



REPUBLIC OF KENYA
MINISTRY OF EDUCATION

JUNIOR SCHOOL CURRICULUM DESIGN

INTEGRATED SCIENCE

GRADE 9

FOR LEARNERS WITH VISUAL IMPAIRMENT



KENYA INSTITUTE OF CURRICULUM DEVELOPMENT
A Skilled and Ethical Society

First Published in 2023

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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, 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, feedback from curriculum implementers and other stakeholders led to rationalisation and review of the basic education curriculum.

The reviewed Grade nine curriculum designs for learners with visual impairment build on competencies attained by learners at Grade eight. Emphasis at this grade is the development of skills for exploration and making informed decision on pathways based on careers.

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.

HON. EZEKIEL OMBAKI MACHOGU, CBS
CABINET SECRETARY,
MINISTRY OF EDUCATION

PREFACE

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

The reviewed Grade nine curriculum furthers implementation of the CBC from Grade eight. The curriculum provides opportunities for learners to focus in a field of their choice to form a foundation for further education and training and/or gain employable skills. 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 nine curriculum designs for learners with visual impairment 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 nine and prepare them for smooth transition to Grade Senior School. Furthermore, it is my hope that teachers will use the adapted 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, that 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 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 nine curriculum designs for learners with visual impairment were developed and adapted 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,

I 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 and adaptation of the Grade nine curriculum designs for learners with visual impairment. In relation to this, I 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 and adapting these designs. Finally, I am very grateful to the KICD Council Chairperson and other members of the Council for very consistent guidance in the process.

I assure all teachers, parents and other stakeholders that this curriculum design will effectively guide the implementation of the CBC at Grade nine and preparation of learners with visual impairment for transition to Senior School.

A handwritten signature in blue ink, appearing to read 'Charles O. Ong'ondo', with a horizontal line underneath the name.

PROF. CHARLES O. ONG'ONDO, PhD, MBS
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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. 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.

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 which are 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 modernization. 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 recognizes 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.

3. 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.

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

5. 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.

6. Promote respect for and development of Kenya's rich and varied cultures

Education should instill 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.

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 of this international community with all the obligations and 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 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 FOR JUNIOR SCHOOL

S/ No.	Learning Area	Lesson
1.	English for Learners with Visual Impairment	5
2.	Kiswahili for Learners with Visual Impairment	4
3.	Mathematics for Learners with Visual Impairment	5
4.	Religious Education	4
5.	Integrated Science for Learners with Visual Impairment	5
6.	Agriculture & Nutrition for Learners with Visual Impairment	4
7.	Social Studies for Learners with Visual Impairment	4
8.	Creative Arts and sports for Learners with Visual Impairment	5
9.	Pre- technical Studies for learners with Visual Impairment	4
10.	Pastoral/ Religious Instruction Programme	1
	Total	41

NOTE: Braille skills for learners with Blindness to be implemented as Non formal (Co-Curricular) Programmes

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 learning area is expected to create a scientific culture that inculcates scientific literacy to enable learners with visual impairment to make informed choices in their personal lives and approach life challenges in a systematic and logical manner. The inclusion of Integrated Science is therefore a deliberate effort to enhance the level of scientific literacy of learners with visual impairment and equip them with the relevant basic integrated scientific knowledge, skills, values and attitudes needed for career development, employment and independent living. Concepts in Integrated Science are presented as units within which there are specific strands that build on the competencies acquired in Science and Technology at Upper Primary level. The emphasis of science education at lower secondary levels is to enhance learners' scientific thinking through learning activities that involve the basic science process skills.

Learners with visual impairment, particularly those with blindness have not been learning certain concepts in science especially those related to chemistry and physics due to lack of science educational resources and instructional methods that have been appropriately adapted to make science accessible to these categories of learners. In view of this, integrated science in Junior School has been adapted to provide multisensory experimental approaches that are crucial in helping learners with blindness to gain more purposeful, independent, and hands-on laboratory experience. Appropriate apparatus, equipment, materials, assistive technology as well as suitable experiences have been suggested to make learning in this subject accommodative and interesting to learners with visual impairment. Learners with low vision need enhancement in terms of materials and learning environment to address the limitations of sight that may hinder effective learning of integrated science.

Integrated Science provides the learner with the basic requisite skills, knowledge, values and attitudes necessary for specialization in the STEM pathway at senior school level. The rationale for inclusion of Integrated Science is anchored on 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.

Integrated Science is 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.

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) <ul style="list-style-type: none"> ● <i>Structure of the atom (protons, electrons, neutrons),</i> ● <i>Atomic number and mass number of elements,</i> ● <i>Electron arrangement of elements,</i> ● <i>Energy level diagrams (cross or dot),</i> ● <i>Metals and non –metals,</i> 	By the end of the sub strand the learner should be able to: <ol style="list-style-type: none"> 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, (<i>for learners with low vision</i>) d) interpret tactile charts of the atomic structure, (<i>for learners with blindness</i>), e) classify elements into metals and non-metals, f) Show interest in classifying elements 	<ul style="list-style-type: none"> ● In groups, learners discuss the meaning of the atom and illustrate its structure. Learners with blindness are guided to make a tactile diagram of the structure of an atom. ● Learners with low vision are guided to study charts in appropriate font and colour contrast showing the structure of the atom and its components and then draw the structure of an atom. Learners with blindness to manipulate models and tactile charts showing the structure of the atom. Learners to model the structure of an atom. ● Learners are guided to work out the mass number of an element. ● Learners are guided to write the electron arrangements of elements in print or braille. ● Learners with low vision are guided to illustrate electron arrangement in atoms using dot or cross diagrams. Learners with blindness manipulate tactile atomic 	How is the structure of the atom important?

	<p>Note: (use the first 20 elements of the periodic table; do not introduce periodic table at this level).</p>	<p>into metals and non-metals.</p>	<p>structure and identify electrons on each energy level.</p> <ul style="list-style-type: none"> ● Learners are guided to use electron arrangement to classify elements into metals and non-metals. ● Learners are guided to use digital devices with assistive technology, print or braille media to search for information on the structure of an atom and electron arrangement. <p><i>Precaution: Observe cyber security measures.</i></p> <p>Project: Learners to model the atomic structure of selected elements of the periodic table using locally available materials. Learners with blindness are supported to assemble materials of different texture to be used to represent different components of an atom.</p>	
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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.

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.

Pertinent and Contemporary Issues (PCIs):

- **Socio-economic Issues** (cyber security): The learner observes cyber security measures when using digital media to observe animations or videos on the structure of an atom and electron arrangement.

Links to other subjects:

- **Mathematics:** The learner works out mass number of the first 20 elements of the periodic table.

Suggested learning resources:

Digital devices with assistive technology such as adapted keyboard, screen readers and screen magnifiers, print media, braille media, print and tactile charts of an atom.

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	1.2 Metals and Alloys (16 lessons) <ul style="list-style-type: none"> ● <i>Physical properties of metals (state, ductility, malleability, electrical and thermal conductivity)</i> ● <i>Composition of alloys (steel, stainless steel, bronze, brass and duralumin)</i> ● <i>uses of metals and alloys in day to day life (sodium, magnesium, aluminium,</i> 	By the end of the sub strand, the learner should be able to: <ol style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> ● Learners are guided to identify metals and non-metals in their environment. Learners with blindness to be orientated in the environment so as to identify metals and non-metals. ● Learners are guided to carry out experiments to demonstrate the physical properties of metals such as colour, ductility and malleability, density, electrical and thermal conductivity. Learners with blindness are guided to explore different metals and experience its physical properties. Learners are given verbal descriptions on aspects that require use of sight such as identifying the colour of different metals. ● In groups, learners discuss the composition of common alloys. ● Learners are guided to discuss causes, effects and ways of controlling rusting of metals. ● Learners are guided to use digital devices with assistive technology, print or braille media to search for 	How are alloys important in day-day life?

	<p><i>copper, iron, gold, silver, brass, steel, bronze, duralumin and stainless steel)</i></p> <ul style="list-style-type: none"> ● <i>Rusting (causes, effects, prevention)</i> 		<p>information on the physical properties of metals and common alloys.</p>	
<p>Core competencies to be developed</p> <ul style="list-style-type: none"> ● Communication and collaboration: The learner works with peers to learners 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. 				
<p>Values</p> <ul style="list-style-type: none"> ● Respect: The learner accommodates others' opinions during group discussions on uses of metals and common alloys. ● Peace: The learner humorously works together with peers learners discuss the composition of common alloys. 				
<p>Pertinent and Contemporary Issues (PCIs)</p> <ul style="list-style-type: none"> ● 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. 				
<p>Link to other subjects</p> <ul style="list-style-type: none"> ● Pre- Technical Studies: The learner links the properties of common metals and alloys used in workshops. 				

- **Agriculture and Nutrition:** The learner uses relates the use of utensils made from metals and their alloys.

Suggested Learning Resources:

Digital devices with assistive technology such as adapted keyboard, screen readers and screen magnifiers, print materials in appropriate font and colour contrast and braille media, print and braille course book.

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
1.0 Mixtures, Elements and Compounds	<p>1.3 Water hardness</p> <p>(14 lessons)</p> <ul style="list-style-type: none"> ● <i>Physical properties of water (taste, colour, odour and boiling point),</i> ● <i>Hard and soft water</i> ● <i>Methods of softening temporary hard water (boiling, addition of washing soda, distilling),</i> 	<p>By the end of the sub strand, the learner should be able to:</p> <ol style="list-style-type: none"> describe the physical properties of water, distinguish between hard and soft water in nature, apply methods softening hard water in day to day life, outline advantages and disadvantages of hard and soft water appreciate the applications of soft and hard water in day to day life. 	<ul style="list-style-type: none"> ● Learners are guided to collect water from different sources and compare them in terms of appearance, odour, taste and boiling point. Learners with blindness are given verbal descriptions on the appearance of water from different sources. <i>Precaution: Taste water from safe sources.</i> ● Learners are guided to carry out activities to compare the lathering abilities of various samples of un boiled water with soap. Learners use their findings to group the samples into hard and soft water. ● Learners are guided to group the samples into hard and soft water. ● In groups, learners explain the meaning of hard and soft water. 	<ol style="list-style-type: none"> 1. Why do we soften hard water? 2. Why is hard water preferred for drinking?

	<p><i>Note. avoid ion exchange</i></p> <ul style="list-style-type: none"> • <i>Advantages and disadvantages of hard water and soft water.</i> 		<ul style="list-style-type: none"> • In pairs, learners discuss the advantages and disadvantages of soft and hard water. • Learners are guided to perform various activities for softening hard water e.g. boiling, addition of washing soda, distilling. • Learners are guided to use digital devices with assistive technology, print or braille media to search for information on the methods of softening hard water and applications of hard and soft water. 	
<p>Core competencies to be developed:</p> <ul style="list-style-type: none"> • 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 hardness and softness of water. 				
<p>Values:</p> <ul style="list-style-type: none"> • Responsibility: The learner plays a role when carrying out experiments on softening hard water. • Respect: The learner gives others an opportunity to air their views as they discuss in a group the differences between hard and soft water. 				
<p>Pertinent and Contemporary Issues (PCIs):</p> <ul style="list-style-type: none"> • Financial literacy: The learner practices how to save on soap by using soft water for laundry. 				
<p>Link to other subjects: Agriculture and Nutrition: The learner relates the uses soft water in laundry work.</p>				
<p>Suggested Learning Resources: Digital devices with assistive technology such as adapted keyboard, screen readers and screen magnifiers, print materials in appropriate font and colour contrast and braille materials and equipment.</p>				

Suggested Assessment Rubric

Level	Exceeds expectation	Meets expectation	Approaches expectation	Below expectation
Indicator				
Ability to: <ul style="list-style-type: none">• Describe the structure of an atom.• Carry out experiment to investigate physical properties of metals.• Describe the composition of alloys,• Distinguish between hard and soft water in nature.	The learner demonstrates four skills.	The learner demonstrates three skills.	The learner demonstrates two skills.	The learner demonstrates one skill or none.

STRAND 2.0: LIVING THINGS AND THEIR ENVIRONMENT

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
<p>2.0 Living Things and their Environment</p>	<p>2.1 Nutrition in plants (18 lessons)</p> <ul style="list-style-type: none"> • <i>Parts of a leaf (external and internal)</i> • <i>Adaptations of the leaf to photosynthesis</i> • <i>Structure of chloroplasts (membranes, grana and stroma)</i> • <i>Process of photosynthesis (chemical reactions during light and dark stage are not required)</i> 	<p>By the end of the sub strand, the learner should be able to:</p> <ol style="list-style-type: none"> 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 importance of photosynthesis in nature. 	<ul style="list-style-type: none"> • Learners with low vision are guided to use a hand lens to observe fresh leaves of plants, draw and label the external parts. Learners with blindness are guided to manipulate a leaf and tactile diagrams of a leaf and identify its external parts. Learners with blindness are given verbal description of the leaf as seen under hand lens. • Learners are guided to use print, braille 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. • In groups, learners discuss the adaptations of a leaf in relation to their roles in photosynthesis. • Learners with low vision are guided to observe and discuss the structure of the chloroplast on charts or photomicrographs and relate it to its 	<ol style="list-style-type: none"> 1. How do plants obtain nutrients? 2. Why is photosynthesis important?

	<p><i>Conditions necessary for photosynthesis</i></p>		<p>role in photosynthesis. Learners with blindness manipulate and interpret a tactile diagram of the structure of the chloroplast and relate it to its role in photosynthesis.</p> <ul style="list-style-type: none"> ● Learners are guided to use print, braille or non-print media to search for information on the process and products of photosynthesis, discuss and share with peers. ● Learners are guided to use print, braille or non-print media to search for information on conditions necessary for photosynthesis, discuss and share with peers. ● Learners are guided to set-up and carry out experiments to show that light, carbon (IV) oxide and chlorophyll are necessary for photosynthesis and share findings with peers. Learners with blindness to be supported to set up the experiment and are given verbal description on the expected colour change. (<i>use the starch test</i>) 	
<p>Core competencies to be developed:</p> <ul style="list-style-type: none"> ● Learning to learn: The learner studies independently while using charts or photomicrographs or non-print media to observe and discuss the internal structure of the leaf in relation to their roles in photosynthesis. 				

- **Self-efficacy:** The learner develops leadership skills while working in groups to discuss the process and products of photosynthesis.

Values:

- **Responsibility:** The learner observes safety precautions while carrying out experiments to show that light, carbon (IV) oxide and chlorophyll are necessary for photosynthesis.
- **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 education and climate change:** The learner collects only the required number of specimens of plants to observe and discuss the external structure of the leaf in relation to their roles in photosynthesis.

Link to other subjects:

- **Agriculture and Nutrition:** The information on photosynthesis is linked to food production.

Suggested Learning Resources:

Print and tactile charts of the internal parts of a leaf, light microscope, digital devices with assistive technology such as adapted keyboard, screen readers and screen magnifiers, print materials in appropriate font and colour contrast and braille materials and equipment.

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Questions
2.0 Living things and their Environment	2.2 Nutrition in animals (16 lessons) <ul style="list-style-type: none"> ● <i>modes of nutrition in animals (parasitic, saprophytic, symbiosis and holozoic)</i> ● <i>dentition in animals (homodont and heterodont; carnivorous, herbivorous and omnivorous)</i> ● <i>types of teeth (incisors, canines, premolars and molars)</i> 	<p>By the end of the sub strand, the learner should be able to:</p> <ol style="list-style-type: none"> 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 	<ul style="list-style-type: none"> ● Learners are guided to use digital devices with assistive technology, print or braille media to search for information on modes of nutrition in animals and make presentations. ● Learners are guided to use specimens, charts, models or digital devices with assistive technology to identify different types of teeth. Learners with blindness are guided to manipulate the specimen and models of teeth so as 	<ol style="list-style-type: none"> 1. How do different animals feed? 2. How is food digested in the human body?

	<p><i>(structure and functions)</i></p> <ul style="list-style-type: none"> ● <i>process of digestion in human beings (ingestion, digestion, absorption, assimilation and egestion)</i> 	<p>digestion in human beings,</p> <p>e) appreciate that animals have varied modes of nutrition.</p>	<p>to identify their shape and features.</p> <ul style="list-style-type: none"> ● Learners with low vision are guided to draw and label different types of teeth while learners with blindness are guided to mount and label parts of different types of teeth. ● In groups, learners discuss the functions of different types of teeth. ● Learners are guided to use specimens, models or digital devices with assistive technology to study dentition in different animals and share the findings with peers. ● Learners are guided to use print, braille or non-print media to search for information on the process of digestion in human beings, and share with peers. 	
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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 collaborates with others 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:

- **Agriculture and Nutrition:** The information on nutrition in animals is linked to feeding of animals.

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Questions
<p>2.0</p> <p>Living Things and their Environment</p>	<p>2.3</p> <p>Reproduction in plants</p> <p>(20 lessons)</p> <ul style="list-style-type: none"> • <i>functions of parts of a flower</i> • <i>meaning and types of pollination (details on factor that promote/hinder self-pollination not required)</i> • <i>adaptations of flowers to wind and insect pollination</i> 	<p>By the end of the sub strand, the learner should be able to:</p> <ol style="list-style-type: none"> a) outline functions of parts of a flower, b) describe pollination in plants, c) outline the adaptations of flowers to wind and insect pollination, 	<ul style="list-style-type: none"> • In groups, learners discuss the functions of parts of a flower. • Learners are guided to use print, braille or non-print media to search for information on meaning and types of pollination, discuss and share findings with peers. • Learners are guided to use print, braille or non-print media to search for information on adaptations of flowers to wind and insect pollination, discuss and share findings with peers. • Learners with low vision are guided to study samples of flowers to discuss their adaptation to agents of pollination, draw, label and share findings with peers. Learners with blindness are guided to manipulate and study samples of flowers and discuss their agents of 	<p>How does reproduction in plants occur?</p>

	<ul style="list-style-type: none"> • <i>fertilisation, seed and fruit formation in flowering plants</i> • <i>fruit and seed dispersal in plants (modes and importance)</i> 	<p>d) explain fertilisation and fruit formation in flowering plants,</p> <p>e) categorise fruits and seeds based on their mode of dispersal,</p> <p>f) recognize the role of flowers in nature.</p>	<p>pollination. The learners to mount and label parts of different flowers.</p> <ul style="list-style-type: none"> • In pairs, learners discuss adaptations of agents of pollination. • Learners watch animations or listen to videos or take an excursion in the school compound or neighbourhood to observe pollinating agents in action, record and discuss. Learners with blindness are given verbal descriptions on how different agent of pollination pollinate flowers. • Learners are guided to use print, braille or non-print media to search for information on the effect of agrochemicals on pollinating agents and their effects on reproduction in plants. • Learners are guided to use print, braille or non-print media to search for information on fertilisation and fruit formation in flowering plants, discuss and share the findings with peers. • Learners are guided to study illustrations or animations on fertilisation, seed and fruit formation, share the findings with peers. Learners 	
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			<p>with blindness listen to a video on fertilisation, seed and fruit formation or are given verbal descriptions on fertilisation, seed and fruit formation. <i>Hint: (details of double fertilisation not required).</i></p> <ul style="list-style-type: none"> • Learners are guided to use print, braille or non-print media to search for information on seeds and fruits dispersal in plants, and discuss the findings with peers. • Learners are guided to observe or manipulate 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>). • Learners are guided to discuss the importance of fruit and seed dispersal with peers. 	
<p>Core competencies to be developed:</p> <ul style="list-style-type: none"> • Learning to learn: The learner searches for information on fertilisation and fruit formation in flowering plants. • Digital literacy: The learner uses digital devices with assistive technology to search for information on the effect of agrochemicals on pollinating agents and its 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):

- **Environmental Education and climate change :** 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:

- **Agriculture and Nutrition:** The information on fertilisation and fruit formation is linked to crop production.

Suggested Learning Resources:

Digital devices with assistive technology such as adapted keyboard, screen readers and screen magnifiers, print media with appropriate font and colour contrast and braille materials and equipment.

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) <ul style="list-style-type: none"> • <i>biotic(living) components of the environment (predation, parasitism, symbiosis, competition and saprophytic),</i> • <i>abiotic(non-living) components of the environment (temperature, light, water, wind, atmospheric pressure, pH and salinity),</i> • <i>energy flow in an ecosystem</i> 	By the end of the sub strand, the learner should be able to: <ol style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> • Learners are guided to use digital, print and braille media to search for information on the interrelationships between biotic factors of the environment. • Learners are guided to investigate the interrelationships between biotic factors of the environment in their locality and discuss the findings with peers. • Learners are guided to use digital devices with assistive technology, print or braille media to search for information on the interrelationships between biotic factors of the environment. • Learners are guided to use print, non-print or braille media to search for information on interrelationships between organisms in Kenya national parks and game reserves. • In groups, learners discuss the effect of abiotic factors on living organisms. • Learners are guided to search for information on the effect of human 	<ol style="list-style-type: none"> 1. How is interdependence in an ecosystem important? 2. How do living and non-living components of the environment influence life?

	<p><i>(food chains and food webs,)</i></p> <ul style="list-style-type: none"> • <i>effect of human activities on the environment (habitat change, hunting and poaching, introduction of new living things).</i> 		<p>activities on the environment and make presentation.</p> <ul style="list-style-type: none"> • Learners are guided to carry out activities to identify living organisms and what they feed on and construct food chains and food webs. Learners with blindness are guided to interpret simple food webs and construct simple food chains. • In pairs, learners discuss the role of decomposers in an ecosystem and their importance in recycling nutrients. <i>(avoid details of chemical reactions and specific microorganisms involved in nitrogen, carbon & sulphur cycles)</i> 	
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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 national parks and game reserves.
- **Critical thinking and problem solving:** The learner develops open-mindedness while investigating the interrelationships between living factors of the environment in their locality and discussing the findings.

Values:

- **Patriotism:** The learner enhances love for the country as they search for information on interrelationships between organisms in Kenya national parks and game reserves.
- **Peace:** The learner enriches 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 education and climate change:** The learner learns importance of decomposers as they discuss the role of decomposers in an ecosystem and their importance in recycling nutrients.

Link to other subjects:

Agriculture and Nutrition: The learner is able to link the information on the role of decomposers in an ecosystem to production of manure.

Suggested Learning Resources:

Digital devices with assistive technology such as adapted keyboard, screen readers and screen magnifiers, print media with appropriate font and colour contrast and braille materials and equipment.

Suggested Assessment Rubric				
Level	Exceeds expectation	Meets expectation	Approaches expectation	Below expectation
Indicator				
Ability to: <ul style="list-style-type: none"> • Identify external and internal parts of a leaf. • Investigate the conditions necessary for photosynthesis. • Classify animals based on their dentition. • Categorise fruits and seeds based on their mode of dispersal. • Explain fertilisation and fruit formation in flowering plants. • Construct food chains and food webs. 	The learner demonstrates six skills.	The learner demonstrates five skills.	The learner demonstrates 3-4 skills.	The learner demonstrates 1-2 skills or none.

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) <ul style="list-style-type: none"> ● <i>types of curved mirrors,</i> ● <i>image formed by concave and convex mirrors (locating images, characteristics of images and uses of curved concave and convex mirrors),</i> ● <i>applications of curved mirrors in day to day life.</i> 	By the end of the sub strand, the learner should be able to: <ol style="list-style-type: none"> a) describe types of curved reflecting surfaces as used in science, b) draw ray diagrams to locate images formed by concave and convex mirrors (<i>for learners with low vision</i>), c) Interpret ray diagrams to locate images formed by concave and convex mirrors (<i>for learners with blindness</i>), d) describe the characteristics of images formed by curved reflecting 	<ul style="list-style-type: none"> ● In groups, learners discuss the various types of curved reflecting surfaces which include concave, convex and parabolic surfaces. Learners with blindness are guided to manipulate curved mirrors to identify the reflecting and polished surface. ● Learners are guided to discuss the terms used in curved reflecting surfaces which include focal length, radius of curvature, principal focus, principal axis, centre of curvature and the pole. ● Learners with low vision are guided to carry out activities locate the position of the image formed by concave and convex mirrors. Learners with blindness are guided to manipulate the setup of the experiment, given verbal descriptions on the steps followed in performing the experiment and the expected observations. 	How are curved mirrors used in day-to-day life?

		<p>surfaces,</p> <p>e) explain the uses of curved reflecting surfaces in day-to-day life,</p> <p>f) appreciate the applications of curved mirrors in day-to-day life.</p>	<p><i>Precaution: Learners to keep a safe distance from the source of fire.</i></p> <ul style="list-style-type: none"> ● Learners with low vision are guided to illustrate image position for various objects position in convex and concave mirrors. ● Learners with blindness are guided to manipulate tactile ray diagrams and identify the position of the image. ● Learners are guided to discuss the characteristics of images formed by curved mirrors. Learners with blindness are guided to manipulate tactile ray diagrams and discuss characteristics of the image formed when the object at infinity, beyond C, at C, between C & F, at F and between F and the pole. ● Learners are guided to discuss the application of concave and convex in day to day life (<i>solar concentrators, car headlamps, shaving mirrors, mirrors used in supermarkets, driving mirrors, projector lamps, and telescopes</i>). ● Learners are guided to use digital devices with assistive technology, print or braille media to explore more information on application of curved 	
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			mirrors.	
<p>Core competencies to be developed:</p> <ul style="list-style-type: none"> ● Self-efficacy: The learner exercises effective communication skills as they discuss and describe the characteristics of images formed by curved mirrors in groups. ● Communication and Collaboration: The learner develops listening and writing skills while discussing in groups various types of curved reflecting surfaces. 				
<p>Values:</p> <ul style="list-style-type: none"> ● Social justice: The learner enhances equity and accord equal opportunity to group members as they discuss and describe the characteristics of images formed by curved mirrors in groups. ● Responsibility: The learner exercises excellence as they locate the position of images formed by concave and convex mirrors. 				
<p>Pertinent and Contemporary Issues (PCIs):</p> <ul style="list-style-type: none"> ● Safety and security: The learner observes personal safety and security while performing experiments to locate the position of the image formed by concave and convex mirrors. 				
<p>Links to other subjects:</p> <ul style="list-style-type: none"> ● Pre-technical studies: The learner relates concepts in curved mirrors to hairdressing and beauty therapy. 				
<p>Suggested Learning Resources:</p> <p>Concave, convex mirrors, mirror holder, metre rule and tactile metre rule, print and tactile ray diagrams, candle, lighter, white screen, digital devices with assistive technology such as adapted keyboard, screen readers and screen magnifiers, print materials in appropriate font and colour contrast and braille materials and equipment.</p>				

Strand	Sub Strand	Specific learning outcomes	Suggested learning experiences	Suggested Key inquiry question(s)
3.0: FORCE AND ENERGY	3.2 Waves (16 lessons) <ul style="list-style-type: none"> • <i>generation of waves,</i> • <i>classification of waves as longitudinal and transverse,</i> • <i>characteristics of waves,</i> • <i>remote sensing applications of waves in day to day life (medical - ultrasound, X-rays, CT scans, MRI scans, cancer therapy and laser surgery; communication - radar, radio, cell-phone, television, Wi-Fi and operation of drones; cooking – microwave.</i> 	<p>By the end of the sub strand, the learner should be able to:</p> <ol style="list-style-type: none"> a) describe generation of waves in nature, b) classify waves as longitudinal and transverse, c) write symbols for parts of waves in braille, <i>(for learners with blindness)</i> d) describe remote sensing platforms in nature, e) describe applications of waves in day to day life, f) appreciate the applications of waves in day to day life. 	<ul style="list-style-type: none"> ● In groups, learners brainstorm on the meaning of waves as used in science. ● Learners are guided to carry out activities to demonstrate generation of waves in nature and classify them into longitudinal and transverse. Learners with blindness are supported to feel the vibrating bodies and given a verbal description on how waves are generated by different bodies. <i>(Use of a slinky spring, skipping rope, water in a basin, a source of sound/speaker, animations on wave).</i> ● Learners are guided to carry out activities to demonstrate characteristics of waves Learners with blindness are given verbal descriptions on the characteristics of waves. <i>(straight line motion, reflection, bending of waves, movement around objects).</i> ● Learners with blindness are guided to identify braille symbols for parts 	<p>How are waves applied in our day to day life?</p>

			<p>of waves in braille which include: (amplitude (A), wavelength (λ), frequency (f), period(T), wave speed (m/s), phase(ϕ))</p> <ul style="list-style-type: none"> ● Learners with blindness are guided to write in braille the symbols for the parts of the waves. <p>Learners are guided to carry out activities to demonstrate parts of a wave. Learners with blindness are given verbal descriptions on the parts of a wave and are guided to manipulate tactile wave charts to identify its parts. (<i>amplitude, wavelength, frequency, period, wave speed, phase include wave equation</i>)</p> <p><i>Velocity = wavelength x frequency.</i></p> <ul style="list-style-type: none"> ● Learners to brainstorm on the meaning of remote sensing. ● In pairs, learners discuss remote sensing in relation to waves (<i>reflection, absorption and transmission of electromagnetic radiation at different wavelength</i>). ● Learners are guided to use digital devices with assistive technology, print or braille media to search for more information between remote sensing and waves, remote sensing processes, active and passive remote sensing, remote 	
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			sensing platforms and carrier associated with remote sensing. <ul style="list-style-type: none"> ● In pairs, learners discuss the applications of waves in real life situations. 	
Core competencies to be developed: <ul style="list-style-type: none"> ● Learning to learn: The learner carries out research using digital, braille or print media to search for and discuss remote sensing platforms in nature. ● Creativity and Imagination: The learner experiments when carrying out activities to demonstrate generation of waves in nature and classify them into longitudinal and transverse waves. 				
Values: <ul style="list-style-type: none"> ● 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.				
Pertinent and Contemporary Issues (PCIs): <ul style="list-style-type: none"> ● Learner support programs: The learner is exposed to team work when working in groups to perform activities to demonstrate the parts of a wave. 				
Links to other subjects: <ul style="list-style-type: none"> ● The learner relates concepts of waves to transmission of sound from musical instruments in Creative Arts and Sports 				
Suggested Learning Resources: Slinky spring, skipping rope, water in a basin, a source of sound/speaker, tactile and print wave diagrams, Digital devices with assistive technology such as adapted keyboard, screen readers and screen magnifiers, print media and braille media.				

Suggested Assessment Rubrics				
Level	Exceeds expectation	Meets expectation	Approaches expectation	Below expectation
Indicator				
Ability to: <ul style="list-style-type: none"> • Describe types of curved reflecting surfaces. • Draw ray diagrams to locate images formed by concave and convex mirrors (<i>for learners with low vision</i>), • Interpret ray diagrams to locate images formed by concave and convex mirrors (<i>for learners with blindness</i>) • Describe generation of waves in nature. • Classify waves as longitudinal and transverse. 	The learner demonstrates five skills.	The learner demonstrates four skills.	The learner demonstrates two – three skills.	The learner demonstrates one skill or none.

APPENDIX 1: GUIDELINES FOR INTEGRATING COMMUNITY SERVICE LEARNING (CSL) PROJECT

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>Problem Identification</p> <p>Learners study their community to understand the challenges faced and their effects on community members. Some of the challenges in the community can be:</p> <ul style="list-style-type: none">• Environmental degradation• Lifestyle diseases, Communicable and non-communicable diseases• Poverty• Violence and conflicts in the community• Food security issues
Milestone 2	<p>Designing a solution</p> <p>Learners create an intervention to address the challenge identified.</p>

Milestone 3	<p>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</p>
Milestone 4	<p>Implementation The learners execute the project and keep evidence of work done.</p>
Milestone 5	<p>Showcasing /Exhibition and Report Writing Exhibitions involve showcasing learners’ project items to the community and reflecting on the feedback</p> <p>Learners write a report detailing their project activities and learnings from feedback</p>
Milestone 6	<p>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.</p>

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.

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

Assessment Methods in Science	Learning Resources	Non-Formal Activities
<ul style="list-style-type: none"> ● Reflections ● Game Playing ● Pre-Post Testing ● Model Making ● Explorations ● Experiments ● Investigations ● Conventions, Conferences and Debates ● Teacher Observations ● Project ● Journals ● Portfolio ● Oral or Aural Questions ● Learner’s Profile ● Written Tests ● Anecdotal Records 	<ul style="list-style-type: none"> ● 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 	<ul style="list-style-type: none"> ● 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.