REPUBLIC OF KENYA
MINISTRY OF EDUCATION

JUNIOR SCHOOL CURRICULUM DESIGN

INTEGRATED SCIENCE

GRADE 9

FOR LEARNERS WITH PHYSICAL IMPAIRMENT

KENYA INSTITUTE OF CURRICULUM DEVELOPMENT
A Skilled and Ethical Society

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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 Physical 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,
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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 Physical 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 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 Physical 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 Physical 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 Physical Impairment for transition to Senior school.

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NATIONAL GOALS OF EDUCATION

Education in Kenya should:

1. **Foster nationalism and patriotism and promote national unity.**
   Kenya's people belong to different communities, races and religions, but these differences need not divide them. They must be able to live and interact as Kenyans. 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 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.

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 equity 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 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.

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 AT JUNIOR SCHOOL

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

LEARNING OUTCOMES FOR JUNIOR SCHOOL

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

a) Apply literacy, numeracy and logical thinking skills for appropriate self-expression.
b) Communicate effectively, verbally and non-verbally, in diverse contexts.
c) Demonstrate social skills, spiritual and moral values for peaceful co-existence.
d) Explore, manipulate, manage and conserve the environment effectively for learning and sustainable development.
e) Practise relevant hygiene, sanitation and nutrition skills to promote health.
f) Demonstrate ethical behaviour and exhibit good citizenship as a civic responsibility.
g) Appreciate the country's rich and diverse cultural heritage for harmonious co-existence.
h) Manage pertinent and contemporary issues in society effectively.
i) Apply digital literacy skills for communication and learning.

1) 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.

ENERAL 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 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)** ● *Structure of the atom (protons, electrons, neutrons),* ● *Atomic number and mass number of elements,* ● *Electron arrangement of elements,* ● *Energy level diagrams (cross or dot),* ● *Metals and non –metals,*	By the end of the sub strand the learner should be able to; a) describe the structure of the atom, b) determine the mass number of elements, c) draw the electron arrangement in atoms using dot or cross diagrams, d) classify elements into metals and non-metals, e) show interest in classifying elements into metals and non-metals.	The learner is guided to: ● Discuss the meaning of the atom and illustrate its structure in purposive groups. Learners with speech difficulties could use Alternative and Augmentative modes of Communication-AAC (residual speech/ digital devices with text-to-speech application/ point/sign/write) during the discussion. ● Work out the mass number of an element with peers. Learners with manipulation difficulties could use adapted writing materials or adapted digital devices to illustrate. ● Write or type the electron arrangements of elements. Learners who type using their lower extremities could be provided with footboards for tablets/ keyboards. ● Illustrate the electron arrangement in atoms using	How is the structure of the atom important?

	Note: (*use the first 20 elements of the periodic table; do not introduce periodic table at this level).*		dot or cross diagrams collaboratively. ● Use electron arrangement to classify elements into metals and non-metals. ● Where possible use digital media to observe animations or videos on the structure of an atom and electron arrangement. Adjust light/ glare on the screens of the digital devices appropriately for learners who are sensitive to light. **Project:** ● Model the atomic structure of selected elements of the periodic table using locally available materials. Learners with manipulation difficulties could use alternative functional parts of the body, given physical support by peers/learner support assistant to carry out the project.	

Core competencies to be developed: ● Communication and collaboration: The learner acquires listening and speaking skills as they discuss with peers the meaning of the atom and illustrate its structure. ● Creativity and imagination: The learner experiments and comes up with models of atoms of selected elements from locally available materials.
Pertinent and Contemporary Issues: Socio-economic issues (cyber security): The learner observes cyber security measures when using digital media to observe structure of an atom and electron arrangement.
Values: ● Unity: The learner respects others opinions while having group discussions. ● Integrity: The learner displays honesty while using digital devices to search for information on the structure of an atom, electron arrangement, atomic number and mass number of elements.
Links to other subjects The learner applies mathematical manipulation to works out the mass number of elements.

Strand	**Sub strand**	**Specific Learning Outcomes**	**Suggested Learning Experiences**	**Suggested Key Inquiry Question(s)**
1.0 Mixtures, Elements and Compounds	**1.2 Metals and Alloys** **(16 lessons)** ● *Physical properties of metals (state, ductility,*	By the end of the sub strand, the learner should be able to; a) describe the physical properties of metals, b) describe the composition of alloys, c) identify the uses of metals and alloys in day to day life,	**The learner is guided to:** ● Identify metals and non-metals in their environment. ● Carry out experiments to demonstrate the physical properties of metals. Learners with manipulation or fine motor difficulties could be assisted by peers or teacher aide as they carry out the experiments. Adapted	How are alloys important in day-day life?

	malleability, electrical and thermal conductivity) ● *Compositio n of alloys (steel, stainless steel, bronze, brass and duralumin)* ● *uses of metals and alloys in day to day life (sodium, magnesium, aluminium, copper, iron, gold, silver, brass, steel, bronze, duralumin*	d) explain the effects of rusting of metals, e) appreciate the importance of common alloys in day to day life.	working surfaces should be provided. Extra time could be allowed for learners to complete the task. ● Discuss the composition of common alloys with peers and record findings. Learners with speech difficulties could use Alternative and Augmentative modes of Communication-AAC (residual speech/ digital devices with text-to-speech application/ point/sign/write) during the discussion. ● Identify some items from the locality that have been made from alloys with peers. Ensure barrier free access for learners with mobility difficulties. Safety for all learners should be observed. ● Discuss the uses of common metals and alloys. Learners with speech difficulties could be given extra time to express themselves. ● Discuss in purposive groups causes, effects and ways of	

	and stainless steel) • *Rusting (causes, effects, prevention)*		controlling rusting of metals and present findings. • Where possible, use digital or print media to search for information on the physical properties of metals and common alloys. Adjust light intensity /control glare on the digital devices for learners who are sensitive to light.	

Core competencies to be developed

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

Pertinent and Contemporary Issues (PCIs)

Financial Literacy: The learner appreciates the economic importance of metals and common alloys in day to day life as they discuss the uses of common metals and alloys

Values

- Respect: The learner accommodates others' opinions during group discussions on uses of metals and common alloys.
- Peace: The learner humorously works together with peers when carrying out experiments to demonstrate the physical properties of metals.

Link to other subjects

- The learner links the properties of common metals and alloys used in workshops in Pre- Technical Studies.
- The learner uses relates the use of utensils made from metals and their alloys in Agriculture and Nutrition.

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
1.0 Mixtures, Elements and Compounds	**1.3 Water hardness** **(14 lessons)** • *Physical properties of water (taste, colour, odour and boiling point),* • *Hard and soft water* • *Methods of softening temporary hard water (boiling, addition of washing soda, distilling),*	By the end of the sub strand, the learner should be able to; a) describe the physical properties of water, b) distinguish between hard and soft water in nature, c) apply methods of softening hard water in day to day life, d) outline advantages and disadvantages of hard and soft water, e) appreciate the applications of soft and hard water in day to day life.	**The learner is guided to**: ● Collect and observe water from different sources, compare them in terms of appearance, odour, taste and boiling point *(taste water from safe sources*). Learners with mobility difficulties could be given physical support by peers, learner support assistant or teacher as they explore. ● Carry out activities to compare the lathering abilities of various samples of unboiled water with soap collaboratively. Learners with manipulation difficulties could use alternative functional parts of the body, appropriate assistive devices or be assisted by peers, learner support assistant or teacher to perform the task. ● Group the samples into hard and soft water. ● Explain the meaning of hard and soft water.	1. Why are different types of water important? 2. Why is hard water preferred for drinking?

	Note. *avoid ion exchange* • *Advantages and disadvantages of hard water and soft water*.		• Discuss the advantages and disadvantages of soft and hard water. Learners with speech difficulties could use Alternative and Augmentative modes of Communication-AAC (residual speech/ digital devices with text-to-speech application/ point/sign/write) during the discussion. • Perform various activities for softening hard water. Ensure safety for all learners especially in handling hot water and chemicals. • Where possible, use digital or print media to search for information, on the methods of softening hard water.	
Core competencies to be developed: • Learning to learn: The learner learns new methods of softening water as they apply methods of softening hard water in day to day life. • Critical thinking and problem solving: The learner learns ways of reducing soap wastage as they relate the lathering ability of water to hardness and softness of water.				
Pertinent and Contemporary Issues (PCIs): Financial literacy**:** The learner practises how to save on soap by using soft water for laundry.				

Values: • Responsibility: The learner plays a role when carrying out experiments on softening hard water. • Respect: The learner gives each other an opportunity to air their views as they discuss in a group the differences between hard and soft water.
Link to other subjects The learner relates the uses soft water in laundry work in Agriculture and Nutrition.

Suggested Assessment Rubric				
Level / Indicator	**Exceeds expectations**	**Meets expectations**	**Approaches expectations**	**Below expectations**
Ability to describe the structure of the atom	The learner describes the structure of the atom comprehensively.	The learner describes the structure of the atom adequately.	The learner partially describes the structure of the atom.	The learner partially describes the structure of the atom, with prompt.
Ability to classify elements into metals and non-metals	The learner classifies all elements into metals and nonmetals comprehensively.	The learner classifies all the elements into metals and nonmetals.	The learner classifies most of the elements into metals and nonmetals.	The learner classifies a few elements into metals and nonmetals.
Ability to outline uses of metals and alloys.	The learner outlines uses of all metals and alloys exhaustively.	The learner outlines uses of all common metals and alloys.	The learner outlines uses of most of the metals and alloys.	The learner outlines uses of a few metals and alloys.

Ability to explain the effect of rusting on metals.	The learner explains the effect of rusting on metals in details comprehensively.	The learner explains the effect of rusting on metals sufficiently.	The learner explains the effect of rusting on metals partially.	The learner explains the effect of rusting on metals partially leaving some key points.
Ability to outline advantages and disadvantages of hard and soft water	The learner outlines advantages and disadvantages of hard and soft water exhaustively.	The learner outlines advantages and disadvantages of hard and soft water	The learner outlines most of the advantages and disadvantages of hard and soft water.	The learner outlines a few advantages and disadvantages of hard and soft water.
Ability to apply different methods to soften temporary hard water	Applies all appropriate methods to soften temporary hard water innovatively.	Applies all appropriate methods to soften temporary hard water	Applies at least appropriate method to soften temporary hard water	Applies less than two methods to soften temporary hard water.

STRAND 2.0: LIVING THINGS AND THEIR ENVIRONMENT

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
2.0 Living things and their Environment	**2.1 Nutrition in plants (18 lessons)** • *Parts of a leaf (external and internal)* • *Adaptations of the leaf to photosynthesis* • *Structure of chloroplasts (membranes, grana and stroma)* • *Process of photosynthesis (chemical reactions during light and dark stage are not required)*	By the end of the sub strand, the learner should be able to; a) identify external and internal parts of a leaf, b) explain adaptations of the leaf to photosynthesis, c) describe the process of photosynthesis, d) investigate the conditions necessary for photosynthesis, e) appreciate the process of photosynthesis in nature.	The learner is guided to: • Use a hand lens to observe fresh leaves of plants, draw and label the external parts. Learners with manipulation difficulties could use alternative functional parts of the body, appropriate assistive devices or be assisted by peers, learner support assistant or teacher to perform the task. • 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. Learners with postural difficulties could be strapped/ splinted on positioning devices such as special seats as they perform the task. • Discuss the adaptations of a leaf in relation to their roles in photosynthesis. Learners with	Why is photosynthesis important in nature?

	• *Conditions necessary for photosynthesis*		speech difficulties could use residual speech/ digital devices with text-to-speech application/ point/sign/write during the discussion. • Observe the structure of the chloroplast on charts/photomicrographs, discuss its role in photosynthesis and share with peers. Learners with postural limitation could be preferentially positioned for enhanced viewing of the charts. • Use print or non-print media to search for information on the process and products of photosynthesis, discuss and share with peers. • Use print or non-print media to search for information on conditions necessary for photosynthesis, discuss and share with peers. • Set-up experiments to show that light, carbon (IV) oxide and chlorophyll are necessary for photosynthesis and share their findings with peers, *(use the starch*	

			test). Adapted working surfaces should be provided. Extra time could be allowed for learners to complete the task.	

Core competencies to be developed

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

Values:

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

Pertinent and Contemporary Issues (PCIs)

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

Link to other learning areas:

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

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
2.0 Living things and their Environment	**2.2 Nutrition in animals** **(16 lessons)**	By the end of the sub strand, the learner should be able to; a) outline modes of nutrition in animals,	The learner is guided to: ● Use print or non-print media to search for information on modes of nutrition in animals, discuss	1. How do different animals feed? 2. How is food digested in the

	● *Modes of nutrition in animals (parasitic, saprophytic, symbiosis and holozoic),* ● *Dentition in animals (homodont and heterodont; carnivorous, herbivorous and omnivorous),* ● *Types of teeth (incisors, canines, premolars and molars) (structure and functions),* ● *Process of*	b) describe the structure and functions of different types of teeth, c) classify animals based on their dentition, d) describe the process of digestion in human beings**,** e) appreciate that animals have varied modes of nutrition.	with peers. Learners with manipulation difficulties could use adapted writing materials or type on adapted digital devices. Learners with speech difficulties could be given extra time to express themselves. ● Use specimens/charts/ models/ digital media to identify and draw different types of teeth. Learners with fine motor difficulties could use alternative functional parts of the body, given physical support by peers/learner support assistant to make the portfolio. Adapted working surfaces should be provided. Extra time could be allowed for learners to complete the task. ● Collaboratively discuss the functions of different types of teeth. Learners with speech difficulties could be given extra time to express themselves. ● Use specimens /charts/models/ digital media to study dentition	human body?

	digestion in human beings (ingestion, digestion, absorption, assimilation and egestion).		in different animals and share with peers. Learners with postural limitation could be preferentially positioned for enhanced viewing of the charts. ● Use print or non-print media to search for information on the process of digestion in human beings, discuss and share with peers**.**	
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 work collaboratively and harmoniously with peers as they study dentition in different animals. ● Respect: The learner appreciates others' opinions while discussing different modes of nutrition in animals.				
Pertinent and Contemporary Issues (PCIs): Animal welfare: The learner cares for animals as they study different types of dentition.				
Links to other learning areas: The leaner is able to link the information on nutrition in animals to feeding of animals in Agriculture and Nutrition.				

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Question(s)
2.0 Living things and their Environment	**2.3 Reproduction in plants (20 lessons)** • *Functions of parts of a flower* • *Meaning and types of pollination* • *(details on factor that promote/hinder self-pollination not required)* • *Adaptations of flowers to wind and insect pollination* • *Fertilisation, seed and fruit formation in*	By the end of the sub strand, the learner should be able to; a) outline functions of parts of a flower, b) describe pollination in plants, c) outline the adaptations of flowers to wind and insect pollination, d) explain fertilisation and fruit formation in flowering plants, e) categorise fruits and seeds based on their mode of dispersal, f) recognize the role of flowers in nature.	The learner is guided to: ● Collaboratively discuss the functions of parts of a flower and present findings. Learners with speech difficulties could use Alternative modes of Communication to express their views during discussion. ● Use print or non-print media to search for information on meaning and types of pollination, discuss and share with peers. Adjust light/ glare on the screens of the digital devices appropriately for learners who are sensitive to light. ● Use print or non-print media to search for information on adaptations of flowers to wind and insect pollination, discuss and share with peers. ● Study samples of flowers to	How does reproduction in plants occur?

	flowering plants • *Fruit and seed dispersal in plants (modes and importance)*		discuss their adaptations to agents of pollination, draw, label and share with peers. Learners with manipulation difficulties could use alternative functional parts of the body, given physical support by peers/learner support assistant to carry out the activity. • Watch animations or take an excursion in the school compound or neighbourhood to observe pollinating agents in action, record and discuss. (*behaviour of insects and birds in relation to flowers; swaying of anthers of grasses e.g maize in wind).* Adjust light/ glare appropriately on the screens of the digital devices for learners who are sensitive to light. Preferentially seat the learners as they carry out the activity using visual aids or digital/	

			adapted digital devices according to their individual needs. Learners with mobility difficulties could be given physical support by peers, learner support assistant or teacher during the excursion. ● Use print or print media to search for information on the effect of agrochemicals on pollinating agents and their effects on reproduction in plants and make a presentation. ● Use print and non-print media to search for information on fertilisation and fruit formation in flowering plants, discuss and share with peers. ● Collaboratively study illustrations/ animations on fertilisation, seed and fruit formation, share with peers*(details of double fertilisation not required).*	

			• Use print and non-print media to search for information on seeds and fruits dispersal in plants, discuss the findings with peers. • Observe different fruits and seeds from their locality, discuss and categorise them based on their mode of dispersal, *(consider locally available and safe wild fruits).* • Discuss the importance of fruit and seed dispersal with peers.	
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 observes equal participation as they discuss the importance of fruit and seed dispersal.				

Pertinent and Contemporary Issues (PCIs): • Biodiversity: The learner searches for information on the effect of agrochemicals on pollinating agents and their effects on reproduction in plants • Safety and Security: The learner takes precautions while collecting various flowers, fruits and seeds from the immediate environment.
Link to other learning areas: The learner is able to link the information on fertilisation and fruit formation to crop production in Agriculture and Nutrition.

Strand	**Sub-Strand**	**Specific Learning Outcomes**	**Suggested Learning Experiences**	**Suggested Key Inquiry Question(s)**
2.0 Living things and their Environment	**2.4 The interdependence of life** **(18 lessons)** • *Biotic(living) components of the environment (predation, parasitism, symbiosis, competition and saprophytic),* • *Abiotic(non-living) components of the environment*	By the end of the sub strand, the learner should be able to; a) explain the biotic and abiotic factors of the environment, b) construct food chains and food webs in the environment, c) describe the effect of human activities on the environment,	The learner is guided to: • Use print and non-print material to search for information biotic interrelationships, share findings with peers. Learners with speech difficulties could use alternative and augmentative modes of communication-aac (residual speech/ digital devices with text-to-speech application/ point/sign/write) during the discussion.	How do the living and non-living factors affect the environment?

	(temperature, light, water, wind, atmospheric pressure, pH and salinity), • *Energy flow in an ecosystem* • *(food chains and food webs,)* • *Effect of human activities on the environment (habitat change, hunting and poaching, introduction of new living things).*	d) appreciate the interdependence between living and non-living factors of the environment.	• Investigate the interrelationships between biotic factors of the environment in their locality and discuss the findings with peers. *(include insects, spiders, lizards, toads, chameleon).* • Where possible observe videos or animations/ showing the interrelationships between biotic factors of the environment. Adjust light/ glare appropriately on the screens of the digital devices for learners who are sensitive to light. Preferentially seat the learners as they carry out the activity using visual aids or digital/ adapted digital devices according to their individual needs. • Use print and non-print media to search for information on interrelationships between organisms in Kenya national parks and game reserves.	

			• Discuss the effect of abiotic factors on living organisms. • Search for information on the effect of human activities on the environment and discuss. • Carry out activities to identify living organisms and what they feed on and construct food chains and food webs. Learners with manipulation difficulties could use alternative functional parts of the body, given physical support by peers/learner support assistant to carry out the activity. • Discuss the role of decomposers in an ecosystem and their importance in recycling nutrients with peers (*avoid details of chemical reactions and specific microorganisms involved in nitrogen, carbon & sulphur cycles*).	

Core competencies to be developed:

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

Values:

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

Pertinent and Contemporary Issues (PCIs)

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

Link to other learning areas

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

Suggested Assessment Rubric

Level / **Indicator**	**Exceeds expectations**	**Meets expectations**	**Approaches expectations**	**Below expectations**
Investigating the conditions necessary for photosynthesis	The learner investigates all the conditions necessary for photosynthesis comprehensively.	The learner investigates all the conditions necessary for photosynthesis.	The learner investigates most of the conditions necessary for photosynthesis.	The learner investigates a few conditions necessary for photosynthesis.

Describing the process of digestion in human beings.	The learner describes the process of digestion in human beings comprehensively.	The learner describes the process of digestion in human beings correctly.	The learner partially describes the process of digestion in human beings simplistically.	The learner partially describes the process of digestion in human beings leaving out some key point.
Explaining pollination, fertilisation and fruit formation in flowering plants.	The learner explains all the concepts of pollination, fertilisation and fruit formation in flowering plants.	The learner explains all the concepts of pollination, fertilisation and fruit formation in flowering plants.	The learner explains at least two concepts among pollination, fertilisation and fruit formation in flowering plants.	The learner explains one concept among pollination, fertilisation and fruit formation in flowering plants.
Categorising fruits and seeds based on their mode of dispersal	The learner categorises fruits and seeds based on their mode of dispersal and other modes.	The learner categorises fruits and seeds based on their mode of dispersal.	The learner categorises fruits and seeds based on their mode of dispersal partially.	The learner partially categorises fruits and seeds without considering their mode of dispersal.
Constructing food chains and food webs in the environment	The learner constructs food chains and food webs in the environment correctly and systematically.	The learner constructs food chains and food webs in the environment correctly.	The learner partially constructs food chains and food webs in the environment correctly.	The learner constructs food chains and food webs in the environment without considering appropriate order.

STRAND 3.0: FORCE AND ENERGY

Strand	Sub Strand	Specific learning outcomes	Suggested learning experiences	Suggested Key Inquiry Question(s)
3.0 Force and Energy	**3.1 Curved mirrors** **(18 lessons)** • *Types of curved mirrors,* • *Image formed by concave and convex mirrors (locating images, characteristics of images and uses of curved concave and convex mirrors),* • *Applications of curved mirrors in day to day life.*	By the end of the sub strand, the learner should be able to; a) describe types of curved mirrors, b) draw ray diagrams to locate images formed by concave and convex mirrors, c) describe the characteristics of images formed by concave and convex mirrors, d) explain the uses of concave and convex mirrors in day to day life, e) appreciate the applications of curved mirrors in day to day life.	The learner is guided to: ● Discuss the types of curved mirrors *(concave, convex and parabolic surfaces).* Learners with speech difficulties could use residual speech/ digital devices with text-to-speech application/ point/sign/write) during the discussion. ● Discuss with peers the terms used in curved mirrors *(aperture, pole, centre of curvature, principal axis, radius of curvature, principal focus, focal length and focal plane).* ● Carry out activities to locate position of images formed by concave and convex mirrors. Learners with manipulation difficulties could be supported by peers as they carry out the	How are curved mirrors used in day to day life?

			activities. ● Illustrate image positions for various object positions in concave and convex mirrors. ● Discuss the characteristics of images formed by curved mirrors *(object at infinity, beyond C, at C, between C & F, at F and between F and P.* ● Discuss the applications of concave and convex mirrors in day to day life (*solar concentrators, car headlamps, shaving mirrors, dentists' mirrors, projector lamps, telescoppes, mirrors used in supermarkets, driving mirrors*). ● Use digital or print media to explore more information on applications of curved mirrors.	
Core competencies to be developed ● Self-efficacy: The learner exercises leadership skills as they discuss with peers the characteristics of images formed by curved mirrors. ● Communication and Collaboration: The learner develops listening and writing skills while discussing with peers the terms used in curved mirrors.				

Pertinent and Contemporary Issues (PCIs): Socio-economic issues: The learner relates concepts of reflection at curved mirrors to safety and security as they discuss the applications of concave and convex mirrors in day to day life *(transport and surveillance).*
Values ● Social justice: The learner exercises equity and accord equal opportunity to group members as they discuss the characteristics of images formed by curved mirrors. ● Responsibility: The learner exercises excellence as they illustrate image positions for various object positions in concave and convex mirrors.
Links to other subjects: The learner relates concepts in curved mirrors to hairdressing and beauty therapy in Pre-technical studies.

Strand	**Sub Strand**	**Specific learning outcomes**	**Suggested learning experiences**	**Suggested Key Inquiry Question(s)**
3.0 Force and Energy	**3.2 Waves (16 lessons)** • *Generation of waves,* • *Classification of waves as longitudinal and transverse,* • *Characteristics of waves,* • *Remote sensing*	By the end of the sub strand, the learner should be able to; a) describe generation of waves in nature, b) classify waves as longitudinal and transverse, c) describe basic characteristic of waves in nature, d) describe remote sensing	The learner is guided to: ● Brainstorm on the meaning of wave as used in science. Learners with speech difficulties could use residual speech/ digital devices with text-to-speech application/ point/sign/write) during the discussion. ● Carry out activities to demonstrate generation of	How are waves applied in day to day life?

	• *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)*	in relation to waves, e) describe applications of waves in day to day life, f) appreciate the applications of waves in day to day life.	waves in nature and classify them into longitudinal and transverse *(use a slinky spring, skipping rope, water in a basin, a source of sound/speaker, animations on wave).* Learners with manipulation difficulties could be supported by peers or teacher aide as they carry out the activities. Adapted working surfaces should be provided. Extra time could be allowed for learners to complete the task. ● Carry out activities to demonstrate the parts of a wave *(amplitude, wavelength, frequency, period, wave speed, phase; include wave equations; velocity=wavelength x frequency).*	

			● Carry out activities in groups to demonstrate characteristics of waves *(straight line motion, reflection, bending of waves, movement around objects).* ● brainstorm on the meaning of remote sensing. ● Discuss remote sensing in relation to waves, and present findings.(*reflection, absorption, and transmission of electromagnetic radiation at different wavelengths*). ● Use digital or print media to search for more information on the relationship between remote sensing and waves, remote sensing processes, active and passive remote sensing, remote sensing platforms and carrier associated with remote	

			sensing. ● Discuss the applications of waves in real life situations *(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).*	

Core competencies to be developed:

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

Pertinent and Contemporary Issues (PCIs):

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

Values

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

Links to other subjects:

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

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

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

APPENDIX I: 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	**Problem Identification** Learners study their community to understand the challenges faced and their effects on community members. Some of the challenges in the community can be: • Environmental degradation • Lifestyle diseases, Communicable and non-communicable diseases • Poverty • Violence and conflicts in the community • Food security issues

Milestone 2	**Designing a solution** Learners create an intervention to address the challenge identified. Learners with speech difficulties could use Alternative and Augmentative modes of Communication-AAC (residual speech/ digital devices with text-to-speech application/ point/sign/write) during the discussion.
Milestone 3	**Planning for the Project** Learners share roles, create a list of activities to be undertaken, mobilise resources needed to create their intervention and set timelines for execution. Learners with manipulation difficulties could use alternative functional parts of the body, appropriate assistive devices or be assisted by peers or teacher to perform the task.
Milestone 4	**Implementation** The learners execute the project and keep evidence of work done.
Milestone 5	**Showcasing /Exhibition and Report Writing** Exhibitions involve showcasing learners' project items to the community and reflecting on the feedback. Learners write a report detailing their project activities and learnings from feedback. Learners with manipulation difficulties could be provided with adapted writing materials such as pen/pencils with grip. They could also type on an adapted digital device or be assisted by a scribe or learner support assistant to write the report. Those with postural deformities could require appropriate positioning.
Milestone 6	**Reflection** Learners review all project work to learn from the challenges faced. They link project work with academic concepts, noting how the concepts enabled them to do their project as well as how the project helped to deepen learning of the academic concepts.

NOTE: The milestones will be staggered across the 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 II: LIST OF ASSESSMENT METHODS, LEARNING RESOURCES AND NON-FORMAL ACTIVITIES

Assessment Methods in Science	Learning Resources	Non-Formal Activities
● Reflections ● Game Playing ● Pre-Post Testing ● Model Making ● Explorations ● Experiments ● Investigations ● Conventions, Conferences, and Debates ● Applications ● Teacher Observations ● Project ● Journals ● Portfolio ● Oral or Aural Question(s) ● Learner's Profile ● Written Tests ● Anecdotal Records	● Laboratory Apparatus and Equipment ● Textbooks ● Text to speech and speech to text software ● Relevant reading materials ● Digital/ adapted digital Devices ● Recordings	● Visit the science historical sites. ● Use digital devices to conduct scientific research. ● Organizing 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 science and engineering fairs ● Organizing and participating in exchange programmes. ● Making oral presentations and demonstrations on science issues.

NOTE: Assessment methods may be modified to accommodate a learner's diverse needs so that he/she can participate and achieve the learning outcomes. The table below shows how modes of assessment may be adapted for learners with physical impairment:

S/No	**Assessment Methods/Modes And Suggested Adaptations**	
	Methods	**Suggested Adaptations**
1.	Written assessment	• Typing, stamping or signing • Description of the task as a scribe or learner support assistant writes Audio visual recording of the learner as he/she makes oral responses • Provision of Adapted digital devices and writing/drawing resources • Adjustment of time according to individual needs • Providing illustrations to be interpreted for activities that involve drawing • Use of worksheets
2.	Oral or Aural assessment	• Written responses • Use of AAC (*Augmentative and Alternative modes of Communication) e.g. talking books, gestures, body movement, sign language, alphabet cards, facial expressions* • Adjustment of time according to individual needs
3.	Portfolio	• Use of E-Portfolio • Provision of physical support • Use of assistive technology • Provision of Adapted digital devices and writing/drawing resources • Adjustment of time according to individual needs • Description of how to carry out a practical activity while being audio/video recorded

4.	Practical assessment/ Experiments	• Provision of physical support • Provision of Adapted resources (learner specific) • Description of how to carry out a practical activity while being audio/video recorded • Adjustment of time according to individual needs • Rest intervals according to individual needs • Environmental adaptation
5.	Project	• Provision of physical support • Provision of Adapted resources (learner specific) • Description of how to carry out a practical activity while being audio/video recorded • Adjustment of time according to individual needs • Environmental adaptation

Note: Safety of all learners should be observed during assessment