aspect of individual development is the building of character.
4. **Promote sound moral and religious values.**
   Education should provide for the development of knowledge, skills, and attitudes that will enhance the acquisition of sound moral values and help children grow into self-disciplined, self-reliant, and integrated citizens.

5. **Promote social equity and responsibility.**
   Education should promote social equality and foster a sense of social responsibility within an education system that provides equal educational opportunities. It should give all children varied and challenging opportunities for collective activities and corporate social service irrespective of gender, ability, or geographical environment.

6. **Promote respect for and development of Kenya's rich and varied cultures.**
   Education should instil in the youth of Kenya an understanding of past and present cultures and their valid place in contemporary society. Children should be able to blend the best of traditional values with the changing requirements that must follow rapid development to build a stable and modern society.

7. **Promote international consciousness and foster positive attitudes towards other nations.**
   Kenya is part of the international community. It is part of the complicated and interdependent network of peoples and nations. Education should, therefore, lead the youth of the country to accept membership in this international community with all the obligations, responsibilities, rights and benefits that this membership entails.

8. **Promote positive attitudes towards good health and environmental protection.**
   Education should inculcate in young people the value of good health for them to avoid indulging in activities that will lead to physical or mental ill health. It should foster positive attitudes towards environmental development and conservation. It should lead the youth of Kenya to appreciate the need for a healthy environment.

LESSON ALLOCATION

S/No	Learning Area	Number of Lessons Per Week
1.	English	5
2.	Kiswahili / Kenya Sign Language	4
3.	Mathematics	5
4.	Religious Education	4
5.	Social Studies	4
6.	Integrated Science	5
7.	Pre-Technical Studies	4
8.	Agriculture	4
9.	Creative Arts and Sports	5
	Pastoral /Religious Instructional Program	1*
Total		**40 + 1***

LEARNING OUTCOMES FOR JUNIOR SCHOOL

By the end of Junior School, the learner should be able to:

1. Apply literacy, numeracy and logical thinking skills for appropriate self-expression.
2. Communicate effectively, verbally and non-verbally, in diverse contexts.
3. Demonstrate social skills, and spiritual and moral values for peaceful co-existence.
4. Explore, manipulate, manage, and conserve the environment effectively for learning and sustainable development.
5. Practise relevant hygiene, sanitation, and nutrition skills to promote health.
6. Demonstrate ethical behaviour and exhibit good citizenship as a civic responsibility.
7. Appreciate the country's rich and diverse cultural heritage for harmonious co-existence.
8. Manage pertinent and contemporary issues in society effectively.
9. Apply digital literacy skills for communication and learning.

ESSENCE STATEMENT

Integrated science is a new learning area that enables learners to apply distinctive ways of logical reasoning, thinking, and working to understand natural phenomena in the biological, physical, and technological world. The emphasis of science education at the Junior School level is to enhance learners' scientific thinking through learning activities that involve the basic science process skills. This subject area is expected to create a scientific culture that inculcates scientific literacy, enabling learners to make informed choices in their personal lives and approach life challenges in a systematic and logical manner.

Integrated Science equips the learner with the basic requisite skills, knowledge, values, and attitudes necessary for specialisation in STEM pathways at the Senior School level. The rationale for including of Integrated Science is anchored in The Kenya Vision 2030, Sessional Papers No. 14 of 2012, and No. 1 of 2019, which all underscore the importance of Science, Technology and Innovation in education and training. The subject area is to be taught through inquiry-based learning approaches with an emphasis on the 5Es: Engagement, Exploration, Explanation, Elaboration and Evaluation.

GENERAL LEARNING OUTCOMES

By the end of Junior School, the learner should be able to:

1. Acquire scientific knowledge, skills, values and attitudes to make informed choices on career pathways at Senior School.
2. Select, improvise and safely use basic scientific tools, apparatus, materials, and chemicals effectively in everyday life.
3. Explore, manipulate, manage, and conserve the environment for learning and sustainable development.
4. practise relevant hygiene, sanitation, and nutrition skills to promote good health.
5. Apply the understanding of body systems to promoting and maintaining good health.
6. Develop a capacity for scientific inquiry and problem-solving in different situations.
7. Appreciate the use of scientific knowledge, skills, principles, and practises in everyday life.
8. Apply acquired scientific knowledge, skills, principles, and practises in everyday life.

SUMMARY OF STRANDS AND SUB-STRANDS

Strands	Sub-Strands	Suggested Number of Lessons
1.0 Mixtures, Elements and Compounds	1.1. Structure of the atom	14
	1.2. Metals and Alloys	16
	1.3. Water hardness	14
2.0 Living Things and the Environment	2.1. Nutrition in plants	18
	2.2. Nutrition in animals	16
	2.3. Reproduction in plants	20
	2.4. The interdependence of life	18
3.0 Force and Energy	3.1. Curved Mirrors	18
	3.2. Waves	16
Total Number of Lessons		**150**
Note: The suggested number of lessons per sub-strand may be less or more depending on the context.		

STRAND 1.0: MIXTURES, ELEMENTS, AND COMPOUNDS

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
1.0 Mixtures, Elements, and Compounds	**1.1 Structure of the atom** **(14 lessons)** • *Structure of the atom (protons, electrons, neutrons),* • *Atomic number and mass number of elements,* • *Electron arrangement of elements,* • *Energy level diagrams (cross or dot),* • *Metals and non-metals,* **Note**: (*use the first 20 elements of the periodic table; do not introduce the periodic table at this level).*	By the end of the sub strand the learner should be able to: a) describe the structure of the atom, b) determine the mass number of elements, c) draw the electron arrangement in atoms using dot or cross diagrams, d) classify elements into metals and non-metals, e) show interest in classifying elements into metals and non-metals.	The learner is guided to: ● discuss the meaning of the atom and illustrate its structure, ● work out the mass number of an element collaboratively, ● write the electron arrangements of elements, ● illustrate the electron arrangement in atoms using dot or cross diagrams collaboratively, ● use electron arrangement to classify elements into metals and non-metals, ● use digital or print media to observe the structure of an atom and its electron arrangement. **Project:** model the atomic structure of selected elements of the periodic table using locally available materials.	How is the structure of the atom important?

Core Competencies to be developed:

- Communication and Collaboration: the learner acquires listening and speaking skills as they discuss with peers the meaning of the atom and illustrate its structure.
- Creativity and Imagination: the learner experiments and comes up with models of atoms of selected elements from locally available materials.

Pertinent and Contemporary Issues:

Socio-economic issues (Cyber Security): the learner observes cyber security measures when using digital media to observe the structure of an atom and electron arrangement.

Values:

- Unity: the learner respects others' opinions while having group discussions.
- Integrity: the learner displays honesty while using digital devices to search for information on the structure of an atom, electron arrangement, atomic number, and mass number of elements.

Links to other Subjects

The learner applies mathematical manipulation to work out the mass number of elements.

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
1.0 Mixtures, Elements, and Compounds	**1.2 Metals and Alloys** **(16 lessons)** • *Physical properties of metals (state, ductility, malleability, electrical and thermal conductivity)* • *Composition of alloys (steel, stainless steel, bronze, brass, and duralumin)* • *uses of metals and alloys in day-to-day life (sodium, magnesium, aluminium, copper, iron, gold, silver, brass, steel, bronze, duralumin, and stainless steel)* • *Rusting (causes, effects, prevention)*	By the end of the sub strand, the learner should be able to: a) describe the physical properties of metals, b) describe the composition of alloys, c) identify the uses of metals and alloys in day-to-day life, d) explain the effects of rusting of metals, e) appreciate the importance of common alloys in day-to-day life.	The learner is guided to: • identify metals and non-metals in their environment, • carry out experiments to demonstrate the physical properties of metals, • discuss the composition of common alloys, • identify some items from the locality that have been made from alloys, • discuss the uses of common metals and alloys, • discuss causes, effects, and ways of controlling the rusting of metals, • use digital or print media to search for information on the physical properties of metals and common alloys.	How are alloys important in day-to-day life?

Core Competencies to be developed • Communication and Collaboration: the learner works with peers to carry out experiments to demonstrate the physical properties of metals. • Digital Literacy: the learner interacts with digital technology as they search for information using digital devices on the physical and chemical properties of metals and common alloys.
Pertinent and Contemporary Issues (PCIs) Financial Literacy: the learner appreciates the economic importance of metals and common alloys in day-to-day life as they discuss the uses of common metals and alloys.
Values • Respect: the learner accommodates others' opinions during group discussions on the uses of metals and common alloys. • Peace: the learner humorously works together with peers when carrying out experiments to demonstrate the physical properties of metals.
Link to other Subjects • The learner links the properties of common metals and alloys used in workshops in Pre-Technical Studies. • The learner uses relates the use of utensils made from metals and their alloys in Agriculture.

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
1.0 Mixtures, Elements, and Compounds	**1.3 Water hardness** **(14 lessons)** • *Physical properties of water (taste, colour, odour and boiling point),* • *Hard and soft water* • *Methods of softening temporary hard water (boiling, addition of washing soda, distilling),* ***Note.*** *avoid ion exchange* • *Advantages and disadvantages of hard water and soft water*.	By the end of the sub strand, the learner should be able to: a) describe the physical properties of water, b) distinguish between hard and soft water in nature, c) apply methods of softening hard water in day-to-day life, d) outline the advantages and disadvantages of hard and soft water, e) appreciate the applications of soft and hard water in day-to-day life.	The learner is guided to: • collect and observe water from different sources, compare them in terms of appearance, odour, taste, and boiling point *(taste water from safe sources),* • carry out activities to compare the lathering abilities of various samples of unboiled water with soap collaboratively, • group the samples into hard and soft water, • explain the meaning of hard and soft water, • discuss the advantages and disadvantages of soft and hard water, • perform various activities for softening hard water (*boiling, addition of*	1. What is the importance of different types of water? 2. Why is hard water preferred for drinking?

			washing soda, distilling), • use digital or print media to search for information, on the methods of softening hard water.	

Core Competencies to be developed:

- Learning to Learn: the learner learns new methods of softening water as they apply methods of softening hard water in day-to-day life.
- Critical thinking and Problem-solving: the learner learns ways of reducing soap wastage as they relate the lathering ability of water to the hardness and softness of water.

Pertinent and Contemporary Issues (PCIs):

Financial Literacy**:** the learner practises how to save on soap by using soft water for laundry.

Values:

- Responsibility: the learner plays a role when carrying out experiments on softening hard water.
- Respect: the learner gives each other an opportunity to air their views as they discuss in a group the differences between hard and soft water.

Link to other Subjects

The learner relates the use of soft water in laundry work in Agriculture.

Suggested Assessment Rubric

Level / Indicator	Exceeds expectation	Meets expectation	Approaches expectation	Below expectation
Ability to describe the structure of the atom.	The learner describes the structure of the atom comprehensively.	The learner describes the structure of the atom adequately.	The learner partially describes the structure of the atom.	The learner partially describes the structure of the atom, with a prompt.
Ability to classify elements into metals and non-metals.	The learner classifies all elements into metals and nonmetals comprehensively.	The learner classifies all the elements into metals and nonmetals.	The learner classifies most of the elements into metals and nonmetals.	The learner classifies a few elements into metals and nonmetals.
Ability to outline the uses of metals and alloys.	The learner outlines the uses of all metals and alloys exhaustively.	The learner outlines the uses of all common metals and alloys.	The learner outlines the uses of most of the metals and alloys.	The learner outlines the uses of a few metals and alloys.
Ability to explain the effect of rusting on metals.	The learner explains the effect of rusting on metals in detail comprehensively.	The learner explains the effect of rusting on metals sufficiently.	The learner explains the effect of rusting on metals partially.	The learner explains the effect of rusting on metals partially leaving some key points.

Ability to outline the advantages and disadvantages of hard and soft water.	The learner outlines the advantages and disadvantages of hard and soft water exhaustively.	The learner outlines the advantages and disadvantages of hard and soft water	The learner outlines most of the advantages and disadvantages of hard and soft water.	The learner outlines a few advantages and disadvantages of hard and soft water.
Ability to apply different methods to soften temporary hard water.	Applies all appropriate methods to soften temporary hard water innovatively.	Applies all appropriate methods to soften temporary hard water.	Applies the least appropriate method to soften temporary hard water.	Applies less than two methods to soften temporary hard water.

STRAND 2.0: LIVING THINGS AND THEIR ENVIRONMENT

Strand	Sub-Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
2.0 Living things and their Environment	**2.1 Nutrition in Plants (18 lessons)** • *Parts of a leaf (external and internal)* • *Adaptations of the leaf to photosynthesis* • *Structure of chloroplasts (membranes, grana, and stroma)* • *Process of photosynthesis (chemical reactions during light and dark stages are not required)* • *Conditions necessary for photosynthesis*	By the end of the sub-strand, the learner should be able to: a) identify external and internal parts of a leaf, b) explain adaptations of the leaf to photosynthesis, c) describe the process of photosynthesis, d) investigate the conditions necessary for photosynthesis, e) appreciate the process of photosynthesis in nature.	The learner is guided to: • use a hand lens to observe the fresh leaves of plants, draw and label the external parts, • use print or non-print media to search for information on the internal structure of the leaf in relation to their roles in photosynthesis, discuss and share with peers, • discuss the adaptations of a leaf in relation to their roles in photosynthesis, • observe the structure of the chloroplast on charts/photomicrographs, discuss its role in photosynthesis, share with peers, • use print or non-print media to search for information on the process and products of photosynthesis, discuss and share with peers, • use print or non-print media to search	What is the importance of photosynthesis in nature?

			for information on conditions necessary for photosynthesis, discuss and share with peers, • set up experiments to show that light, carbon (IV) oxide, and chlorophyll are necessary for photosynthesis and share their findings with peers, *(use the starch test).*	

Core Competencies to be developed

- Learning to Learn: the learner searches for information on photosynthesis, discusses, and shares with peers.
- Self-efficacy: the learner successfully carries out experiments on conditions necessary for photosynthesis and shares the findings.

Values:

- Social Justice: the learner shares resources equitably while carrying out experiments to show that light, carbon (IV) oxide, and chlorophyll are necessary for photosynthesis.
- Integrity: the learner displays honesty while carrying out experiments to show that light, carbon (IV) oxide, and chlorophyll are necessary for photosynthesis and presenting their own results.

Pertinent and Contemporary Issues (PCIs)

- Environmental Conservation: the learner collects only the required number of leaves to observe the external structure.
- Safety: the learner observes safety precautions while carrying out experiments on photosynthesis.

Link to other Learning Areas:

The information on photosynthesis is linked to food production.

Strand	Sub-Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
2.0 Living things and their Environment	**2.2 Nutrition in animals** **(16 lessons)** • *Modes of nutrition in animals (parasitic, saprophytic, symbiosis, and holozoic),* • *Dentition in animals (homodont and heterodont; carnivorous, herbivorous, and omnivorous),* • *Types of teeth (incisors, canines, premolars and molars)* • *(structure and functions),* • *Process of digestion in human beings (ingestion, digestion, absorption, assimilation, and egestion).*	By the end of the sub-strand, the learner should be able to: a) outline modes of nutrition in animals, b) describe the structure and functions of different types of teeth, c) classify animals based on their dentition, d) describe the process of digestion in human beings**,** e) appreciate that animals have varied modes of nutrition.	The learner is guided to; • use print or non-print media to search for information on modes of nutrition in animals and discuss, • use specimens/charts/ models/ digital media to identify and draw different types of teeth, • discuss the functions of different types of teeth, • use specimens/ charts/ models/ digital media to study dentition in different animals and share the findings with peers, • use print or non-print media to search for information on the process of digestion in human beings, discuss, and share with peers**.**	1. How do different animals feed? 2. How is food digested in the human body?

Core Competencies to be developed: Communication and Collaboration: the learner acquires speaking and listening skills as they discuss the process of digestion in human beings.
Values: ● Unity: the learner works collaboratively and harmoniously with peers as they study dentition in different animals. ● Respect: the learner appreciates others' opinions while discussing different modes of nutrition in animals.
Pertinent and Contemporary Issues (PCIs): Animal Welfare: the learner cares for animals as they study different types of dentition.
Links to other Learning Areas: The learner can link the information on nutrition in animals to feeding of animals in Agriculture.

Strand	Sub-Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
2.0 Living things and their Environment	**2.3 Reproduction in plants (20 lessons)** • *Functions of parts of a flower* • *Meaning and types of pollination* • *(details on factors that promote/hinder self-pollination not required)* • *Adaptations of flowers to wind and insect pollination* • *Fertilisation, seed and fruit formation in*	By the end of the sub-strand, the learner should be able to: a) outline functions of parts of a flower, b) describe pollination in plants, c) outline the adaptations of flowers to wind and insect pollination, d) explain fertilisation and fruit formation in flowering plants, e) categorise fruits and seeds based on their mode of dispersal, f) recognise the role of flowers in nature.	The learner is guided to: • collaboratively discuss the functions of parts of a flower, • use print or non-print media to search for information on meaning and types of pollination, discuss and share the findings with peers, • use print or non-print media to search for information on adaptations of flowers to wind and insect pollination, discuss and share the findings with peers, • study samples of flowers to discuss their adaptations to agents of pollination, draw, label, and share the findings with peers, • watch animations or take an excursion in the school compound or neighbourhood to observe pollinating agents in action, record and discuss, (*the behaviour of insects and birds in relation to*	How does reproduction in plants occur?

	flowering plants • *Fruit and seed dispersal in plants (modes and importance*		*flowers; swaying of anthers of grasses e.g maize in wind),* • use print or non-print media to search for information on the effect of agrochemicals on pollinating agents and their effects on reproduction in plants, • use print and non-print media to search for information on fertilisation and fruit formation in flowering plants, discuss and share the findings with peers, • collaboratively study illustrations/animations on fertilisation, seed and fruit formation, share the findings with peers *(details of double fertilisation not required),* • use print and non-print media to search for information on seeds and fruit dispersal in plants, discuss the findings, • observe different fruits and seeds from their locality, discuss and categorise them based on their mode of dispersal, *(consider locally*	

			available and safe wild fruits), • discuss the importance of fruit and seed dispersal.	

Core Competencies to be developed

- Learning to Learn: the learner searches for information on fertilisation and fruit formation in flowering plants.
- Digital Literacy: the learner uses digital devices to search for information on the effect of agrochemicals on pollinating agents and their effect on reproduction in plants.

Values

Social Justice: the learner observes equal participation as they discuss the importance of fruit and seed dispersal.

Pertinent and Contemporary Issues (PCIs):

- Biodiversity: the learner searches for information on the effect of agrochemicals on pollinating agents and their effects on reproduction in plants
- Safety and Security: the learner takes precautions while collecting various flowers, fruits, and seeds from the immediate environment.

Link to other Learning Areas:

The learner can link the information on fertilisation and fruit formation to crop production in Agriculture.

Strand	Sub-Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
2.0 Living things and their Environment	**2.4 The Interdependence of Life (18 lessons)** • *Biotic(living) components of the environment (predation, parasitism, symbiosis, competition, and saprophytic),* • *Abiotic(non-living) components of the environment (temperature, light, water, wind, atmospheric pressure, pH and salinity),* • *Energy flow in an ecosystem* • *(food chains and food webs,)* • *Effect of human activities on the*	By the end of the sub-strand, the learner should be able to: a) explain the biotic and abiotic factors of the environment, b) construct food chains and food webs in the environment, c) describe the effect of human activities on the environment, d) appreciate the interdependence between living and non-living factors of the environment.	The learner is guided to: ● use print and non-print material to search for information on biotic interrelationships, share findings with peers, ● investigate the interrelationships between biotic factors of the environment in their locality and discuss the findings with peers *(include insects, spiders, lizards, toads, chameleons),* ● use digital or print media to search for more information on the interrelationships between biotic factors of the environment, ● use print and non-print media to search for information on interrelationships between organisms in Kenya national parks and game reserves, ● discuss the effect of abiotic factors on living organisms, ● search for information on the effect of	What is the role of living and non-living factors in environments?

	environment (habitat change, hunting and poaching, introduction of new living things).		human activities on the environment and discuss, ● carry out activities to identify living organisms and what they feed on and construct food chains and food webs, ● discuss the role of decomposers in an ecosystem and their importance in recycling nutrients (*avoid details of chemical reactions and specific microorganisms involved in nitrogen, carbon & Sulphur cycles*).	

Core Competencies to be developed:

- Citizenship: the learner develops a sense of responsibility to the nation while searching for information on interrelationships between organisms in Kenya's national parks and game reserves.
- Communication and Collaboration: the learner develops speaking and listening skills as they discuss the role of decomposers in an ecosystem and their importance in recycling nutrients.

Values:

- Patriotism: the learner develops a love for the country as they search for information on interrelationships between organisms in Kenya's national parks and game reserves.
- Peace: the learner shows respect for diversity and heritage as they study the interdependence between living and non-living components of the environment.

Pertinent and Contemporary Issues (PCIs)

Environmental Conservation: the learner learns the importance of decomposers as they discusses the role of decomposers in an ecosystem and their importance in recycling nutrients.

Link to other Learning Areas

The learner can link the information on the role of decomposers in an ecosystem to the production of manure in Agriculture.

Suggested Assessment Rubric

Levels / Indicators	Exceeds Expectation	Meets Expectation	Approaches Expectation	Below Expectation
Investigating the conditions necessary for photosynthesis.	The learner investigates all the conditions necessary for photosynthesis comprehensively.	The learner investigates all the conditions necessary for photosynthesis.	The learner investigates most of the conditions necessary for photosynthesis.	The learner investigates a few conditions necessary for photosynthesis.
Describing the process of digestion in human beings.	The learner describes the process of digestion in human beings comprehensively.	The learner describes the process of digestion in human beings correctly.	The learner partially describes the process of digestion in human beings simplistically.	The learner partially describes the process of digestion in human beings leaving out some key points.
Explaining pollination, fertilisation, and fruit formation in flowering plants.	The learner explains all the concepts of pollination, fertilisation, and fruit formation in flowering plants.	The learner explains all the concepts of pollination, fertilisation, and fruit formation in flowering plants.	The learner explains at least two concepts among pollination, fertilisation, and fruit formation in flowering plants.	The learner explains one concept among pollination, fertilisation, and fruit formation in flowering plants.
Categorising fruits and seeds based on their mode of dispersal.	The learner categorises fruits and seeds based on their mode of dispersal and other modes.	The learner categorises fruits and seeds based on their mode of dispersal.	The learner categorises fruits and seeds based on their mode of dispersal partially.	The learner partially categorises fruits and seeds without considering their mode of dispersal.
Constructing food chains and food webs in the environment.	The learner constructs food chains and food webs in the environment correctly and systematically.	The learner constructs food chains and food webs in the environment correctly.	The learner partially constructs food chains and food webs in the environment correctly.	The learner constructs food chains and food webs in the environment without considering the appropriate order.

STRAND 3.0: FORCE AND ENERGY

Strand	Sub-Strand	Specific learning outcomes	Suggested learning experiences	Suggested Key Inquiry Question(s)
3.0 Force and Energy	**3.1 Curved mirrors (18 lessons)** • *Types of curved mirrors,* • *Image formed by concave and convex mirrors (locating images, characteristics of images, and uses of curved concave and convex mirrors),* • *Applications of curved mirrors in day-to-day life.*	By the end of the sub-strand, the learner should be able to: a) describe types of curved mirrors, b) draw ray diagrams to locate images formed by concave and convex mirrors, c) describe the characteristics of images formed by concave and convex mirrors, d) explain the uses of concave and convex mirrors in day-to-day life, e) appreciate the applications of curved mirrors in	The learner is guided to: • discuss the types of curved mirrors *(concave, convex, and parabolic surfaces),* • discuss the terms used in curved mirrors *(aperture, pole, centre of curvature, principal axis, radius of curvature, principal focus, focal length, and focal plane),* • carry out activities to locate the position of images formed by concave and convex mirrors, • illustrate image positions for various object positions in concave and convex mirrors, • discuss the characteristics of images formed by curved mirrors *(object at infinity, beyond C, at C, between C & F, at F, and between F and P),* • discuss the applications of concave and convex mirrors in day-to-day life (*solar concentrators, car headlamps,*	How are curved mirrors used in day-to-day life?

		day-to-day life.	*shaving mirrors, dentists' mirrors, projector lamps, telescopes, mirrors used in supermarkets, driving mirrors*), • use digital or print media to explore more information on applications of curved mirrors.	

Core Competencies to be developed

- Self-efficacy: the learner exercises leadership skills as they discuss with peers the characteristics of images formed by curved mirrors.
- Communication and Collaboration: the learner develops listening and writing skills while discussing with peers the terms used in curved mirrors.

Pertinent and Contemporary Issues (PCIs):

Socio-economic Issues: the learner relates concepts of reflection at curved mirrors to safety and security as they discuss the applications of concave and convex mirrors in day-to-day life *(transport and surveillance)*.

Values

- Social Justice: the learner exercises equity and accord equal opportunity to group members as they discuss the characteristics of images formed by curved mirrors.
- Responsibility: the learner exercises excellence as they illustrate image positions for various object positions in concave and convex mirrors.

Links to other Subjects:

The learner relates concepts in curved mirrors to hairdressing and beauty therapy in Pre-technical studies.

Strand	Sub-Strand	Specific learning outcomes	Suggested learning experiences	Suggested Key Inquiry Question(s)
3.0 Force and Energy	**3.2 Waves (16 lessons)** • *Generation of waves,* • *Classification of waves as longitudinal and transverse,* • *Characteristics of waves,* • *Remote sensing* • *Applications of waves in day-to-day life (medical - ultrasound, X-rays, CT scans, MRI scans, cancer therapy, and laser surgery; communication*	By the end of the sub-strand, the learner should be able to: a) describe the generation of waves in nature, b) classify waves as longitudinal and transverse, c) describe basic characteristics of waves in nature, d) describe remote sensing in relation to waves, e) describe applications of waves in day-to-day life, f) appreciate the applications of	The learner is guided to: • brainstorm on the meaning of wave as used in science, • carry out activities to demonstrate the generation of waves in nature and classify them into longitudinal and transverse *(use a slinky spring, skipping rope, water in a basin, a source of sound/speaker, animations on wave),* • carry out activities to demonstrate the parts of a wave *(amplitude, wavelength, frequency, period, wave speed, phase; include wave equations; velocity=wavelength x frequency),* • carry out activities to demonstrate characteristics of waves *(straight line motion, reflection, bending of waves, movement around objects)* • brainstorm on the meaning of remote sensing, • discuss remote sensing in relation to waves, (*reflection, absorption, and transmission of*	How are waves applied in our day-to-day life?

	- radar, radio, cell phone, television, Wi-Fi, and operation of drones; cooking - microwave)	waves in day-to-day life.	*electromagnetic radiation at different wavelengths*), • use digital or print media to search for more information on the relationship between remote sensing and waves, remote sensing processes, active and passive remote sensing, remote sensing platforms, and carrier associated with remote sensing, • discuss the applications of waves in real-life situations.	

Core Competencies to be developed:

- Learning to Learn: the learner gains new knowledge and skills as they use digital or print media to search for more information on the relationship between remote sensing and waves.
- Creativity and Imagination: the learner experiments with various activities as they carry out activities to demonstrate generation of waves in nature and classify them into longitudinal and transverse.

Pertinent and Contemporary Issues (PCIs):

Learner Support Programs: the learner is exposed to career guidance services on various opportunities in the field of remote sensing as a career.

Values

- Respect: the learner exercises open-mindedness as they embrace discussions on different ideas on applications of waves in day-to-day life.
- Peace: the learner works in harmony with peers as they carry out activities to demonstrate characteristics of waves.

Links to other Subjects:

The learner relates concepts of waves to the transmission of sound from musical instruments in Creative Arts and Sports.

Suggested Assessment Rubric

Levels / Indicators	Exceeds expectation	Meets expectation	Approaches expectation	Below expectation
Drawing ray diagrams to locate images formed by concave and convex mirrors.	The learner draws ray diagrams to locate all images formed by concave and convex mirrors correctly and systematically.	The learner draws ray diagrams to locate all images formed by concave and convex mirrors.	The learner draws ray diagrams to locate most of the images formed by concave and convex mirrors.	The learner draws ray diagrams to locate a few images formed by concave and convex mirrors.
Describing the characteristics of images formed by concave and convex mirrors.	The learner describes all the characteristics of images formed by concave and convex mirrors comprehensively.	The learner describes all the characteristics of images formed by concave and convex mirrors.	The learner describes most of the characteristics of images formed by concave and convex mirrors.	The learner describes a few characteristics of images formed by concave and convex mirrors.
Explaining the uses of concave and convex mirrors in day-to-day life.	The learner explains the uses of concave and convex mirrors in day-to-day life extensively.	The learner explains the uses of concave and convex mirrors in day-to-day life sufficiently.	The learner explains most of the uses of concave and convex mirrors in day-to-day life.	The learner explains a few uses of concave and convex mirrors in day-to-day life.
Describing generation of waves in nature.	The learner describes the generation of waves in nature comprehensively.	The learner describes the generation of waves in nature correctly.	The learner partially describes the generation of waves in nature partially.	The learner partially describes the generation of waves in nature partially leaving out some key points.

Ability to describe the basic characteristics of waves in nature.	The learner describes the basic characteristics of waves in nature comprehensively.	The learner describes the basic characteristics of waves in nature sufficiently	The learner describes the basic characteristics of waves in nature partially.	The learner describes the basic characteristics of waves in nature omitting some key points partially leaving out some key details.
Ability to describe remote sensing in relation to waves.	The learner describes remote sensing in relation to waves correctly and comprehensively.	The learner describes remote sensing in relation to waves correctly.	The learner describes remote sensing in relation to waves partially.	The learner describes remote sensing in relation to waves partially with prompt.
Ability to describe the applications of waves in day-to-day life.	The learner describes the applications of waves in day-to-day life exhaustively.	The learner describes the applications of waves in day-to-day life sufficiently.	The learner describes most of the applications of waves in day-to-day life.	The learner describes a few applications of waves in day-to-day life.

APPENDIX 1: GUIDELINES FOR INTEGRATING COMMUNITY SERVICE LEARNING PROJECT

Introduction

In Grade 9, learners will undertake an integrated Community Service Learning (CSL) project of choice, focusing on a single subject or combining multiple subject. The CSL project will enable the learner to apply knowledge and skills from other subjects to address a problem in the community. The implementation of the integrated CSL project will follow a Whole School Approach, involving all members of the school community. This includes teachers, school administration, parents/guardians/, the local community and support staff. It will be a collaborative effort where the Social Studies teacher will coordinate and work with other subject teachers to design and implement the integrated CSL project. The teachers will select a theme for the CSL project, drawing from different Learning Areas and broader categories of Pertinent and Contemporary Issues (PCIs). The project should also provide an opportunity for learners to develop core competencies and nurture values. Learners will participate in a **variety of** integrated CSL group projects, working in teams and following a six-step milestone approach as follows:

Milestone	**Description**
Milestone 1	**Problem Identification** Learners study their community to understand the challenges faced and their effects on community members. Some of the challenges in the community can be: • Environmental degradation • Lifestyle diseases, Communicable and non-communicable diseases • Poverty • Violence and conflicts in the community • Food security issues
Milestone 2	**Designing a solution** Learners create an intervention to address the challenge identified.

Milestone 3	**Planning for the Project** Learners share roles, create a list of activities to be undertaken, mobilise resources needed to create their intervention, and set timelines for execution
Milestone 4	**Implementation** The learners execute the project and keep evidence of work done.
Milestone 5	**Showcasing /Exhibition and Report Writing** Exhibitions involve showcasing learners' project items to the community and reflecting on the feedback Learners write a report detailing their project activities and learnings from feedback
Milestone 6	**Reflection** Learners review all project work to learn from the challenges faced. They link project work with academic concepts, noting how the concepts enabled them to do their project as well as how the project helped to deepen learning of the academic concepts.

Note: The milestones will be staggered across the three terms of the academic calendar.

Assessment of Community Service Learning Integrated Project

Assessment for the integrated CSL group projects will be conducted formatively. The assessment will consider both the process and end product. This entails assessing each of the milestone stages of the integrated CSL group projects. The assessments will focus on three components namely: skills from various learning areas applied in carrying out the projects, core competencies developed and values nurtured.

APPENDIX 2: LIST OF ASSESSMENT METHODS, LEARNING RESOURCES AND NON-FORMAL ACTIVITIES

Assessment Methods in Science	Learning Resources	Non-Formal Activities
• Reflections • Game Playing • Pre-Post Testing • Model Making • Explorations • Experiments • Investigations • Conventions, Conferences and Debates • Teacher Observations • Project • Journals • Portfolio • Oral or Aural Question(s)s • Learner's Profile • Written Tests • Anecdotal Records	• Laboratory Apparatus and Equipment • Textbooks • Models • Digital media (Radio and TV education programmes, Kenya education cloud, and OERs) • Print media (charts, pictures, journals, magazines) • Digital Devices • Software • Recordings • Resource persons	• Visit the science historical sites. • Use digital devices to conduct scientific research. • Organising walks to have live learning experiences. • Developing simple guidelines on how to identify and solve some community problems. • Conducting science document analysis. • Participating in talks by resource persons on science concepts. • Participating in science clubs and societies. • Attending and Participating in Science and Engineering fairs. • Organising and participating in exchange programs. • Making oral presentations and demonstrations on science issues.