



**KENYA INSTITUTE OF CURRICULUM DEVELOPMENT**  
*A Skilled and Ethical Society*

## **JUNIOR SCHOOL CURRICULUM DESIGN**

### **INTEGRATED SCIENCE**

**GRADE 9**



First published 2024

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## NATIONAL GOALS OF EDUCATION

Education in Kenya should:

**i) 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. It is a paramount duty of education to help young people acquire this sense of nationhood by removing conflicts and promoting positive attitudes of mutual respect which enable them to live together in harmony and foster patriotism in order to make a positive contribution to the life of the nation.

**ii) 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 which are necessary for the smooth progress of a rapidly developing modern economy. There is bound to be a silent social revolution following the wake of rapid modernisation. Education should assist our youth to adapt to this change.

**b) Economic Needs**

Education in Kenya should produce citizens with the skills, knowledge, expertise and personal qualities that are required to support a growing economy. Kenya is building up a modern and independent economy which is in need of 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 taking place, especially in the developed world. We can only be part of this development if our education system is deliberately focused on the knowledge, skills and attitudes that will prepare our young people for these changing global trends.

**iii) Promote individual development and self-fulfilment**

Education should provide opportunities for the fullest development of individual talents and personality. It should help children to develop their potential interests and abilities. A vital aspect of individual development is the building of character.

iv) **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 to grow up into self-disciplined, self-reliant and integrated citizens.

v) **Promote social equality and responsibility.**

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

vi) **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 in order to build a stable and modern society.

vii) **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 of this international community with all the obligations and responsibilities, rights and benefits that this membership entails.

viii. **Promote positive attitudes towards good health and environmental protection.**

Education should inculcate in young people the value of good health in order 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 AT JUNIOR SCHOOL

S/No	Learning Area	Number of Lessons
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 and Nutrition	4
9.	Creative Arts and Sports	5
	Pastoral /Religious Instructional Program	1
<b>Total</b>		<b>40 + 1</b>



## **LEARNING OUTCOMES FOR JUNIOR SCHOOL**

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

Integrated Science provides the learner with the basic requisite skills, knowledge, values and attitudes necessary for specialization in STEM pathway at Senior School level. The rationale for inclusion 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 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 with a view to promote and maintain good health.
6. Develop capacity for scientific inquiry and problem solving in different situations.
7. Appreciate the use of scientific knowledge, skills, principles and practices in everyday life.
8. Apply acquired scientific knowledge, skills, principles and practices in everyday life.

## STRAND 1.0: MIXTURES, ELEMENTS AND COMPOUNDS

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question
<b>1.0 Mixtures, Elements and Compounds</b>	<b>1.1 Structure of the atom</b> <b>(14 lessons)</b> <ul style="list-style-type: none"> <li>● Structure of the atom (<i>protons, electrons, neutrons</i>)</li> <li>● Atomic number and mass number of elements</li> <li>● Electron arrangement of elements</li> <li>● Energy level diagrams (<i>cross or dot</i>)</li> <li>● Metals and non – metals</li> </ul> <p><b>Note:</b> (use the first 20 elements of the periodic table; do not</p>	<p>By the end of the sub strand the learner should be able to:</p> <ol style="list-style-type: none"> <li>describe the structure of the atom,</li> <li>determine the mass number of elements,</li> <li>draw the electron arrangement in atoms using dot or cross diagrams,</li> <li>classify elements into metals and non-metals,</li> <li>show interest in classifying elements into metals and non-metals.</li> </ol>	<p>The learner is guided to:</p> <ul style="list-style-type: none"> <li>● discuss the meaning of the atom and illustrate its structure,</li> <li>● work out the mass number of an element with peers,</li> <li>● write the electron arrangements of elements,</li> <li>● illustrate the electron arrangement in atoms using dot or cross diagrams collaboratively,</li> <li>● use electron arrangement to classify elements into metals and non-metals,</li> <li>● where possible use digital media to observe animations or videos on the structure of an atom and electron arrangement.</li> </ul> <p>Project:</p> <p>model the atomic structure of selected elements of the periodic</p>	How is the structure of the atom important?

	<i>(introduce periodic table at this level)</i>		table using locally available materials.	
<b>Core competencies to be developed:</b> <ul style="list-style-type: none"> <li><b>Communication and collaboration:</b> The learner speaks clearly and effectively as they discuss with peers the meaning of the atom and illustrate its structure.</li> <li><b>Creativity and imagination:</b> The learner experiments and comes up with models of atoms of selected elements from locally available materials.</li> </ul>				
<b>Pertinent and Contemporary Issues:</b> <p><b>Socio-economic issues (cyber security):</b> The learner observes cyber security measures when using digital media to observe animations or videos on the structure of an atom and electron arrangement.</p>				
<b>Values:</b> <ul style="list-style-type: none"> <li><b>Unity:</b> The learner respects others opinions while having group discussions</li> <li><b>Integrity:</b> 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.</li> </ul>				
<b>Links to other subjects</b> <ul style="list-style-type: none"> <li><b>Mathematics:</b> The learner works out the mass number of elements.</li> </ul>				

## STRAND 1.0: MIXTURES, ELEMENTS AND COMPOUNDS

Strand	Sub strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question
<b>1.0 Mixtures, Elements and Compounds</b>	<b>1.2 Metals and Alloys (16 lessons)</b> <ul style="list-style-type: none"> <li>Physical properties of metals (<i>state, ductility, malleability, electrical and thermal conductivity</i>)</li> <li>Composition of alloys (<i>steel, stainless steel, bronze, brass and duralumin</i>)</li> <li>uses of metals and alloys in day to day life (<i>sodium, magnesium, aluminium, copper, iron, gold, silver, brass, steel, bronze, duralumin and stainless steel</i>)</li> <li>Rusting (<i>causes, effects, prevention</i>)</li> </ul>	<p>By the end of the sub strand, the learner should be able to:</p> <ol style="list-style-type: none"> <li>describe the physical properties of metals,</li> <li>describe the composition of alloys,</li> <li>identify the uses of metals and alloys in day to day life,</li> <li>explain the effects of rusting of metals,</li> <li>appreciate the importance of common alloys in day to day life.</li> </ol>	<p>The learner is guided to:</p> <ul style="list-style-type: none"> <li>identify metals and non-metals in their environment,</li> <li>carry out experiments to demonstrate the physical properties of metals,</li> <li>discuss the composition of common alloys with peers,</li> <li>identify some items from the locality that have been made from alloys with peers,</li> <li>discuss the uses of common metals and alloys,</li> <li>discuss causes, effects and ways of controlling rusting of metals,</li> <li>where possible, use digital or print media to search for information on the physical properties of metals and common alloys.</li> </ul>	How are alloys important in day-day life?



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**Core competencies to be developed**

- **Communication and collaboration:** The learner works with peers to discuss the composition of common alloys
- **Digital literacy:** The learner interacts with digital technology as they search for information using digital devices on physical and chemical properties of metals and common alloys.

**Pertinent and Contemporary Issues (PCIs)**

- **Financial Literacy:** The learner appreciates the 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 uses of metals and common alloys.
- **Peace:** The learner avoids harming others when carrying out experiments to demonstrate the physical properties of metals

**Link to other subjects**

- **Pre- Technical Studies:** The learner learns about common metals and alloys used in workshops.
- **Agriculture and Nutrition:** The learner uses utensils made from metals and their alloys.

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Questions
<b>1.0 Mixtures, Elements and Compounds</b>	<b>1.3 Water hardness (14 lessons)</b> <ul style="list-style-type: none"> <li>● Physical properties of water (taste, colour, odour and boiling point )</li> <li>● Hard and soft water</li> <li>● Methods of softening temporary hard water (boiling, addition of washing soda, distilling, <b>Note. avoid ion exchange</b></li> <li>● Advantages and disadvantages of hard water and soft water</li> </ul>	<p>By the end of the sub strand, the learner should be able to:</p> <ol style="list-style-type: none"> <li>a) describe the physical properties of water,</li> <li>b) distinguish between hard and soft water in nature,</li> <li>c) apply methods of softening hard water in day to day life,</li> <li>d) outline advantages and disadvantages of hard and soft water,</li> <li>e) appreciate the applications of soft and hard water in day to day life.</li> </ol>	<p>The learner is guided to:</p> <ul style="list-style-type: none"> <li>● Collect and observe water from different sources, compare them in terms of appearance, odour, taste and boiling point (<i>taste water from safe sources</i>),</li> <li>● carry out activities to compare the lathering abilities of various samples of unboiled water with soap collaboratively,</li> <li>● group the samples into hard and soft water,</li> <li>● explain the meaning of hard and soft water,</li> <li>● discuss the advantages and disadvantages of soft and hard water,</li> <li>● perform various activities for softening hard water,</li> <li>● where possible, use digital or print media to search</li> </ul>	<ol style="list-style-type: none"> <li>1. What is the importance of different types of water?</li> <li>2. Why is hard water preferred for drinking?</li> </ol>

			for information, on the methods of softening hard water.	
<b>Core competencies to be developed:</b> <ul style="list-style-type: none"> <li>• <b>Learning to learn:</b> The learner reflects on their experiences as they apply methods of softening hard water in day to day life.</li> <li>• <b>Critical thinking and problem solving:</b> The learner develops interpretation skills as they relate the lathering ability of water to hardness and softness of water.</li> </ul>				
<b>Pertinent and Contemporary Issues (PCIs):</b> <ul style="list-style-type: none"> <li>• <b>Financial literacy:</b> The learner practises how to save on soap by using soft water for laundry.</li> </ul>				
<b>Values:</b> <ul style="list-style-type: none"> <li>• <b>Responsibility:</b> The learner plays a role when carrying out experiments on softening hard water.</li> <li>• <b>Respect:</b> The learner gives each other an opportunity to air their views as they discuss in a group the differences between hard and soft water.</li> </ul>				
<b>Link to other subjects</b> <ul style="list-style-type: none"> <li>• <b>Agriculture and Nutrition:</b> The learner uses soft water in laundry work.</li> </ul>				

**Assessment Rubric**

<b>Indicator/Level</b>	<b>Exceeds expectation</b>	<b>Meets expectation</b>	<b>Approaches expectation</b>	<b>Below expectation</b>
Ability to describe the structure of the atom	Describes the structure of the atom comprehensively	Describes the structure of the atom sufficiently	Describes the structure of the atom partially	Describes the structure of the atom superficially
Ability to classify elements into metals and non-metals	Classifies all elements into metals and nonmetals	Classifies most elements into metals and nonmetals	Classifies some elements into metals and nonmetals	Classifies a few elements into metals and nonmetals with prompts
Ability to outline uses of metals and alloys	Outlines uses of all metals and alloys correctly	Outlines uses of most metals and alloys correctly	Outlines uses of some metals and alloys correctly	Outlines uses of a few metals and alloys correctly with prompts
Ability to explain the effect of rusting on metals	Explains the effect of rusting on metals in details comprehensively	Explains the effect of rusting on metals sufficiently	Explains the effect of rusting on metals cursory	Explains the effect of rusting on metals superficially
Ability to outline advantages and disadvantages of hard and soft water	Outlines advantages and disadvantages of hard and soft water in details	Outlines advantages and disadvantages of hard and soft water	Outlines advantages and disadvantages of hard and soft water partially	Outlines advantages and disadvantages of hard and soft water superficially
Ability to apply different methods to soften temporary hard water	Applies all appropriate methods to soften temporary hard water	Applies appropriate methods to soften temporary hard water	Applies an appropriate method to soften temporary hard water	Applies an inappropriate method 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 Questions
2.0 <b>Living Things and their Environment</b>	<b>2.1 Nutrition in plants (18 lessons)</b> <ul style="list-style-type: none"> <li>Parts of a leaf (external and internal)</li> <li>Adaptations of the leaf to photosynthesis</li> <li>Structure of chloroplasts (membranes, grana and stroma)</li> <li>Process of photosynthesis (<i>chemical reactions during light and dark stage are not required</i>)</li> <li>Conditions necessary for photosynthesis</li> </ul>	By the end of the sub strand, the learner should be able to: <ol style="list-style-type: none"> <li>identify external and internal parts of a leaf,</li> <li>explain adaptations of the leaf to photosynthesis,</li> <li>describe the process of photosynthesis,</li> <li>investigate the conditions necessary for photosynthesis,</li> <li>appreciate the process of photosynthesis in nature.</li> </ol>	The learner is guided to: <ul style="list-style-type: none"> <li>use a hand lens to observe fresh leaves of plants, draw and label the external parts,</li> <li>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,</li> <li>discuss the adaptations of a leaf in relation to their roles in photosynthesis,</li> <li>observe the structure of the chloroplast on charts/photomicrographs, discuss its role in photosynthesis, share with peers,</li> <li>use print or non-print media to search for information on the process and products of photosynthesis, discuss and share with peers,</li> </ul>	What is the importance of photosynthesis in nature?

			<ul style="list-style-type: none"> <li>use print or non-print media to search for information on conditions necessary for photosynthesis, discuss and share with peers,</li> <li>set-up experiments to show that light, carbon (IV) oxide and chlorophyll are necessary for photosynthesis and share their findings with peers, (<i>use the starch test</i>).</li> </ul>	
<b>Core competencies to be developed</b> <ul style="list-style-type: none"> <li><b>Learning to learn:</b> The learner searches for information on photosynthesis, discusses and shares with peers.</li> <li><b>Self-efficacy:</b> The learner successfully carries out experiments on conditions necessary for photosynthesis and shares the findings.</li> </ul>				
<b>Values:</b> <ul style="list-style-type: none"> <li><b>Social justice:</b> The learner shares resources equitably while carrying out experiments to show that light, carbon (IV) oxide and chlorophyll are necessary for photosynthesis.</li> <li><b>Integrity:</b> 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.</li> </ul>				
<b>Pertinent and Contemporary Issues (PCIs)</b> <ul style="list-style-type: none"> <li><b>Environmental conservation:</b> The learner collects only the required number of leaves to observe the external structure.</li> <li><b>Safety:</b> The learner observes safety precautions while carrying out experiments on photosynthesis.</li> </ul>				
<b>Link to other learning areas:</b> <ul style="list-style-type: none"> <li>The information on photosynthesis is linked to food production Agriculture and Nutrition.</li> </ul>				



Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Questions
<b>2.0 Living things and their Environment</b>	<b>2.2 Nutrition in animals (16 lessons)</b> <ul style="list-style-type: none"> <li>● Modes of nutrition in animals (<i>parasitic, saprophytic, symbiosis and holozoic</i>)</li> <li>● Dentition in animals (<i>homodont and heterodont; carnivorous, herbivorous and omnivorous</i>)</li> <li>● Types of teeth (<i>incisors, canines, premolars and molars</i>) (structure and functions)</li> <li>● Process of digestion in human beings (<i>ingestion, digestion, absorption, assimilation and egestion</i>)</li> </ul>	<p>By the end of the sub strand, the learner should be able to:</p> <ol style="list-style-type: none"> <li>a) outline modes of nutrition in animals,</li> <li>b) describe the structure and functions of different types of teeth,</li> <li>c) classify animals based on their dentition,</li> <li>d) describe the process of digestion in human beings,</li> <li>e) appreciate that animals have varied modes of nutrition.</li> </ol>	<p>The learner is guided to;</p> <ul style="list-style-type: none"> <li>● use print or non-print media to search for information on modes of nutrition in animals, discuss with peers,</li> <li>● use specimens/charts/ models/ digital media to identify and draw different types of teeth,</li> <li>● collaboratively discuss the functions of different types of teeth,</li> <li>● use specimens/charts/models/ digital media to study dentition in different animals and share with peers,</li> <li>● use print or non-print media to search for information on the process of digestion in human beings, discuss and share with peers.</li> </ul>	<ol style="list-style-type: none"> <li>1. How do different animals feed?</li> <li>2. How is food digested in the human body?</li> </ol>

<b>Core competencies to be developed:</b> <ul style="list-style-type: none"><li>● <b>Communication and Collaboration:</b> The learner listens to others as they discuss the process of digestion in human beings.</li></ul>				
<b>Values:</b> <ul style="list-style-type: none"><li>● <b>Unity:</b> The learner collaborates with others as they study dentition in different animals.</li><li>● <b>Respect</b> The learner appreciates others' opinions while discussing different modes of nutrition in animals.</li></ul>				
<b>PCIs:</b> <ul style="list-style-type: none"><li>● <b>Animal welfare:</b> The learner cares for animals as they study different types of dentition.</li></ul>				
<b>Links to other learning areas:</b> <ul style="list-style-type: none"><li>● The information on nutrition in animals is linked to feeding of animals in Agriculture and Nutrition.</li></ul>				

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Questions
<b>2.0</b> <b>Living Things and their Environment</b>	<b>2.3</b> <b>Reproduction in plants</b> <b>(20 lessons)</b> <ul style="list-style-type: none"> <li>● Functions of parts of a flower</li> <li>● Meaning and types of pollination (<i>details on factor that promote/hinder self-pollination not required</i>)</li> <li>● Adaptations of flowers to wind and insect pollination</li> <li>● Fertilisation, seed and fruit formation in flowering plants</li> </ul>	By the end of the sub strand, the learner should be able to: <ol style="list-style-type: none"> <li>a) outline functions of parts of a flower,</li> <li>b) describe pollination in plants,</li> <li>c) outline the adaptations of flowers to wind and insect pollination,</li> <li>d) explain fertilisation and fruit formation in</li> </ol>	The learner is guided to: <ul style="list-style-type: none"> <li>● collaboratively discuss the functions of parts of a flower,</li> <li>● use print or non-print media to search for information on meaning and types of pollination, discuss and share with peers,</li> <li>● use print or non-print media to search for information on adaptations of flowers to wind and insect pollination, discuss and share with peers,</li> <li>● study samples of flowers to discuss their adaptations to agents of pollination, draw, label and share with peers,</li> <li>● watch animations or take an excursion in the school compound or neighbourhood to observe pollinating agents in action, record and discuss, (<i>the behaviour of insects and birds in relation to flowers; swaying of anthers of grasses e.g maize in wind</i>),</li> <li>● use print or print media to search for information on the effect of agrochemicals on pollinating agents and their effects on reproduction in plants,</li> </ul>	How does reproduction in plants occur?

	<ul style="list-style-type: none"> <li>• Fruit and seed dispersal in plants (modes and importance)</li> </ul>	<ul style="list-style-type: none"> <li>e) flowering plants, categorise fruits and seeds based on their mode of dispersal, recognize the role of flowers in nature.</li> <li>f)</li> </ul>	<ul style="list-style-type: none"> <li>• use print and non-print media to search for information on fertilisation and fruit formation in flowering plants, discuss and share with peers,</li> <li>• collaboratively study illustrations/ animations on fertilisation, seed and fruit formation, share with peers (<i>details of double fertilisation not required</i>),</li> <li>• use print and non-print media to search for information on seeds and fruits dispersal in plants, discuss the findings with peers,</li> <li>• observe different fruits and seeds from their locality, discuss and categorise them based on their mode of dispersal, (<i>consider locally available and safe wild fruits</i>),</li> <li>• discuss the importance of fruit and seed dispersal with peers.</li> </ul>	
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#### 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 its effect on reproduction in plants.

#### Values

- **Social Justice:** The learner collaboratively studies illustrations/ animations on fertilisation, seed and fruit formation.

#### 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 information on fertilisation and fruit formation is linked to crop production in Agriculture and Nutrition.

Strand	Sub-Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Questions
<b>2.0 Living Things and their Environment</b>	<b>2.4 The interdependence of life (18 lessons)</b> <ul style="list-style-type: none"> <li>● Biotic(living) components of the environment (<i>predation, parasitism, symbiosis, competition and saprophytic</i>)</li> <li>● Abiotic(non-living) components of the environment (<i>temperature, light, water, wind, atmospheric pressure, pH and salinity</i>)</li> <li>● Energy flow in an ecosystem (<i>food chains and food webs</i>)</li> </ul>	By the end of the sub strand, the learner should be able to: <ul style="list-style-type: none"> <li>a) explain the biotic and abiotic factors of the environment,</li> <li>b) construct food chains and food webs in the environment,</li> <li>c) describe the effect of human activities on the environment,</li> <li>d) appreciate the interdependence between living and non-living factors of the environment</li> </ul>	The learner is guided to: <ul style="list-style-type: none"> <li>● use print and non-print material to search for information biotic interrelationships, share findings with peers,</li> <li>● investigate the interrelationships between biotic factors of the environment in their locality and discuss the findings with peers (<i>include insects, spiders, lizards, toads, chameleon</i>),</li> <li>● where possible observe videos or animations/ showing the interrelationships between biotic factors of the environment,</li> <li>● use print and non-print media to search for information on interrelationships between organisms in Kenya national parks and game reserves,</li> <li>● discuss the effect of abiotic factors on living organisms,</li> <li>● search for information on the effect of human activities on the environment and discuss,</li> </ul>	What is the role of living and non-living factors in environments?

	<ul style="list-style-type: none"> <li>Effect of human activities on the environment (<i>habitat change, hunting and poaching, introduction of new living things</i>)</li> </ul>	environment.	<ul style="list-style-type: none"> <li>carry out activities to identify living organisms and what they feed on and construct food chains and food webs,</li> <li>discuss the role of decomposers in an ecosystem and their importance in recycling nutrients with peers (<i>avoid details of chemical reactions and specific microorganisms involved in nitrogen, carbon &amp; sulphur cycles</i>).</li> </ul>	
<b>Core competencies to be developed:</b> <ul style="list-style-type: none"> <li><b>Citizenship:</b> The learner develops a sense of responsibility to the nation while searching for information on interrelationships between organisms in Kenya national parks and game reserves.</li> <li><b>Critical thinking and problem solving:</b> The learner shows open-mindedness while investigating the interrelationships between living factors of the environment in their locality and discussing the findings.</li> </ul>				
<b>Values:</b> <ul style="list-style-type: none"> <li><b>Patriotism:</b> The learner develops love for the country as they search for information on interrelationships between organisms in Kenya national parks and game reserves.</li> <li><b>Peace:</b> The learner shows respect for diversity and heritage as they study the interdependence between living and non-living components of the environment.</li> </ul>				
<b>Pertinent and Contemporary Issues (PCIs)</b> <ul style="list-style-type: none"> <li><b>Environmental conservation:</b> The learner discusses the role of decomposers in an ecosystem and their importance in recycling nutrients.</li> </ul>				
<b>Link to other learning areas</b> <ul style="list-style-type: none"> <li>The information on the role of decomposers in an ecosystem is linked to production of manure in Agriculture and Nutrition.</li> </ul>				

### Suggested Assessment Rubric

Levels Indicator	Exceeds expectation	Meets expectation	Approaches expectation	Below expectation
Investigating the conditions necessary for photosynthesis	Investigates the conditions necessary for photosynthesis systematically	Investigates the conditions necessary for photosynthesis	Investigates the conditions necessary for photosynthesis inconclusively	Investigates the conditions necessary for photosynthesis inconclusively with prompts
Describing the process of digestion in human beings	Describes the process of digestion in human beings systematically and extensively	Describes the process of digestion in human beings	Describes the process of digestion in human beings simplistically	Describes the process of digestion in human beings simplistically with prompts
Explaining pollination, fertilisation and fruit formation in flowering plants	Explains pollination, fertilisation and fruit formation in flowering plants comprehensively	Explains pollination, fertilisation and fruit formation in flowering plants	Explains pollination, fertilisation and fruit formation in flowering plants partially	Explains pollination, fertilisation and fruit formation in flowering plants partially with prompts
Categorising fruits and seeds based on their mode of dispersal	Categorises fruits and seeds based on their mode of dispersal precisely	Categorises fruits and seeds based on their mode of dispersal	Categorises fruits and seeds based on their mode of dispersal partially	Categorises fruits and seeds based on their mode of dispersal partially with prompts
Constructing food chains and food webs in the environment	Construct food chains and food webs in the environment skillfully	Construct food chains and food webs in the environment	Construct food chains and food webs in the environment partially	Construct food chains and food webs in the environment sketchily



## STRAND 3.0: FORCE AND ENERGY

Strand	Sub Strand	Specific learning outcomes	Suggested learning experiences	Key inquiry question(s)
<b>3.0: FORCE AND ENERGY</b>	<b>3.1 Curved mirrors (18 lessons)</b>  <ul style="list-style-type: none"> <li>● Types of curved mirrors</li> <li>● Image formed by concave and convex mirrors (<i>locating images, characteristics of images and uses of curved concave and convex mirrors</i>)</li> <li>● Applications of curved mirrors in day to day life.</li> </ul>	By the end of the sub strand, the learner should be able to: <ol style="list-style-type: none"> <li>a) describe types of curved mirrors,</li> <li>b) draw ray diagrams to locate images formed by concave and convex mirrors,</li> <li>c) describe the characteristics of images formed by concave and convex mirrors,</li> <li>d) explain the uses of concave and convex mirrors in day to day life,</li> <li>e) appreciate the applications of curved mirrors in day to day life.</li> </ol>	The learner is guided to: <ul style="list-style-type: none"> <li>● discuss the types of curved mirrors (<i>concave, convex and parabolic surfaces</i>),</li> <li>● discuss with peers the terms used in curved mirrors (<i>aperture, pole, centre of curvature, principal axis, radius of curvature, principal focus, focal length and focal plane</i>),</li> <li>● carry out activities to locate position of images formed by concave and convex mirrors,</li> <li>● illustrate image positions for various object positions in concave and convex mirrors,</li> <li>● discuss the characteristics of images formed by curved mirrors (<i>object at infinity, beyond C, at C, between C &amp; F, at F and between F and P</i>),</li> <li>● discuss the applications of concave and convex mirrors in day to day life (<i>solar concentrators, car headlamps, shaving mirrors, dentists' mirrors, projector lamps, telescopes, mirrors used in supermarkets, driving mirrors</i>),</li> </ul>	How are curved mirrors used in day to day life?

			<ul style="list-style-type: none"> <li>use digital or print media to explore more information on applications of curved mirrors.</li> </ul>	
<b>Core competencies to be developed</b>				
<ul style="list-style-type: none"> <li><b>Self-efficacy:</b> The learner exercises leadership skills as they discuss with peers the characteristics of images formed by curved mirrors.</li> <li><b>Communication and Collaboration:</b> The learner develops listening and writing skills while discussing with peers the terms used in curved mirrors.</li> </ul>				
<b>Pertinent and Contemporary Issues (PCIs):</b>				
<ul style="list-style-type: none"> <li><b>Socio-economic issues:</b> 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 (<i>transport and surveillance</i>).</li> </ul>				
<b>Values</b>				
<ul style="list-style-type: none"> <li><b>Social justice:</b> The learner exercises equity and accord equal opportunity to group members as they discuss the characteristics of images formed by curved mirrors.</li> <li><b>Responsibility:</b> The learner exercises excellence as they illustrate image positions for various object positions in concave and convex mirrors.</li> </ul>				
<b>Links to other subjects:</b>				
<ul style="list-style-type: none"> <li><b>Pre-technical studies:</b> The learner relates concepts in curved mirrors to hairdressing and beauty therapy.</li> </ul>				

Strand	Sub Strand	Specific learning outcomes	Suggested learning experiences	Key inquiry question(s)
<b>3.0: FORCE AND ENERGY</b>	<b>3.2 Waves (16 lessons)</b> <ul style="list-style-type: none"> <li>● Generation of waves</li> <li>● Classification of waves as longitudinal and transverse</li> <li>● Characteristics of waves</li> <li>● Remote sensing</li> <li>● Applications of waves in day to day life (<i>medical - ultrasound, X-rays, CT scans, MRI scans, cancer therapy and laser surgery; communication - radar, radio, cell-phone, television, Wi-Fi and</i></li> </ul>	<p>By the end of the sub strand, the learner should be able to:</p> <ol style="list-style-type: none"> <li>a) describe generation of waves in nature,</li> <li>b) classify waves as longitudinal and transverse,</li> <li>c) describe basic characteristic of waves in nature,</li> <li>d) describe remote sensing in relation to waves,</li> <li>e) describe applications of waves in day to day life,</li> <li>f) appreciate the applications of waves in day to day life.</li> </ol>	<p>The learner is guided to:</p> <ul style="list-style-type: none"> <li>● brainstorm on the meaning of wave as used in science,</li> <li>● carry out activities to demonstrate generation of waves in nature and classify them into longitudinal and transverse (<i>use a slinky spring, skipping rope, water in a basin, a source of sound/speaker, animations on wave</i>),</li> <li>● Carry out activities to demonstrate the parts of a wave (<i>amplitude, wavelength, frequency, period, wave speed, phase; include wave equations; velocity=wavelength x frequency</i>),</li> <li>● carry out activities in groups to demonstrate characteristics of waves (<i>straight line motion, reflection, bending of waves, movement around objects</i>)</li> <li>● discuss remote sensing in relation to waves, (<i>reflection, absorption, and transmission of electromagnetic radiation at different wavelengths</i>),</li> <li>● use digital or print media to search for more information on the relationship between</li> </ul>	How are waves applied in our day to day life?

	<i>operation of drones; cooking - microwave)</i>		remote sensing and waves, <ul style="list-style-type: none"> <li>discuss the applications of waves in real life situations.</li> </ul>	
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**Core competencies to be developed:**

- Learning to learn:** The learner does investigations 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 cares for others as they carry out activities in groups to demonstrate characteristics of waves.

**Links to other subjects:**

- Creative Arts and Sports:** The learner relates concepts of waves to transmission of sound from musical instruments.

**Assessment Rubrics**

<b>Indicators</b>	<b>Exceeds expectation</b>	<b>Meets expectation</b>	<b>Approaches expectation</b>	<b>Below expectation</b>
Drawing ray diagrams to locate images formed by concave and convex mirrors	Draws ray diagrams to locate images formed by concave and convex mirrors correctly and systematically	Draws ray diagrams to locate images formed by concave and convex mirrors correctly	Draws ray diagrams to locate images formed by concave and convex mirrors, omitting some details	Draws ray diagrams to locate images formed by concave and convex mirrors omitting some details with prompts
Describing the characteristics of images formed by concave and convex mirrors	Describes the characteristics of images formed by concave and convex mirrors correctly and consistently	Describes the characteristics of images formed by concave and convex mirrors correctly	Describes some characteristics of images formed by concave and convex mirrors correctly	Describes the characteristics of images formed by concave and convex mirrors with prompt
Explaining the uses of concave and convex mirrors in day to day life	Explains the uses of concave and convex mirrors in day to day life extensively	Explains the uses of concave and convex mirrors in day to day life sufficiently	Correctly explains some uses of concave and convex mirrors in day to day life	With prompt, explains the uses of concave and convex mirrors in day to day life
Describing generation of waves in nature	Describes generation of waves in nature comprehensively	Describes generation of waves in nature correctly	Describes generation of waves in nature partially	Describes the generation of waves in nature partially with prompt

Ability to describe basic characteristics of waves in nature	Describes basic characteristics of waves in nature extensively	Describes basic characteristics of waves in nature sufficiently	Describes basic characteristics of waves in nature partially	Describes basic characteristics of waves in nature partially with prompt
Ability to describe remote sensing in relation to waves	Describes remote sensing in relation to waves comprehensively	Describes remote sensing in relation to waves correctly	Describes remote sensing in relation to waves partially	Describes remote sensing in relation to waves partially with prompt
Ability to describe applications of waves in day to day life	Describes applications of waves in day to day life extensively	Describes applications of waves in day to day life sufficiently	Describes some applications of waves in day to day life	Describes some applications of waves in day to day life with prompt

## APPENDIX

Assessment Methods in Science	Learning Resources	Non-Formal Activities
<ul style="list-style-type: none"> <li>● Reflections</li> <li>● Game Playing</li> <li>● Pre-Post Testing</li> <li>● Model Making</li> <li>● Explorations</li> <li>● Experiments</li> <li>● Investigations</li> <li>● Conventions, Conferences and Debates</li> <li>● Teacher Observations</li> <li>● Project</li> <li>● Journals</li> <li>● Portfolio</li> <li>● Oral or Aural Questions</li> <li>● Learner's Profile</li> <li>● Written Tests</li> <li>● Anecdotal Records</li> </ul>	<ul style="list-style-type: none"> <li>● Laboratory Apparatus and Equipment</li> <li>● Textbooks</li> <li>● Models</li> <li>● Digital media (Radio and TV education programmes, kenya education cloud and OERs)</li> <li>● Print media ( charts, pictures, journals, magazines)</li> <li>● Digital Devices</li> <li>● Software</li> <li>● Recordings</li> <li>● Resource persons</li> </ul>	<ul style="list-style-type: none"> <li>● Visit the science historical sites.</li> <li>● Use digital devices to conduct scientific research.</li> <li>● Organising walks to have live learning experiences.</li> <li>● Developing simple guidelines on how to identify and solve some community problems.</li> <li>● Conducting science document analysis.</li> <li>● Participating in talks by resource persons on science concepts.</li> <li>● Participating in science clubs and societies.</li> <li>● Attending and Participating in Science and Engineering fairs.</li> <li>● Organising and participating in exchange programs.</li> <li>● Making oral presentations and demonstrations on science issues.</li> </ul>

## CSL AT GRADE 9

### Introduction

In Grade 9, learners will undertake an integrated Community Service Learning (CSL) project of choice from a single or combined 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 take a Whole School Approach, where all members of the school community including teachers, school administration, parents/guardians/ local community and support staff. It will be a collaborative effort where the teacher of Social Studies coordinates and works with other subject teachers to design and implement the integrated CSL project. The teachers will select a theme drawn from different Learning Areas and the broader categories of Pertinent and Contemporary Issues (PCIs) for the CSL project. It should also provide an opportunity for development of core competencies and nurturing of values. Learners will undertake a **variety of** integrated CSL group projects in teams of following a 6-step milestone approach as follows:

Milestone	Description

Milestone 1	<p><b>Problem Identification</b></p> <p>Learners study their community to understand the challenges faced and their effects on community members.</p> <p>Some of the challenges in the community can be:</p> <ul style="list-style-type: none"> <li>• Environmental degradation</li> <li>• Lifestyle diseases, Communicable and non-communicable diseases</li> <li>• Poverty</li> <li>• Violence and conflicts in the community</li> <li>• Food security issues</li> </ul>
Milestone 2	<p><b>Designing a solution</b></p> <p>Learners create an intervention to address the challenge identified.</p>
Milestone 3	<p><b>Planning for the Project</b></p> <p>Learners share roles, create a list of activities to be undertaken, mobilise resources needed to create their intervention and set timelines for execution</p>
Milestone 4	<p><b>Implementation</b></p> <p>The learners execute the project and keep evidence of work done.</p>

Milestone 5	<b>Showcasing /Exhibition and Report Writing</b> 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	<b>Reflection</b> 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 3 terms of the academic calendar.

### **Assessment of CSL 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. They will focus on 3 components namely: skills from various learning areas applied in carrying out the projects, core competencies developed and values nurtured.