REPUBLIC OF KENYA

MINISTRY OF EDUCATION

JUNIOR SECONDARY SCHOOL CURRICULUM DESIGN

INTEGRATED SCIENCE

GRADE 9

KENYA INSTITUTE OF CURRICULUM DEVELOPMENT

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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 Kenya Constitution 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 and Primary School levels. The roll out of Junior Secondary School (Grade 7-9) will subsequently follow as from 2023-2025.

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

The curriculum designs present National Goals of Education, essence statements, general and specific expected learning outcomes for the learning areas (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, Community Service Learning (CSL) activities 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
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PREFACE

The Ministry of Education (MoE) is implementing the second phase of the curriculum reforms with the national roll out of the Competency Based Curriculum (CBC) having been implemented in 2019. Grade 9 is the final level of the Junior Secondary School (JSS) in the new education structure.

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

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

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

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ACKNOWLEDGEMENT

The Kenya Institute of Curriculum Development (KICD) Act Number 4 of 2013 (Revised 2019) mandates the Institute to develop 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), that responds to the demands of the 21st Century and the aspirations captured in the Kenya Constitution 2010, the Kenya Vision 2030, East African Community Protocol and the United Nations Sustainable Development Goals (SDGs).

KICD receives its funding from the Government of Kenya to enable the successful achievement of the stipulated mandate and implementation of the Government and Sector (Ministry of Education (MoE) plans. The Institute also receives support from development partners targeting specific programmes. The Grade 9 curriculum designs have been developed with the support of the World Bank through the Kenya Secondary Education Quality Improvement Program (SEQIP) commissioned by the MoE. Therefore, the Institute is very grateful for the support of the Government of Kenya, through the MoE and the development partners for the policy, resource and logistical support. Specifically, special thanks to the Cabinet Secretary MoE and the Principal Secretary – State Department of Early Learning and Basic Education,

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

Finally, we are very grateful to the KICD Council Chairperson Prof. Elishiba Kimani and other members of the Council for very consistent guidance in the process. We assure all teachers, parents and other stakeholders that these curriculum designs will effectively guide the implementation of the CBC at Grade 9 and preparation of learners for transition to Senior Secondary School.

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LESSON ALLOCATION

	Subject	**Number of Lessons Per Week (40 minutes per lesson)**
1.	English	5
2.	Kiswahili/KSL	4
3.	Mathematics	5
4.	Integrated Science	5
5.	Pre-Technical Studies	4
6.	Social Studies	4
7.	Religious Education (CRE/IRE/HRE)	3
8.	Business Studies	3
9.	Agriculture	3
10.	Physical Education and Sports	2
11.	Optional Subject	3
12.	Optional Subject	3
	Total	**44**

NATIONAL GOALS OF EDUCATION

Education in Kenya should:

i) Foster nationalism and patriotism and promote national unity.

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

ii) Promote the social, economic, technological and industrial needs for national development.

Education should prepare the youth of the country to play an effective and productive role in the life of the nation.

a) Social Needs

Education in Kenya must prepare children for changes in attitudes and relationships which are necessary for the smooth progress of a rapidly developing modern economy. There is bound to be a silent social revolution following 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.

iii) Promote individual development and self-fulfilment

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

iv) Promote sound moral and religious values.

Education should provide for the development of knowledge, skills and attitudes that will enhance the acquisition of sound moral values and help children to grow up into self-disciplined, self-reliant and integrated citizens.

v) Promote social equality and responsibility.

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

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

Education should 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.

vii) Promote international consciousness and foster positive attitudes towards other nations.

Kenya is part of the international community. It is part of the complicated and interdependent network of peoples and nations. Education should therefore lead the youth of the country to accept membership of this international community with all the obligations and responsibilities, rights and benefits that this membership entails.

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

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

LEVEL LEARNING OUTCOMES FOR MIDDLE SCHOOL

By end of Middle 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 subject 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 lower secondary levels is to enhance learners' scientific thinking through learning activities that involve the basic science process skillsThe 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.

It 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 Sc. 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

SUBJECT GENERAL LEARNING OUTCOMES

Integrated Science provides the learner with opportunities to:

1. Acquire sufficient scientific knowledge, skills, values and attitudes to make informed choices on career pathways at senior school and for everyday use, further education and training.
2. Select, improvise and safely use basic scientific 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 and use scientific principles and knowledge in everyday life.
8. Apply acquired scientific skills and knowledge to construct appropriate scientific devices from available resources

STRAND 1.0: SCIENTIFIC INVESTIGATION

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Key Inquiry Questions
1.0 Scientific Investigation	**1.1 Waste Management and Disposal** (4 lessons)	By the end of the sub strand the learner should be able to: a) describe ways of disposing waste safely, b) improvise science learning resources from locally available materials, c) appreciate consumer rights to a safe and healthy environment.	The learner is guided to: • collect and categorise waste materials from the immediate environment that can be improvised, re-used and recycled, • practise safe ways of disposing of hazardous laboratory wastes, • discuss safe and innovative ways of disposing waste: (*include solid waste: biodegradable, non-biodegradable and chemical waste),* • carry out activities to improvise science learning resources from locally available materials, • deliberate on the consumer rights to a safe and healthy environment, • use digital or print media to search for information on safe waste disposal mechanisms.	1. How does waste disposal affect the environment? 2. How is waste managed?
Core competencies to be developed: • Critical thinking and problem solving: as the learner considers safe and innovative ways of disposing waste. • Learning to learn: as the learner deliberates on the consumer's rights to a safe and healthy environment.				

- Digital literacy: as the learner uses digital or print media to search for information on safe waste disposal mechanisms.

Pertinent and Contemporary Issues(PCIs):

- Environmental Conservation: as the learner carries out activities to improvise science learning resources from locally available materials.
- Disaster Risk Reduction: as the learner practises safe and innovative ways of disposing waste.
- Health Education: as the learner practises safe disposal of waste to prevent infectious and communicable diseases**.**

Values

- Responsibility: as the learner manages wastes and hazardous materials.
- Social Justice: as the learner understands the consumer right to a safe and healthy environment.

Link to other subjects

- Home Science: as the learner practises safe ways of managing wastes produced at home.

Assessment Rubric

Indicator	**Exceeds Expectation**	**Meets Expectation**	**Approaches Expectation**	**Below Expectation**
Ability to describe ways of disposing wastes safely.	Correctly and consistently describes ways of disposing wastes safely.	Correctly describes ways of disposing wastes safely.	Correctly describes some ways of disposing wastes safely.	With prompt, describes ways of disposing wastes safely.
Ability to improvise science learning resources from locally available materials.	Accurately and consistently improvises science learning resources from locally available materials.	Accurately improvises science learning resources from locally available materials.	Improvises some science learning resources from locally available materials.	With assistance, improvises science learning resources from locally available materials.

STRAND 2.0: MIXTURES, ELEMENTS AND COMPOUNDS

Strand	Sub strand	Specific Learning Outcomes	Suggested Learning Experiences	Key Inquiry Questions
2.0 **Mixtures, Elements and Compounds**	2.1 **Metals** (12 lessons)	By the end of the sub strand, the learner should be able to: a) classify metals and non-metals in nature, b) describe the physical and chemical properties of metals, c) describe the composition of common alloys, d) identify the uses of selected metals and alloys in day to day life, e) appreciate the value of metals and common alloys in day to day life.	The learner is guided to: • discuss with peers and identify metals and non-metals in nature, • carry out experiments to demonstrate the physical properties of metals (*colour, ductility and malleability, density, electrical and thermal conductivity*). • perform simple experiments to demonstrate chemical properties of Sodium, Aluminium & Iron metals (*rusting, reactions with water, steam, air and dilute acids*). • carry out experiments to demonstrate reactions between metals (*Sodium, Magnesium & Iron*) and non-metals (*Oxygen, Sulphur, Chlorine*), • write equations on reactions between metals and non-metals, • discuss with peers, the composition of common alloys (*brass, steel, bronze & duralumin*), • identify some items from the locality that have been made from alloys,	What properties of metals make them suitable for use in day to day life?

			• discuss the uses and value of common metals and alloys (*sodium, magnesium, aluminium, copper, zinc, iron, gold, silver, brass, steel, bronze & duralumin*), • where possible, use digital or print media to for information on the physical and chemical properties of metals and common alloys.	

Core competencies to be developed

- Communication and collaboration: as the learner discusses with peers and classifies metals and non-metals in nature.
- Self-efficacy: as the learner carries out experiments to demonstrate the physical properties of metals.
- Digital literacy: as the learner searches for information using digital devices on physical and chemical properties of metals and common alloys.

Pertinent and Contemporary Issues (PCIs)

- Financial Literacy: as the learner appreciates the value and economic importance of metals and common alloys in day to day life.

Values

- Respect: as the learner accommodates others' opinions during group discussions on uses of metals and common alloys.
- Peace and Unity: as the learner works with others harmoniously in groups.

Link to other subjects

- Pre- Technical Studies: as the learner learns about material used in workshops.
- Home Science: as the learner uses utensils made from metals and their alloys.

Assessment Rubric				
Indicator	**Exceeds expectation**	**Meets expectation**	**Approaches expectation**	**Below expectation**
Ability to classify metals and non-metals in nature.	Accurately classifies metals and non-metals in nature giving examples from the locality.	Accurately classifies metals and non-metals in nature.	Accurately classifies some metals and non-metals in nature.	With prompt, classifies some metals and non-metals in nature.
Ability to describe the physical and chemical properties of metals.	Correctly and comprehensively describes the physical and chemical properties of metals.	Correctly describes the physical and chemical properties of metals.	Correctly describes some of the physical and chemical properties of metals.	With prompt, describes the physical and chemical properties of metals.
Ability to describe the composition of common alloys.	Accurately and exhaustively describes the composition of common alloys.	Accurately describes the composition of common alloys.	Accurately describes the composition of some of the common alloys.	With prompt, describes the composition of common alloys.
Ability to identify the uses of selected metals in day to day life.	Precisely and exhaustively identifies the uses of selected metals in day to day life.	Precisely identifies the uses of selected metals in day to day life.	Precisely identifies some of the uses of selected metals in day to day life.	Needs assistance to identify the uses of selected metals in day to day life.

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Key Inquiry Questions
2.0 Mixtures, Elements and Compounds	**2.2 Water** **(8 lessons)**	By the end of the sub strand, the learner should be able to: a) investigate the physical properties of water, b) distinguish between hard and soft water in nature, c) describe methods of softening hard water, d) apply different methods to soften water, e) appreciate the applications of soft and hard water in day to day life.	The learner is guided to: • carry out activities to demonstrate the physical properties of water in groups *(colour, odour, boiling point & density*), • brainstorm the differences between hard and soft water (*include advantages and disadvantages*), • carry out experiments on softening hard water (*boiling, distillation and use of chemicals*), ***Note****: Exclude ion exchange at this level.* • discuss applications of hard and soft water in day to day life, • Where possible, use digital or print media to search for information, videos and simulations explaining the methods of softening hard water and applications of hard and soft water.	1. How can hard water be softened? 2. What is the importance of different types of water?

Core competencies to be developed

- Communication and collaboration: as the learner discusses with peers the applications of hard and soft water in day to day life in groups.
- Learning to learn: as the learner carries out experiments on softening hard water using various methods.
- Self-efficacy: as the learner carries out activities to demonstrate the physical properties of water in groups.

Pertinent and Contemporary Issues (PCIs)

- Financial literacy: as the learner practises how to save on soap by using soft water for laundry.
- Safety and security: as the learner takes precautions while softening water through various methods.

Values

- Responsibility: as each learner plays a role when carrying out experiments on softening hard water.
- Respect: as 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

- Home science: as the learner uses soft water in laundry work.

Assessment Rubric

Indicator	Exceeds expectation	Meets expectation	Approaches expectation	Below expectation
Ability to investigate the physical properties of water.	Correctly and consistently investigates the physical properties of water.	Correctly investigates the physical properties of water.	Correctly investigates some physical properties of water.	Needs assistance to investigate the physical properties of water.
Ability to distinguish between hard and soft water in nature.	Clearly and consistently distinguishes between hard and soft water in nature.	Clearly distinguishes between hard and soft water in nature.	Clearly distinguishes between hard and soft water in nature leaving out few details.	Distinguish between hard and soft water nature leaving out many details.
Ability to describe methods of softening hard water.	Correctly and comprehensively describes methods of softening hard water.	Correctly describes methods of softening hard water.	Correctly describes some of the methods of softening hard water.	With prompt, describes methods of softening hard water.

Ability to apply different methods to soften water.	Correctly and consistently applies different methods to soften water.	Correctly applies different methods to soften water.	Correctly applies some methods to soften water.	With assistance, applies different methods to soften water.

STRAND 3.0: LIVING THINGS AND THEIR ENVIRONMENT

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Key Inquiry Questions
3.0 **Living Things and their Environment**	3.1 **Nutrition in plants** (12 lessons)	By the end of the sub strand, the learner should be able to: a) explain adaptations of the leaf to photosynthesis, b) investigate the conditions necessary for photosynthesis, c) appreciate the importance of photosynthesis in nature.	The learner is guided to: • observe and discuss the external and internal structure of the leaf in relation to its role in photosynthesis, • observe and discuss the structure of the chloroplast in photomicrographs and relate it to its role in photosynthesis, • discuss the products of photosynthesis, • carry out an experiment to test for the presence of starch in a leaf, • carry out experiments to show that light, carbon (IV) oxide, water and chlorophyll are necessary for photosynthesis and share the results, • discuss the importance of photosynthesis, • where possible, use digital or print media to search for information and watch animations or videos on photosynthesis.	1. What influences photosynthesis? 2. What is the importance of photosynthesis?
Core competencies to be developed ● Communication and collaboration: as the learner discusses with peers in a group the importance of photosynthesis. ● Digital literacy: as the learner searches for information and watches videos or animations on photosynthesis.				

- Self-efficacy: as the learner carries out experiments on conditions necessary for photosynthesis and shares the results.

Pertinent and Contemporary Issues (PCIs)

- Environmental conservation: as the learner takes care of plants while collecting leaves to observe structure of the leaf in relation to its role in photosynthesis.
- Safety: as the learner observes safety precautions while collecting leaves from the environment.

Values:

- Responsibility: as each learner plays a role as they carry out experiments to show that light, carbon (IV) oxide, water and chlorophyll are necessary for photosynthesis.
- Integrity: as the learner carries out experiments and presents his/her own results to show that light, carbon (IV) oxide, water and chlorophyll are necessary for photosynthesis.

Link to other subjects:

- Agriculture: as the learner studies the concept of food production.
- Home science: as the learner studies the concept of nutrition.

Assessment Rubric

Indicator	**Exceeds expectation**	**Meets expectation**	**Approaches expectation**	**Below expectation**
Ability to explain adaptations of the leaf to photosynthesis.	Comprehensively explains adaptations of the leaf to photosynthesis.	Correctly explains adaptations of the leaf to photosynthesis.	Correctly explains some adaptations of the leaf to photosynthesis.	With prompt, explains adaptations of the leaf to photosynthesis.
Ability to investigate the conditions necessary for photosynthesis.	Adequately investigates all the conditions necessary for photosynthesis, giving illustrations.	Adequately investigates all the conditions necessary for photosynthesis.	Adequately investigates some conditions necessary for photosynthesis.	With assistance, investigates the conditions necessary for photosynthesis.

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Key Inquiry Questions
3.0 Living Things and their Environment	**3.2 Reproduction in plants** **(18 lessons)**	By the end of the sub strand, the learner should be able to: a) relate parts of a flower to their functions, b) describe pollination, fertilisation and fruit formation in flowering plants, c) describe the modes of fruit and seed dispersal in plants, d) recognize the role of flowers in nature.	The learner is guided to: • observe, identify and relate parts of a flower to their functions, • use examples to discuss the differences between self and cross-pollination, • take an excursion in the school compound/neighbourhood to observe agents of pollination in action, • explore the agents of pollination, • discuss fertilisation and fruit formation in flowering plants, • collect and observe different types of fruits and seeds from the locality to relate them to their adaptations for dispersal, • discuss with peers the importance of fruit and seed dispersal, • where possible, use digital or print media to search for information on the effect of	How does reproduction in plants occur?

			agrochemicals on pollinating agents and its effect on reproduction in plants, • Where possible, search for videos and animations showing pollination, fertilisation, fruit formation and dispersal in plants and discuss the findings.	

Core competencies to be developed

- Learning to learn: as the learner observes different types of fruits and seeds to relate them to their adaptations for dispersal.
- Digital literacy: as the learner uses digital devices to search for information on the effect of agrochemicals on pollinating agents and its effect on reproduction in plants.

Pertinent and Contemporary Issues (PCIs)

- Safety: as the learner takes precaution while collecting various flowers, fruits and seeds from the immediate environment.
- Parental Engagement and Empowerment: as the learner engages their parents while collecting different types of fruits and seeds from the locality and share their findings.

Values

- Social Justice: as the learner shares tasks when carrying out an excursion in the school compound or neighbourhood to observe agents of pollination in action.

Link to other subjects:

- Agriculture: as the learner learns the concepts of plant breeding and food production.

Assessment Rubric				
Indicator	**Exceeds expectation**	**Meets expectation**	**Approaches expectation**	**Below expectation**
Ability to relate parts of a flower to their functions.	Accurately relates parts of a flower to their functions, with illustrations.	Accurately relates parts of a flower to their functions.	Accurately relates some parts of a flower to their functions.	With prompt, relates parts of a flower to their functions.
Ability to describe pollination, fertilisation and fruit formation in flowering plants.	Correctly and comprehensively describes pollination, fertilisation and fruit formation in flowering plants.	Correctly describes pollination, fertilisation and fruit formation in flowering plants.	Describes pollination, fertilisation and fruit formation in flowering plants leaving out few details.	With prompt, describes pollination, fertilisation and fruit formation in flowering plants.
Ability to describe the modes of fruit and seed dispersal in plants.	Correctly and systematically describes the modes of fruit and seed dispersal in plants.	Correctly describes the modes of fruit and seed dispersal in plants.	Correctly describes some modes of fruit and seed dispersal in plants.	With prompt, describes the modes of fruit and seed dispersal in plants.

Strand	Sub-Strand	Specific Learning Outcomes	Suggested Learning Experiences	Key Inquiry Questions
3.0 Living Things and their Environment	**3.3 The interdependence of life** (20 lessons)	By the end of the sub strand, the learner should be able to: a) examine the biotic and abiotic components of the environment and their interactions, b) construct simple food chains and food webs, c) appreciate the interdependence between living and non-living components of the environment.	The learner is guided to: • observe the interrelationships between living components of the environment, • discuss with others the effect of living thing (*biotic*) and non - living (*abiotic*) components of the environment on living organisms, • carry out activities to identify living organisms and what they feed on and construct simple food chains and food webs, • discuss with peers the role of decomposers in an ecosystem and their importance in recycling nutrients (*avoid details of nitrogen, carbon & sulphur cycles*), • where possible, search and watch videos on decomposers and adaptations of organisms to their environment.	1. What is the importance of interdependence of life in an ecosystem? 2. How do living and non-living components of the environment influence life?

Core competencies to be developed: ● Creativity and imagination: as the learner carries out activities to identify living organisms and what they feed on to construct simple food chains and food webs. ● Communication and collaboration: as the learner discusses with peers in a group the role of decomposers in an ecosystem and their importance in recycling nutrients. ● Digital literacy: as the learner searches and watches videos on decomposers and adaptations of organisms to their environment.
Pertinent and Contemporary Issues (PCIs) ● Social cohesion: as the learner works with others while constructing simple food chains and food webs. ● Environmental Education: as the learner appreciates the inter-relationships between biotic and abiotic components of the environment.
Values: ● Respect: as the learner gives others the opportunity to present their opinions while discussing the effect of non - living components of the environment on living organisms. ● Responsibility: as the learner plays different roles while observing different plants and animals in their locality as they discuss their adaptations.
Link to other subjects ● Agriculture: as the learner studies the concept of organic farming.

Assessment Rubric				
Indicator	**Exceeds expectation**	**Meets expectation**	**Approaches expectation**	**Below expectation**
Ability to examine the biotic and abiotic components of the environment and their interactions.	Correctly and consistently examines the biotic and abiotic components of the environment and their interactions.	Correctly examines the biotic and abiotic components of the environment and their interactions.	Correctly examines some biotic and abiotic components of the environment and their interactions.	With prompt, examines biotic and abiotic components of the environment and their interactions.
Ability to construct simple food chains and food webs.	Sufficiently and systematically constructs simple food chains and food webs.	Sufficiently constructs simple food chains and food webs.	Constructs simple food chains and food webs but omits some sections.	With prompt, constructs simple food chains and food webs.

STRAND 4.0: FORCE AND ENERGY

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Key Inquiry Questions
4.0 Force and Energy	**4.1 Concave and convex mirrors** **(12 lessons)**	By the end of the sub strand, the learner should be able to: a) determine the focal length of a concave mirror by focusing a distant object, b) use ray diagrams to locate images formed by concave and convex mirrors, c) describe the characteristics of images formed by concave and convex mirrors, d) relate curved mirrors to their uses in day to day life, e) appreciate the applications of curved mirrors in day to day life.	The learner is guided to: • discuss the meaning of the terms associated with curved mirrors (*focal length, radius of curvature, principal focus, principal axis, centre of curvature, focal plane and the pole*), • carry out activities to determine the focal length of a concave mirror using diagrams (*avoid the mirror formula*), • carry out activities to locate images formed by curved mirrors and discuss their characteristics, • illustrate images formed by curved mirrors using ray diagrams, • where possible, use videos to explore applications of curved mirrors (*include concave, convex and parabolic reflectors*).	How are curved mirrors used in day to day life?

Core competencies to be developed

- Communication and Collaboration: as the learner discusses with peers in a group the meaning of the terms associated with curved mirrors.
- Creativity and Imagination: as the learner uses ray diagrams to locate images formed by curved mirrors.

Pertinent and Contemporary Issues (PCIs)

- Safety and Security Education: as the learner explores different applications of curved mirrors in relation to security and safety (side *mirrors, under vehicle search mirrors, security and safety mirrors*).

Values

- Unity: as the learner works in harmony with peers in a group while demonstrating the formation of images using curved mirrors.
- Responsibility: as the learner takes care of the materials used while carrying out experiments using curved mirrors.

Links to other subjects:

- Hairdressing and beauty therapy: as the learner learns the uses of curved mirrors for magnifying images at salons and barber shops.

Assessment Rubric

Indicator	**Exceeds expectation**	**Meets expectation**	**Approaches expectation**	**Below expectation**
Ability to determine the focal length of a concave mirror by focusing a distant object.	Accurately determines the focal length of a concave mirror by focusing a distant object, giving illustrations.	Accurately determines the focal length of a concave mirror by focusing a distant object.	Determines the focal length of concave mirrors by focusing a distant object, but omits some steps.	Needs assistance to determine the focal length of a concave mirror by focusing a distant object.
Ability to use ray diagrams to locate images formed by	Accurately and consistently uses ray diagrams to locate all images formed by	Accurately uses ray diagrams to locate all images formed	Uses ray diagrams to locate most of the images formed by concave and convex mirrors.	Uses ray diagrams to locate a few images formed by

concave and convex mirrors.	concave and convex mirrors.	by concave and convex mirrors.		concave and convex mirrors.
Ability to describe the characteristics of images formed by concave and convex mirrors.	Correctly describes the characteristics of all the images formed by concave and convex mirrors, giving illustrations.	Correctly describes the characteristics of all the images formed by concave and convex mirrors.	Describes at least two characteristics of images formed by concave and convex mirrors.	Describes less than two characteristics of images formed by concave and convex mirrors.
Ability to relate curved mirrors to their uses in day to day life.	Correctly and exhaustively relates curved mirrors to their uses in day to day life.	Correctly relates curved mirrors to their uses in day to day life.	Relates curved mirrors to some of their uses in day to day life.	With prompt, relates curved mirrors to their uses in day to day life.

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Key Inquiry Questions
4.0 Force and Energy	**4.2 Introduction to Remote Sensing** **(12 lessons)**	By the end of the sub strand, the learner should be able to: a) explain the meaning of remote sensing as used in science, b) describe remote sensing process as used in science, c) distinguish between passive and active remote sensing, d) describe remote sensing platforms in space, e) describe applications of remote sensing in day-to-day life, f) appreciate the role of remote sensing in day-to-day life.	The learner is guided to: • brainstorm on the meaning of the term remote sensing, • discuss remote sensing process (*sunlight, atmosphere, earth features, ground station and applications*), • use digital or print media to search for information on differences between passive and active remote sensing, • discuss remote sensing platforms in space [*spaceborne (satellites or space shuttles); airborne (drones, kites or aircrafts); ground-based (hand-held cameras, tethered balloons, cranes)*], • use digital or print media to search for information on applications of remote sensing and careers associated with it.	What kind of information is collected by remote sensing platforms?
Core competencies to be developed ● Communication and Collaboration: as the learner discusses with peers in a group, the remote sensing platforms in space.				

- Critical thinking and problem solving: as the learner learns about applications of remote sensing in car tracking, identification of land boundaries, forest fire, deforestation and animal census.
- Learning to learn: as the learner searches for information on differences between passive and active remote sensing.

Pertinent and Contemporary Issues (PCIs)

- Safety and Security: as the learner learns about applications of remote sensing in enhancing security in a region.

Values

- Responsibility: as the learner explores safe internet sites while searching for information on applications of remote sensing and careers associated with it.
- Peace: as the learner discusses harmoniously with peers on the remote sensing process.

Links to other subjects:

- Computer Science: as the learner learns about the uses of computers in processing and translating the message from ground station or satellites into easily understandable content.
- Social Studies: as the learner links the solar system to remote sensing.

Assessment Rubric

Indicator	**Exceeds expectation**	**Meets expectation**	**Approaches expectation**	**Below expectation**
Ability to explain the meaning of remote sensing as used in science.	Correctly and comprehensively explains the meaning of remote sensing as used in science	Correctly explains the meaning of remote sensing as used in science	Partially explains the meaning of remote sensing as used in science	With prompt, explains the meaning of remote sensing as used in science
Ability to describe remote sensing process as used in science.	Correctly and systematically describes remote sensing process as used in science.	Correctly describes remote sensing process as used in science.	Describes remote sensing process as used in science, omitting a few stages.	With prompt, describes remote sensing process as used in science.
Ability to distinguish between	Clearly distinguishes between passive and active	Clearly distinguishes between passive and	Distinguishes between passive and active	With prompt, distinguishes between

passive and active remote sensing.	remote sensing, giving illustrations.	active remote sensing.	remote sensing, omitting some concepts.	passive and active remote sensing.
Ability to describe remote sensing platforms in space.	Comprehensively describes remote sensing platforms in space, giving examples from the locality.	Adequately describes remote sensing platforms in space.	Describes some remote sensing platforms in space.	With prompt, describes remote sensing platforms in space.
Ability to describe applications of remote sensing in day-to-day life.	Correctly describes applications of remote sensing in day-to-day life, giving examples from the locality.	Correctly describes applications of remote sensing in day-to-day life.	Describes some applications of remote sensing in day-to-day life.	With prompt, describes applications of remote sensing in day-to-day life.

COMMUNITY SERVICE LEARNING PROJECT

Introduction

In Grade 9, learners will undertake a CSL activity on thematic areas provided to them. They will be required to identify a community problem through research, design solutions and come up with a plan to solve the problem. The preparations will be carried out in convenient groups. Learners will build on CSL knowledge, skills and attitudes acquired during Life Skills Education in other learning areas.

CSL Skills to be covered:

i) Leadership: Learners develop leadership skills as they undertake various roles during preparation.

ii) Financial Literacy and Entrepreneurship Skills: Learners will gain skills on wise spending, saving and investing for sustained economic growth. They could consider ways of generating income as they undertake the CSL project through innovative ways. Moreover, they could identify business ideas and opportunities as well as resources to meet the needs of the community.

iii) Research: Learners will exploit research skills as they identify a problem or a pertinent issue in the community, design a solution and plan how the problem will be solved. They will then do a report of the project accomplished.

iv) Communication and collaboration: Learners will develop these skills as they interrogate the problem in the society, research and brainstorm on a solution, and collaborate with the members of the community in the implementation process.

v) Citizenship: Learners will engage in the CSL activities, in appreciation of their responsibilities, rights and privileges as citizens, giving them a sense of belonging and attachment to the nation. They will also be empowered to engage and assume active roles in shaping a more cohesive, peaceful and inclusive society.

vi) Life Skills: Learners will develop life skills in the areas of decision making, assertiveness, effective communication, problem solving and stress management.

vii) Community Development: Learners will be sensitised with the needs or gaps in the community and empowered to take responsibility within their means for stronger and more resilient communities.

Suggested PCIs	**Specific Learning Outcomes**	**Suggested Learning Experiences**	**Key Inquiry Questions**
• Environmental degradation • Lifestyle diseases • Communicable and non-communicable diseases • Poverty • Violence in community • Food security issues • Conflicts in the community Note: The suggested PCIs are only examples. Teachers should allow learners to identify PCIs as per their context and reality.	By the end of the CSL project, the learner should be able to: a) identify a problem in the community through research, b) design a solution to the identified problem, c) plan to solve the identified problem in the community, d) implement the plan to solve the problem, e) report and reflect on the concluded project, f) appreciate the need to belong to a community.	The learner is guided to: • brainstorm on pertinent and contemporary issues in their community that need attention in groups, • choose a PCI that needs immediate attention and explain why in groups, • carry out research using digital devices print media/interactions with members of the community/resource persons in identifying a community problem to address in groups, • discuss possible solutions to the identified issue in groups, • propose the most appropriate solution to the problem in groups, • discuss ways and instruments they can use to collect data on the problem (questionnaires, interviews, observation schedule, etc), • develop instruments for data collection, • identify resources needed for the CSL project (human, technical, financial), • discuss when the project will begin and end, • prepare a programme/timetable of the entire project execution,	1. How does one determine a community need? 2. Why is it necessary to make adequate preparations before embarking on a project?

		• assign roles to be carried by all group members, • reflect on how the project preparation enhanced learning.	

Key Component of CSL developed:

a) identification of a problem in the community through research,
b) designing solution(s) to the identified problem,
c) planning to implement the solution,
d) implementing the plan to solve the problem,
e) conclude, reflect, report on the project.

Core Competencies to be Developed:

- Communication and collaboration: Learners will make the preparations in groups and conduct discussions on best ways of carrying out the project.
- Self-efficacy: Learners develop the skills of self-awareness and leadership as they undertake the CSL project.
- Creativity and Imagination: Learners will come up with creative ways of solving the identified community problem.
- Critical Thinking and Problem Solving: Learners will demonstrate autonomy in identifying a community need, exploring plausible solutions and making necessary preparations to address the problem.
- Digital Literacy: Learners can use technology when they research a community problem that they can address.
- Learning to Learn: Learners gain new knowledge and skills as they identify a community problem to be addressed and make preparations to carry out the project.
- Citizenship: This is enhanced as learners chooses a PCI that needs immediate attention in the community.

Pertinent and contemporary Issues

- Social cohesion: as learners discuss possible solutions to the identified issue.
- Financial Literacy: as learners prepare a budget for their project and evaluate the economic value of their project.

Values

- Integrity: as learners carry out research using digital devices and print media as they identify a community problem to address.
- Respect as learners appreciate each other's opinions while brainstorming on pertinent and contemporary issues in their community that need attention.

Assessment Rubric

Indicator	**Exceeds Expectation**	**Meets Expectation**	**Approaches Expectation**	**Below Expectation**
Ability to identify a problem in the community.	Correctly and systematically identifies a problem in the community.	Correctly identifies a problem in the community.	Partially identifies a problem in the community.	With prompt, identifies a problem in the community.
Ability to design solutions to the identified problem.	Accurately and systematically designs solutions to the identified problem.	Accurately designs solutions to the identified problem.	Designs some solutions to the identified problem.	With assistance, designs solutions to the identified problem.
Ability to plan to solve the identified problem in the community.	Accurately and systematically plans to solve the identified problem in the community.	Accurately plans to solve the identified problem in the community.	Partially plans to solve the identified problem in the community.	With assistance, plans to solve the identified problem in the community.
Ability to implement the plan to solve the problem.	Correctly and systematically implements the plan to solve the problem.	Correctly implements the plan to solve the problem.	Partially implements the plan to solve the problem.	With assistance, implements the plan to solve the problem.

Ability to report and reflect on the concluded project.	Accurately and exhaustively reports and reflects on the concluded project.	Accurately reports and reflects on the concluded project.	Partially reports and reflects on the concluded project.	With assistance, reports and reflects on the concluded project.

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

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